

PERSPECTIVES on Science and Christian Faith

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*“The fear of the Lord
is the beginning of Wisdom.”*

Psalm 111:10

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Arie Leegwater

Disentangling Theology and Science: The Instrumentalization of Science

During the past four years as editor of *PSCF*, I have received and read a goodly number of submissions dealing with apologetic and natural theological themes and arguments. Examining and utilizing scientific findings, authors seek to bolster or support a particular view of the Bible, a certain theological doctrine of Christianity, or a coveted theory that is deemed concordant with a particular reading of Scripture. This seemingly omnipresent feature, almost a penchant of evangelical Christian reflection about science and its practices, reflects a desire to look for God in the results of science: finding God as the result of an inference to the best explanation, or if not the best explanation, the most lovely one (in the latest version of Peter Lipton).

Judging from F. Alton Everest's retelling of the early history of the ASA (*The American Scientific Affiliation: Its Growth and Early Development* [Ipswich, MA: ASA Press, 2010]), the very beginnings of the ASA also reflect this type of effort, particularly the "Sermons from Science" films produced by Irving Moon for Moody Bible Institute. A number of these films were initially endorsed by ASA. I still vividly remember how one of these films, "God and the Atom," impressed me as a fifteen-year-old growing up in the Tidewater region of North Carolina. Any reader can undoubtedly come up with many more-contemporary examples of this genre of film. This apologetic effort, of course, is not a recent occurrence. It has a long and intricate history: a movement from medieval forms of natural theology to evidentialist apologetics, generated as a response to the challenges presented by Enlightenment thought.¹

There is a rich diversity of these design arguments, and they are deeply embedded in different

historical contexts. Several "interests" play themselves out in this intricate and difficult apologetic venture. We need to understand who makes these types of arguments, to whom they are addressed, and for what purpose. And the arguments do not all flow in one direction, that is, from "science" to "religion." When comparing our century with earlier ones, Peter Harrison comments:

Given the current status of science, it is natural to assume that the positive interactions of science and religion during the seventeenth and eighteenth centuries are to be understood primarily as attempts to establish the rational foundations of theistic belief. Arguments from design, thus interpreted, are apologetic exercises intended to support religion. My suggestion is that these are indeed apologetic exercises, but they are apologies for science, not religion, and that their primary function, at least initially, was to provide religious legitimation for the new sciences.²

For some evangelicals today, something similar may be happening, namely, arguing for the legitimation of participation in (secular) scientific work since this allows one to illumine God's nature and parse out his attributes. For others, it may be an effort of using the scientific methods of "secular" science to slay atheistic "religious" dragons. Thus we may encounter apologetic arguments directed to a religious community as well as apologetic arguments shared by a religious community directed at a particular scientific community. Science and religion are seemingly converging in their respective aims.

However, we are beginning to suffer from a "deluge" of these apologetic forays. This particular flood of apologetic theological discourse can be self-defeating. In many popular presentations, science

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and technology are considered to be instruments, as ways of presenting the Gospel message, of enhancing Christian worship, or of establishing certain “theistic” propositions about the existence of God or an (intelligent) designer. We invariably look for the theological potential of science. Science, considered to be internally deficient, is not real science without a theological reason for being. Scientific practices are incomplete unless they bear some theological utility. In these many ways, science becomes instrumentalized. Scientific illustrations, either by positive or negative example, become employed to reinforce already held beliefs. Theology, in turn, becomes a gloss, a veneer, an addition, either after the fact or advanced as a reason to make a particular group comfortable with modern science. To many a Christian, this might imply that science is merely a fiction, a fantasy claiming realist credentials, but needing theology to anchor its meaning. For others, it might be a fight against those who hold that scientific knowledge is transcendent, who advance a form of “scientism,” in which knowledge is discovered not made, placeless, timeless, objective, unaffected by the conditions of its creation or the personalities and biases of its makers.

I am not sure this is the best way of interpreting the world or of framing the issues. We spend an inordinate amount of time and effort attempting to defend Christianity, the Scriptures, intelligent design, and so forth; however, to my mind, far too little attention is spent teasing out what a robust Christian position might mean for scientific practice in a particular discipline. It is as if the major interest is science’s utility for theological purposes, rather than its inherent worth as a creaturely gift in its own right, as its own way of disclosing meaning in the world. Instead of asking scientists to show us God, we should want them to reveal the world in all its subtleness and mystery.

Could we be looking for God in the wrong places or at least in the wrong way? God can sometimes be silent. Are we looking in a way which delimits our appreciation of what scientists and technologists actually do? We stress time and time again the theological potential of science, how science can inform, open up, refresh, and enhance our theology and worship. The church, in turn, appreciates and appropriates science for its theological value. This journal and the Christian community need far more

serious reflection on issues within the disciplines. We need to develop a framework that allows us to discuss issues such as indeterminism, reductionism, theories of bonding, systems thinking, information theory, evolutionary theory, bioethics, philosophy of technology, and so forth in ways that reflect Christian engagement from the start, not as a post hoc justification for participation in the scientific enterprise or as an effort in apologetics.

Notes

¹ See Nicholas Wolterstorff’s essay, “The Migration of the Theistic Arguments: From Natural Theology to Evidentialist Apologetics,” in *Practices of Belief: Selected Essays*, vol. 2 (New York: Oxford University Press, 2010), 173–216.

² Peter Harrison, “Religion, the Royal Society, and the Rise of Science,” *Theology and Science* 6, no. 3 (2008): 268–9.

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In This Issue

This June issue of *PSCF* is characterized by an extremely broad range of subject matter. The five main articles vary in content from a study of evangelical applications of the popular idea of complementarity (Christopher Rios, Baylor University), a comparison of naturalistic versus eschatological theologies of evolution held by two major theologians, the Englishman Arthur Peacocke and the German Wolfhart Pannenberg (Junghyung Kim, Graduate Theological Union, Berkeley), a reflection on different approaches to death and pain in the created order (Keith Miller, Kansas State University), a reexamination of the question “Does the Earth Move?” (George Murphy, Trinity Lutheran Seminary), to a close mathematical examination of biblical longevities (Walter Makous, University of Rochester). Clearly, there is sufficiently diverse material for thought and reflection.

The book review section introduces the reader to a number of interesting books, some of which promise to make a distinctive mark. Two letters to the editor written in response to a previously published essay book review complete the issue.

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Claiming Complementarity: Twentieth-Century Evangelical Applications of an Idea

Christopher M. Rios



Christopher M. Rios

Over the course of the twentieth century the concept of complementarity earned considerable support among evangelical scientists. Leading figures in both the USA and Britain argued that science and theology offered distinct perspectives of the natural world that were reconcilable, if recognized as complementary descriptions rather than mutually exclusive claims. Though not without critics, this logic was employed by the most conspicuous evangelical researchers who attempted to ease the tension between Christianity and modern science. The benefit of such a view, they argued, was the avoidance of reductionism: neither Christians nor scientists could claim that their view of the world invalidated the other perspective. Drawing on the history of the American Scientific Affiliation and the Research Scientists' Christian Fellowship (now Christians in Science), this article examines the past use of complementarity in light of recent criticism and asks why it became so broadly espoused by leading members of these groups.

As disheartening as it was to some, twentieth-century evangelicals earned a reputation as passionate critics of modern science. Characterized most clearly by the Scopes Trial of 1925 and the birth of the creationist movement in the 1960s, outspoken leaders and laypeople often claimed irreconcilable differences between the biblical and scientific views of the world.

Over the past generation, scholars have done much to remind us that such conflict is not the whole story. Even as antievolutionism and scientific creationism were reaching a fevered pitch, significant numbers of American and British evangelical scientists challenged these notions.¹ These groups saw the conclusions of modern science not as conflicting claims that challenged the Bible's authority but as alternative perspectives of God's creation. Central for much of their thinking was an idea known as complementarity: the view that science

and the Bible offer distinct perspectives of the natural world that are reconcilable if recognized as complementary descriptions rather than mutually exclusive claims.

Though not without critics, this logic was employed by the most conspicuous evangelical scientists who worked to ease the tension between Christianity and modern science throughout the second half of the twentieth century. Complementarity, they were convinced, avoided reductionism by affirming the perspectives of both science and theology without rejecting either or superficially conflating the two.

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At the 2009 annual meeting of the American Academy of Religion, Cambridge theologian Sarah Coakley questioned the value of complementarity for contemporary discussions. Rather than fostering genuine dialogue, she argued, its logic treats science and religion as distinct, unaffected categories and allows for a fully reductionist view of the issues. Coakley's is not the first critique of complementarity, but it serves as a useful reminder of the challenges facing those who attempt to reconcile science and religion and of the questions one should ask about the methods one chooses. This article attempts to ground such a conversation in the history of those within evangelical circles who first employed complementarity in science-faith dialogue.

Recalling the Context

Two key developments shaped the twentieth-century evangelical engagement with science. First was the dramatic decline in science and faith dialogue among conservative evangelicals after 1920, a reversal of the trends that began in the last quarter of the nineteenth century. Between the 1880s and the 1920s, notable scientific and religious leaders worked to overcome the apparent antitheses between science and religion—particularly, evolution and Christianity—that had characterized the preceding decades. Among church leaders were the Scottish Presbyterian minister James Orr (1844–1913), the American Reformed theologian B. B. Warfield (1851–1921), and the Scottish philosopher and Princeton University President James McCosh (1811–1894). Among scientists, none was more prominent than the American botanist Asa Gray, a close friend of Charles Darwin and staunch advocate for a Christian interpretation of evolution. Yet, beginning in the 1920s and extending through the next decade, a resurgence of social and religious conservatism undermined efforts at reconciliation. Economic depression, the growing threat of war, and theological responses to liberalism led many conservative Christian leaders to abandon their efforts to integrate science and theology.² At the same time, science's increasingly specialized and esoteric areas of research hindered meaningful dialogue with other disciplines. At its best, these trends led scientists to ignore religion and compelled theologians to turn their attention toward other more fundamental issues. At its worst, it triggered a bitter struggle for the right to define reality.

The second development was the extraordinary rise in the level of deference shown to scientists and their research overall. As science and faith dialogue declined, science enjoyed a period of extraordinary growth and professionalization. In the century following the publication of Charles Darwin's *Origin of Species* (1859), scientific discoveries and technological achievements brought a sweeping revision of our understanding of the universe and helped propel the field as a major force in popular thought. These events effected a dramatic transformation in science itself and strengthened its appreciation by the broader culture. As the world became increasingly dependent upon scientific developments, research received unprecedented support, while scientists were increasingly heralded as the most reliable source of truth.

The prestige science earned during this period is hard to overstate. In 1931, Sir William Dampier, a Fellow of the Royal Society, expressed the views of many when he declared that “the vast and imposing structure of modern science is perhaps the greatest triumph of the human mind.”³ Arguably, the most dramatic example of this mood came at the British Association for the Advancement of Science conference held at the Royal Institution in London in 1941. Confronted by the immediate realities of World War II, researchers from twenty-two nations asked what science should do to begin healing the world once the fighting had ended. In his report of the meeting, J. G. Crowther boldly stated, “If democracy does not learn to seek guidance from, and utilize, science, then it will not survive.”⁴ Science, which had only recently emerged from the shadows of other disciplines, was increasingly recognized as essential for future prosperity.⁵

Scientists were not alone in touting their own significance. As the 1939 World's Fair in New York City made clear, political and business leaders gladly boasted how science and technology were “Building the World of Tomorrow,” the phrase chosen as the theme for the fair. Many of the leading philosophers of the day praised the epistemological potential of science. Figures such as Bertrand Russell (1872–1970) and Ludwig Wittgenstein (1889–1951) influenced a generation who came to see their task as verbal precision rather than discovery.⁶ The new goal was to deconstruct language and problems into their most basic parts in order to analyze them and

to understand the complex entities they formed. These ideas were radically advanced by the logical positivists, who claimed that anything that could not be verified empirically was metaphysics and by definition, in the words of A. J. Ayer (1910–1989), the leading figure of the movement in the English language, “neither true nor false but literally senseless.”⁷ “The philosopher,” he wrote, “is not in a position to furnish speculative truths, which would ... compete with the hypotheses of science,” but “is to clarify the propositions of science by exhibiting their logical relationships” and to “define the symbols which occur in them.”⁸ Such was the level of deference offered to science.

The scientific establishment was not uniformly materialistic. Some, such as Arthur Eddington (1882–1944), Plumian Professor of Astronomy, Cambridge University, maintained a robust Christian faith. Yet there was a prevailing naturalistic mood within the laboratories and—as the renowned theoretical chemist C. A. Coulson (1910–1974) later recalled about his matriculation to Cambridge in 1928—a growing sense that the “divorce between science and religion was almost absolute.”⁹ Furthermore, increasing numbers of people claimed that religion itself was a product of the natural world. The avowed humanist Julian Huxley could hardly have been clearer when he declared in 1923 that “God is an inevitable product of biological evolution, arising when the human type of mind first came into being, and taking shape and form as a definite God or Gods.”¹⁰ British embryologist C. H. Waddington (1905–1975) drew heavily on Sigmund Freud’s thought to claim that science had reached the point at which it could function as a religion and do a better job. “Science is not ethically neutral,” he argued. “It has, in fact, something to say about the most important questions of the world, and it could therefore be a candidate for the position of super-ego.”¹¹ He continued:

One might have a scientific society, officially based on the practice of empirical reason; but ... the other side of man’s nature would have to be satisfied by a belief in some authority, a thrill for some romance. We have now reached the conclusion that science can also provide their thrill and this authority. Science by itself is able to provide mankind with a way of life which is, firstly, self-consistent and harmonious, and, secondly, free for the exercise of that objective reason on which

our material progress depends. So far as I can see, the scientific attitude of mind is the only one which is, at the present day, adequate in both these respects.¹²

In other words, science could make traditional religion irrelevant by dispelling its false views while still providing its psychological benefits.

Such was the attitude at the end of World War II. While most conservative religious leaders were ignoring or attacking modern science, scientists were increasingly seen as the suppliers of useful knowledge. Science had won the war, would help establish the peace, and would be essential in rebuilding societies that had been destroyed. It was within this intellectual and cultural milieu that groups of evangelicals who were professional scientists began exploring new ways to understand the relationship between their faith and work. For many of them, complementarity became the most useful framework for this relationship.

Development of the Idea

The concept of complementarity originated with the work of Danish physicist Niels Bohr (1885–1962) and his attempt to explain how mutually exclusive sets of experimental data could be equally true, though seemingly contradictory. He argued that the apparent contradiction implied by the use of competing models for understanding some quantum particles, e.g., light, can be reconciled as long as one understands that the models measure distinct aspects of the object of study and that each model is unable to detect and may obscure the data of the other. The wave model can only detect the wave-like aspects of light, the particle model only the particle-like aspects. Neither model disproves the validity or predicts the outcomes of the other.¹³

Thinkers quickly applied complementarity to the science-faith dialogue. Bohr recognized the implications of his ideas and attempted to establish complementarity as a new epistemological principle that could inform a wide range of disciplines.¹⁴ Some have found traces of complementarity in the metaphysical writings of A. N. Whitehead (1861–1947).¹⁵ Historian of science Peter Bowler has noted C. A. Coulson as marking the start of a new direction in science and faith discourse and credits his *Science and Christian Belief* (1955) as the first significant discussion of complementarity within evangelicalism.¹⁶

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Coulson's ideas developed in the early 1950s. Although he denied that religion, in its broadest sense, was merely one view of the natural world, he affirmed that science and theology, one component of religion, were complementary.¹⁷ Coulson is often remembered for his description of the differing perspectives of architectural drawings. Floor plans are different from elevations, he noted, and each elevation is different from the others. Still, they all describe the same building because they imagine the final product from distinct perspectives. Although initially the drawings may seem to contradict, upon further investigation, their complementary relationship becomes clear. However, if one wishes to envision the building before it is complete, one cannot simply lay the drawings on top of each other, but must use an "act of reflection" to imagine the finished product. It was through this act of reflection that one could reconcile science and theology.¹⁸

Around the same time that Coulson was developing his views, a Scottish brain scientist named Donald M. MacKay (1922–1987), a younger colleague of Coulson at the University of London at the time, began articulating similar ideas.¹⁹ MacKay and Coulson had much in common. They both denounced the god-of-the-gaps mentality (the idea that God could be found only in those areas in which science was ignorant). They considered science as a means of revelation. And they saw complementarity as a useful model for reconciling scientific and theological claims.²⁰ If Coulson's use of complementarity came first, it was MacKay who has been remembered as the one who drew out fully its logical ramifications. Through a series of books, articles, and BBC broadcasts that appeared between the 1950s and 1970s, MacKay helped popularize complementarity among British and American evangelicals. His message was simple and consistent: Scientists looked at the world as a self-contained, closed physical system and attempted to understand it on its own terms. Christians looked at the world as an open system with more processes and events occurring than meet the scientific eye. Only when one accepted the validity of both perspectives could one avoid the potential conflict between them.²¹ For MacKay's work in neuroscience, this meant that it would be foolish to expect scientists to locate some aspect of the brain where physical laws were disobeyed, thus proving the mind as something other than a product of natural forces. The scientific understanding of the mind

as a product of matter in motion was perfectly justified; the naturalistic claim that it was merely such a product was not. As MacKay wrote,

The scientific method has been compared to a net, which can give knowledge only of those aspects of reality which it can catch. The kind of description which it can give "passes by" spiritual truths; the Christian's belief that God controls the universe, for example, has never had any bearing on scientifically ascertained probabilities, far less any inconsistency with them.²²

Christianity and science, in other words, do not offer competing claims because each is incapable of addressing the other's concerns.

Yet there was more to complementarity than merely distinguishing between the Christian and scientific views of the world. If applied correctly, it also prevented one from combining their descriptions in the wrong way or unnecessarily claiming conflict between them. As psychologist and Research Scientists' Christian Fellowship (RSCF) leader Malcolm A. Jeeves described it, "The somewhat negative point which arises from all this is that before religious and scientific statements are debated as rivals, it is obligatory that we should establish that they are not in fact complementary."²³ More positively, MacKay described the process of reconciliation thus:

To keep scientific and Christian doctrines rigidly apart would be silly as well as potentially dishonest. To try to make them into one by chopping bits from each and pasting them together, or by treating them as rival ways of giving identical information, would be equally to miss the point. We can come to relate them properly only by holding both constantly together in our minds, until little by little there comes to us some glimmering of that greater whole of which they present complementary aspects, the activity and character of God himself: not God seen only in the gaps of the scientific picture, not God deduced only as the conclusion of a scientific argument, but God revealed as the Author of the whole story.²⁴

Thus, complementarity not only justified Christian and scientific views, it also suggested the proper way of relating the two.

In his attempts to explain the differing perspectives of science and theology, MacKay emphasized the different levels from which they achieved their

conclusions, and he saw this as an important distinction between his views and Coulson's. While Coulson focused on differing perspectives based on the direction from which one addressed the subject, MacKay emphasized differing logical levels or planes. Two people, he argued, might examine a subject from the same direction and still arrive at equally valid though vastly different interpretations, because each asked a different set of questions. Each applied a different kind of logic to the situation. Take a simple math problem on a chalk board, he often noted. A chemist could describe with complete accuracy the chemical composition of the writing without ever attempting to discern the equation present. The message that would be plain to everyone else, that $2 + 2 = 4$, would be a distraction from the chemist's examination. It would be foolish, MacKay would say, to argue that because the chemist missed the meaning of the message that his analysis was wrong. It would be equally foolish to assume that the message was somehow less true than the chemist's conclusions. If one is to fully understand the writing on the board, both views must be considered. The failure to accept either one, MacKay insisted, led to reductionism, what MacKay called the fallacy of "nothing-buttery" — "the idea that because in one sense, at one level, or viewed from one angle, there is nothing there but chalk, therefore it is unnecessary, it makes no sense, it is superfluous to talk about what is there in any other terms."²⁵ By the early 1970s, MacKay had labeled his own emphasis on the different levels of analysis "hierarchical complementarity."²⁶

Influence

For the generation of American and British evangelical scientists working between 1955 and 1985, complementarity offered an effective means for reconciling science and religion. By the late 1950s, the idea essentially served as the official view of the leaders of the RSCF, now Christians in Science, an association of evangelical scientists and those interested in science throughout the UK. This development was due in no small part to MacKay's popularity among British evangelical scientists and to a series of publications aimed for a popular audience, including *Where Science and Faith Meet* and *Science and Faith Today* (both BBC broadcasts published in 1953), *Science and Christian Faith Today* (1960), and *Christianity in a Mechanistic Universe* (1965).

The American Scientific Affiliation's (ASA) appreciation for complementarity grew more slowly and, though the idea failed to win broad support within the ASA until the 1970s, reveals the developing relationship between the American and British organizations. In 1956, physicist Richard Bube published an article in the *Journal of the American Scientific Affiliation (JASA)* on the relevance of complementarity to Christian theology. He argued that the concept helped validate theological paradoxes that some critics saw as signs of the incoherence of Christian faith. Bube repeated this line of reasoning in his chapter on physics in *The Encounter between Christianity and Science* (1968). In 1967, W. Jim Neidhardt, physicist at Newark College of Engineering, similarly employed complementarity as a profitable means for affirming paradox and undermining the goals of "extreme reductionists [sic]."²⁷ In 1961, John Sinclair, then research assistant at the University of California Medical School, San Francisco, attempted to apply complementarity to the mind-brain problem.²⁸ One commonality shared by each of these publications was that none of them suggested complementarity as a way for reconciling science and theology.

There were some references to this aspect of complementarity before 1970. In 1964, the current ASA logo first appeared. Commenting on the figure, sociologist and ASA Fellow David Moberg, then *JASA* editor, wrote that the figure could be interpreted in many ways but suggested that it represented "two perspectives, two types of truth, two sources of knowledge, two commitments" that confronted each other in the ASA.²⁹ Complementarity was also suggested in a 1969 *JASA* symposium on biblical interpretation, in which twenty-one ASA leaders offered their perspectives of the relationship between science and the Bible. Most of the contributors expressed ideas consistent with complementarity, which might suggest a relatively widespread awareness and acceptance of the idea by this point. Richard Bube, then *JASA* editor, clearly believed it did so. In his summary of the symposium, he claimed that by a margin of three-to-one the contributors described the Bible and science as providing "complementary insights into the nature of the world."³⁰ Referring to the overarching themes of the participants, he wrote,

The majority opinion appears to us to be consistent with the growing realization that the description of

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the world requires a multilevel approach in which different terms and concepts may be needed to describe the physical, the biological, the psychological and the spiritual.³¹

Bube's summary may have read complementarity into the majority of the comments and perhaps reflected his own appreciation of MacKay, whom he had met at an important, though largely forgotten, international meeting of evangelical scientists at Oxford in the summer of 1965. Only two contributors, Baylor University psychology professor C. Eugene Walker and Newark College of Engineering physicist W. Jim Neidhardt, made explicit reference to complementarity. Nevertheless, its underlying principles seem to have gained some support by this time.

Complementarity became broadly popular within the ASA only after the publication of three important works. The first was *The Scientific Enterprise and Christian Faith* (1969), the product of the 1965 meeting in Oxford, which was hosted by the RSCF and funded by Norman Lea, a Canadian engineer of vigorous evangelical faith and considerable generosity. The event laid the foundation for an enduring relationship between the ASA and RSCF and helped make MacKay and other RSCF members highly esteemed among ASA leaders. The next publications, both by MacKay and both published in 1974, were an article in the journal *Zygon* entitled "'Complementarity' in Scientific and Theological Thinking" and the InterVarsity Press publication *The Clockwork Image*.

Unremarkably, complementarity did not win unanimous approval among RSCF and ASA members, but those who accepted it often exemplified two characteristics. First, they were staunch defenders of both science and the Bible. The histories of the ASA and RSCF are marked by their attempts to affirm the validity of modern science against its critics, Christian or not, while defending the relevance and truth of the Scriptures against secular and liberal challengers. Second, they accepted the epistemological limitations of both. That is, they rejected reductionism—both biblical and scientific.

Accepting the epistemological limitations of science meant understanding that the methodological reductionism science requires does not necessitate philosophical reductionism. In 1965, for example,

Frank H. T. Rhodes, then professor of geology, University College of Swansea, argued that science provided an accurate mechanistic understanding of the world, but insisted that it remains

only one view, only one description, only one model, only one interpretation. Because it is limited by its own self-chosen method, abstractions and restrictions, it can never claim to do justice to the whole of reality.³²

In a 1952 BBC broadcast, R. L. F. Boyd (later Sir Robert Boyd, the patriarch of the British space program) made a similar point when he argued that the Aristotelian distinction between efficient and final causes made reconciliation between science and Christianity possible. There are two kinds of explanations for every event, he insisted. Some answer the question "how"; others, the question "why." The difference between the questions reflects the differences between the scientific and Christian agendas.³³ "Trouble is," Boyd wrote, "that we have now swung to the opposite extreme and have become so impressed with the usefulness of asking 'How?' that we are liable to forget ever to ask 'Why?'"³⁴ Recognizing the epistemological limitation of science meant, to use MacKay's metaphor, accepting that the scientists' net is unable to catch all truth.

Accepting the limitations of Scripture often entailed moving beyond a commonsense-literalistic view of the Bible. For some, this meant remembering Calvin's emphasis on divine accommodation, the idea that God necessarily accommodates himself to our finite intellect and knowledge. Thus, the Bible may be seen as being one hundred percent true, though not one hundred percent of the truth. For others, it meant appreciating the literary, poetic, or symbolic meaning of the Bible. For a growing number of ASA members during the 1970s, it meant distinguishing between the revelational and nonrevelational aspects of Scripture, a hermeneutical approach advocated by Fuller Theological Seminary professor Daniel Fuller.³⁵ This topic reveals an important distinction between the broader contexts of the ASA and the RSCF.

Among the many important differences between twentieth-century British and American evangelicalism were the differing approaches to Scripture that developed at the end of the nineteenth century, especially regarding the inerrancy of Scripture. Stephen

Holmes' recent study in this area is particularly illuminating.³⁶ Conservative Christians have always held a high regard for the accuracy of the Bible. In late nineteenth- and early twentieth-century America, however, theologians at Princeton Seminary, notably Archibald Alexander Hodge (1823–1886) and B. B. Warfield, helped elevate the latent belief in the accuracy of the Bible to a full-blown articulation of plenary verbal inspiration, the idea that even the words of Scripture are inspired, infallible, and errorless. As a result, Holmes argues, inerrancy became the primary lens through which to understand Scripture. These views remained popular among American evangelicals throughout the twentieth century, with the fullest expression coming through a series of international conferences on the Bible that produced the so-called Chicago Statements of 1978 and 1982.³⁷

The situation in the UK was considerably different. By 1900, the majority of British evangelical scholars had rejected the need to defend the Bible as completely free of error.³⁸ As a result, they gave more attention to the inspiration and authority of the Bible in matters related to "faith and conduct" than to its inerrancy. The consequences, Holmes argues, was that whereas twentieth-century American evangelicals tended to see the Bible as a collection of facts to be believed, British evangelicals saw the Bible as rules to be obeyed. There are, of course, important exceptions on both sides of the Atlantic. Still, both the relative ease with which British evangelicals accepted evolution and the antievolutionary impulse in American fundamentalism may be seen as a logical outcome of a particular understanding of the nature of the Bible.

The British view of Scripture, combined with MacKay's complementarity, helped the RSCF develop a clear approach for relating science and the Bible. As Christians, they felt little need to align particular passages of Scripture with specific scientific ideas, while as scientists they were free to pursue their research without fear of undermining theology. In a 1952 BBC broadcast, RSCF founder Oliver Barclay expressed this view clearly. "There was a time," he stated, "when the relationship between science and faith was generally thought of in terms of disagreement about matters of fact."³⁹ Such attempts, he insisted, missed the point. Efforts to align

specific verses with particular scientific conclusions fail by trying to solve the wrong problem. The goal is not to reconcile contradictory claims about creation. "The real problem is how to reconcile two different habits of mind," how to appreciate two distinct views of the same event.⁴⁰

For the ASA, it was already noted that key publications helped determine the timing of the group's acceptance of complementarity. Key also for this acceptance was the group's wrestling with questions of biblical interpretation. Between 1960 and 1980, the ASA experienced a dramatic, sometimes painful, and often hotly contested shift in its general approach to the Bible. The transition was led largely by Richard Bube and his appreciation for Fuller Seminary theologians. The result was that by 1980, the majority of ASA leaders had nearly abandoned strict inerrancy. It is not surprising, then, to find that as increasing numbers of ASA members moved further from the Hodge-Warfield understanding, they also developed a greater appreciation for complementarity.

Criticism and Defense

These generalizations are not meant to suggest that the ASA unanimously accepted complementarity. In 1975, a reviewer of *The Clockwork Image* criticized MacKay for not doing more to prove the Christian perspective as essential. The reviewer described complementarity as an "illegitimate tool with which to loosen the grip of the 'clockwork image' on the minds of modern men."⁴¹ There is a sense in which this critique is valid, but it missed a fundamental point: MacKay was not trying to prove the Christian view any more than he was trying to prove the scientific view. Neither was he trying to prove that one of the views was somehow incomplete without reference to the other. In fact, MacKay's logic insisted that each perspective remain self-consistent and able to provide its own complete view without appealing to the other.

The most thorough critique of complementarity came from two 1983 articles by ASA Fellow J. W. Haas. The first examined the concept broadly. The second focused on MacKay's ideas. Haas concluded by suggesting that MacKay offered an "imaginative approach" that avoided many of the errors found in other attempts to reconcile Christianity and science.

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Yet he criticized MacKay for not being more philosophically consistent. "It appears," Haas wrote, "that an exposition of the ontological-epistemological status of complementarity is needed before a full evaluation of this approach can be made."⁴² Haas seems to have desired a level of certainty about the conclusions of complementarity that exceeded MacKay's intentions.

Still, in the same 1983 issue of the *JASA*, retiring editor Richard Bube offered his support to complementarity. Bube acknowledged Haas's critique, but asked a more immediate question. What were the other choices? There were only a few paradigms through which one could view the relationship between science and the Bible, Bube asserted. One was conflict, the idea that science and theology reveal the same kind of truth about the same kinds of things, thus requiring a choice between them. Another was compartmentalization, the idea that the two say different kinds of things about different things, which Bube suggested resulted in a "schizophrenic response" toward life and meaning. The only other option, he insisted, was complementarity, which validated both science and the Bible without ending in conflict or schizophrenia. Bube concluded his article by pointing out what he saw as the obvious point:

We may debate whether one should say that science and theology are complementary, but it does not appear that there is any debate that scientific descriptions are often complementary to theological descriptions of the same event. If this were not the case, what other option do we have?⁴³

Similar arguments appeared within the pages of the *JASA* (now named *Perspectives on Science and Christian Faith [PSCF]*) over the next twenty-plus years. In 2004, for example, Ross H. McKenzie offered a review of Alister McGrath's *Foundations of the Dialogue in Science and Religion* (1998) in which he criticized McGrath's use of complementarity because the idea had become regarded by most physicists as an "ill-defined philosophical concept" with a long history of abuse.⁴⁴ Yet the December 2009 issue of *PSCF* included an interview of chemist Robert C. Fay by Karl E. Johnson and Keith Yoder in which Professor Fay urged that the churches need to do a better job teaching the complementary relationship between science and faith.⁴⁵ Thus, even after a half century of use, questions of the idea's value remain.

Conclusion

Thus, complementarity won considerable support among evangelical scientists during the second half of the twentieth century. Although some rejected the concept overall, many affirmed it as an effective means for reconciling ideas that on the surface appeared mutually exclusive. The ostensibly competing conclusions of science and theology, they argued, were better understood as complementary descriptions rather than contradictory claims.

Still, for those asking to what extent complementarity will remain useful in the twenty-first century, key questions remain. How reliable is the concept overall? How philosophically consistent must it be to be of value? Or, as Professor Coakley asked, does the willingness to affirm the individual conclusions of science and theology allow or even encourage reductionism? Perhaps this is the most pressing question. In the sense that complementarity grants science and theology freedom to pursue their separate agendas without fear of violating the other, the answer must be yes. Methodological reductionism was, after all, accepted by those who affirmed complementarity. Yet, they also insisted that methodological reductionism did not entail philosophical reductionism. Affirming the perspectives and conclusions of science and theology individually did not require one to choose between them.

But to stop here would be to miss the point. The value of complementarity was not merely its ability to disentangle conflated scientific and theological claims but its ability to make room for their proper reconciliation. In this way, complementarity should not be confused with Stephen Jay Gould's nonoverlapping magisteria, the idea that science and theology do not contradict because of the "lack of overlap between their respective domains of professional expertise."⁴⁶ Complementarity allows one to affirm that there are key areas in which science and theology overlap. Yet when they do so, their claims are not necessarily in competition with each other for the final say on the matter.

Only time will tell how long complementarity will remain useful for reconciling science and faith. Yet, for those of the previous generation, the answer is clear. In the context of logical positivism and scientific materialism on the one hand and conservative antievolutionism on the other, complementarity

proved a valuable approach for dealing with the challenges at hand without rejecting either the fundamental theories of modern science or biblical faith. ❧

Notes

- ¹The history of these groups is the subject of my 2010 dissertation, "Reclaiming Peace: Evangelical Scientists and Evolution after World War II." Any assertions that follow about the broader histories of the American Scientific Affiliation and the Research Scientists' Christian Fellowship (now Christians in Science) are given more detailed treatment there.
- ²See Peter J. Bowler, *Reconciling Science and Religion: The Debate in Early-Twentieth-Century Britain* (Chicago: The University of Chicago Press, 2001), 3–4, 417; see also, George M. Marsden, *Fundamentalism and American Culture*, 2d ed. (New York: Oxford University Press, 2006); Ferenc M. Szasz, *The Divided Mind of Protestant America, 1880–1930* (Tuscaloosa, AL: University of Alabama Press, 1982).
- ³William Cecil Dampier, *A History of Science and its Relations with Philosophy & Religion* (New York: Macmillan, 1931), vii.
- ⁴J. G. Crowther, *Science and World Order* (Harmondsworth, UK: Penguin Books, 1942), 18.
- ⁵*Ibid.*, 18–25.
- ⁶I.e., John Wisdom, *Problems of Mind and Matter* (Cambridge: Cambridge University Press, 1934), 1–2.
- ⁷A. J. Ayer, *Language, Truth and Logic* (New York: Dover, 1936), 31.
- ⁸*Ibid.*, 31–32.
- ⁹C. A. Coulson, *Science and the Idea of God: The Eleventh Arthur Stanley Eddington Memorial Lecture 21 April 1958* (New York: Cambridge University Press, 1958), 2.
- ¹⁰Julian Huxley, "Rationalism and the Idea of God," *Essays of a Biologist* (London: Chatto & Windus, 1923), 208.
- ¹¹C. H. Waddington, *The Scientific Attitude* (Harmondsworth, UK: Penguin Books, 1941), 169.
- ¹²*Ibid.*, 169–70.
- ¹³See Gerald Holton, "The Roots of Complementarity," *Daedalus* 117, no. 3 (1988): 151–97; Ian G. Barbour, *Religion and Science: Historical and Contemporary Issues* (New York: HarperCollins, 1997), 121, 166–70; Peter J. Bowler and Iwan Rhys Morus, *Making Modern Science: A Historical Survey* (Chicago, IL: The University of Chicago Press, 2005), 265–70; John Hedley Brooke, *Science and Religion: Some Historical Perspectives* (New York: Cambridge University Press, 1991), 329, 331.
- ¹⁴Holton, "The Roots of Complementarity," 187–92.
- ¹⁵E.g., Stephen David Ross, *Perspective in Whitehead's Metaphysics* (Albany, NY: State University of New York Press, 1983), 33–4; Michael Epperson critiques Ross's position, *Quantum Mechanics and the Philosophy of Alfred North Whitehead* (New York: Fordham University Press, 2004), 2–3.
- ¹⁶Bowler, *Reconciling Science and Religion*, 415–6; see also, Barbour, *Religion and Science*, 167–70.
- ¹⁷See Arie Leegwater, "Charles Alfred Coulson: Mixing Methodism and Quantum Chemistry," in *Eminent Lives in Twentieth-Century Science and Religion*, 2d rev. and much expanded ed., ed. Nicolaas A. Rupke (Frankfurt am Main: Peter Lang, 2009), 94.
- ¹⁸C. A. Coulson, *Science and Christian Belief* (Chapel Hill, NC: The University of North Carolina Press, 1955), 67–83.
- ¹⁹Malcolm Jeeves to author June 11, 2010.
- ²⁰Coulson, *Science and Christian Belief*, 64–5.
- ²¹Donald M. MacKay, "Persons and Things" in *Science and Faith To-Day* (London: Lutterworth Press, 1953), 33–5.
- ²²Donald M. MacKay, "The 'Electronic Brain' and Its Philosophical Implications—Some Introductory Notes," *Christian Graduate* 2, no. 3 (1949): 86, emphasis original.
- ²³Malcolm A. Jeeves, *The Scientific Enterprise and Christian Faith* (Downers Grove, IL: InterVarsity Press, 1969), 71.
- ²⁴Donald M. MacKay, "Looking for Connections," in *Where Science and Faith Meet*, contributors, James B. Torrance, Donald M. MacKay, Malcolm Jeeves, Robert L. F. Boyd, Oliver Barclay (London: Inter-Varsity Fellowship, 1953), 17.
- ²⁵_____, "Man as a Mechanism" in *Christianity in a Mechanistic Universe and Other Essays*, ed. Donald M. MacKay (London: Inter-Varsity Fellowship, 1965), 58.
- ²⁶_____, *The Clockwork Image: A Christian Perspective on Science* (Downers Grove, IL: InterVarsity Press, 1974), 91.
- ²⁷W. Jim Neidhardt, "The Solution of Seeming Contradictions: Not Either-Or but Both-And," *JASA* 19, no. 2 (1967): 33–5, www.asa3.org/ASA/PSCF/1967/JASA6-67Neidhardt.html (last accessed February 27, 2011).
- ²⁸John Sinclair, "The Mind-Brain Problem," *JASA* 13, no. 3 (1961): 72–3, www.asa3.org/ASA/PSCF/1961/JASA9-61Sinclair.html (last accessed February 27, 2011).
- ²⁹David O. Moberg, "Editorial: Expanding Horizons in a Shrinking World," *JASA* 16, no. 1 (1964): 3.
- ³⁰Richard Bube, "Summary" in *JASA* 21, no. 4 (1969): 124.
- ³¹*Ibid.*
- ³²Frank F. T. Rhodes, "Christianity in a Mechanistic Universe," in *Christianity in a Mechanistic Universe*, 38.
- ³³R. L. F. Boyd, "The Why and the How?" in *Science and Faith To-Day*, 23–31.
- ³⁴*Ibid.*, 25–7.
- ³⁵See, for example, Daniel P. Fuller, "The Nature of Biblical Inerrancy," *JASA* 24, no. 2 (1972): 47–50; see also, George Marsden, *Reforming Fundamentalism* (Grand Rapids, MI: William B. Eerdmans Publishing, 1987).
- ³⁶Stephen R. Holmes, "Evangelical Doctrines of Scripture in Transatlantic Perspective," *Evangelical Quarterly* 81, no. 1 (2009): 38–63; see also, _____, "British (and European) Evangelical Theologies," in *Cambridge Companion to Evangelical Theology*, ed. Timothy Larsen and Daniel J. Treier (New York: Cambridge University Press, 2007), 254–6.
- ³⁷"The Chicago Statement on Biblical Inerrancy," *Journal of the Evangelical Theological Society* 21, no. 4 (1978): 289–96; "The Chicago Statement on Biblical Hermeneutics," *Journal of the Evangelical Theological Society* 25, no. 4 (1982): 397–401.
- ³⁸D. W. Bebbington, "Evangelicalism in Modern Britain and America," in Mark A. Noll, D. W. Bebbington, George A. Rawlyk, John Walsh, Susan O'Brien, Harry S. Stout, David A. Currie et al., *Evangelicalism: Comparative Studies of Popular Protestantism in North America, the British Isles, and Beyond 1700–1900* (New York: Oxford University Press, 1994), 197.
- ³⁹Oliver R. Barclay, "A Synthesis," in *Where Science and Faith Meet*, 33.
- ⁴⁰*Ibid.*, 33.

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⁴¹John A. Cramer, "Disappointed with MacKay," *JASA* 27, no. 2 (1975): 96, www.asa3.org/ASA/PSCF/1975/JASA6-75Cramer.html (last accessed February 27, 2011).

⁴²John W. Haas Jr., "Complementarity and Christian Thought: An Assessment, 2. Logical Complementarity," *JASA* 35, no. 4 (1983): 203-9, www.asa3.org/ASA/PSCF/1983/JASA12-83Haas.html (last accessed February 27, 2011).

⁴³Richard H. Bube, "The Appeal (the Necessity?) of Complementarity," *JASA* 35, no. 4 (1983): 240.

⁴⁴Ross H. McKenzie, "Foundations of the Dialogue between the Physical Sciences and Theology," *PSCF* 56, no. 4 (2004): 242.

⁴⁵Karl E. Johnson and Keith Yoder, "Chemist as Complementarian: An Interview with Robert C. Fay," *Perspectives on Science and Christian Faith* 61, no. 4 (2009): 233-9.

⁴⁶Stephen Jay Gould, "Nonoverlapping Magisteria," *Natural History* 106 (March 1997): 16-22.

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Keith B. Miller

“And God Saw That It Was Good”: Death and Pain in the Created Order

Keith B. Miller

In the Genesis account and elsewhere, Scripture declares God’s love and care for creation, and the glory and praise it returns to him. Yet, the creation that Scripture declares both good and an object of God’s care is a creation in which death and pain are integral, indeed vital, aspects. A number of different approaches have been used to develop a theodicy for the existence of this “natural evil” within the created order. Approaches that view death and pain in the nonhuman creation as a consequence of either a human or angelic fall are difficult to reconcile with both the testimony of Scripture and nature. More helpful are approaches that stress the “self-emptying” of God, and the cruciform character of the creation. But ultimately, we seek some explanation that has relevance at the level of the individual creature’s life. Here, something similar to the “soul-making” theodicy of John Hick seems to provide a framework for understanding the fulfillment of animal existence in a world beset by suffering and challenge.

To Mrs Professor in Defense of My Cat’s Honor and Not Only

My valiant helper, a small-sized tiger
Sleeps sweetly on my desk,
by the computer,
Unaware that you insult his tribe.

Cats play with a mouse or
with a half-dead mole.
You are wrong, though:
it’s not out of cruelty.
They simply like a thing that moves.

For, after all, we know that only
consciousness
Can for a moment move into the Other,
Empathize with the pain and panic
of a mouse.

And such as cats are, all of Nature is.
Indifferent, alas, to the good and the evil.
Quite a problem for us, I am afraid.

Natural history has its museums,
But why should our children learn
about monsters,
An earth of snakes and reptiles
for millions of years?

Nature devouring, nature devoured,
Butchery day and night
smoking with blood.
And who created it? Was it the good Lord?

Yes, undoubtedly, they are innocent,
Spiders, mantises, sharks, pythons.
We are the only ones who say: cruelty.

Our consciousness and our conscience
Alone in the pale anthill of galaxies
Put their hope in a humane God.

Who cannot but feel and think,
Who is kindred to us by his warmth and
movement,
For we are, as he told us, similar to Him.

Yet if it is so, then He takes pity
On every mauled mouse,
every wounded bird.
Then the universe for him
is like a Crucifixion.

Such is the outcome of your attack
on the cat:
A theological, Augustinian grimace,
Which makes difficult our walking
on this earth.

–Czeslaw Milosz¹
translated by the author and
Robert Hass

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"And God Saw That It Was Good": Death and Pain in the Created Order

The Problem

The poem above communicates in a very poignant and profound way the essence of the theological problem of death, pain, and suffering in the natural world—what has been referred to as “natural evil.” As we will see, it may also point to at least one aspect of a Christian response.

I have become convinced that one of the fundamental issues underlying much of the resistance of many Christians to an ancient, evolving creation is that of the problem of “natural evil.” “Natural evil” is also very often a primary focus of those who reject a personal and compassionate God, as it was for Darwin himself. The issue of theodicy thus seems not only to drive many people of Christian faith away from an acceptance of the conclusions of modern science, but also to drive members of the scientific community away from a serious consideration of the claims of the Christian faith. The topic is important, not because its solution is central to the validity of the Christian faith, but because it often serves as an unnecessary stumbling block to a productive engagement of both science and faith.

The tension generated by our understanding of God’s character, as revealed in the Bible, and by the reality of the natural world around us has been the focus of much theological and philosophical debate within the Christian church since the first century. This article sets out to examine critically several of the proposed solutions to this problem, viewing them from the perspective of a geologist, paleontologist, and orthodox evangelical Christian.

The theological problem of death and pain emerges from the following propositional statements. (1) Scripture consistently declares the absolute goodness of God and the very goodness of his creation. Furthermore, Scripture declares God’s love and care for creation, and the glory and praise it returns to him. (2) Scripture also confesses a transcendent God who is omnipotent in power, yet immanent in creation as well. God’s creative activity is not described as being confined to some past event at the beginning of time, but as a present and continuing reality. God upholds creation in its being from moment to moment, and is creatively active in its history. This understanding of God’s relationship to creation has been well articulated by Jürgen Moltmann.² (3) In seeming conflict with these confes-

sions of God’s character, we observe death, pain, and suffering as ubiquitous, even integral, aspects of the creation around us.

The apparent conflict between God’s goodness and the presence of pain and suffering is made especially acute when we consider the nonhuman creation.³ How can we accommodate the death and suffering of animals within a theology that declares both God’s omnipotence and goodness? C. S. Lewis forcefully puts the issue before us in his book *The Problem of Pain*.

The problem of animal suffering is appalling; not because the animals are so numerous ... but because the Christian explanation of human pain cannot be extended to animal pain. So far as we know beasts are incapable either of sin or virtue: therefore they can neither deserve pain nor be improved by it.⁴

Because the issue of animal pain so directly impacts our understanding of the goodness of creation, I will focus particularly on solutions to the problem as posed by Lewis.

How do we then reconcile the goodness of God who is immanent and active in his creation with the death, pain, and suffering we see embedded within it? There seem to be two basic alternative approaches to this dilemma.⁵ (1) Natural evil can be attributed to something independent of God and acting against his will. This position threatens to limit God’s power and freedom. (2) Natural evil can be considered a part of God’s good purpose for creation, and either directly willed or permitted by him. Such a view would seem to bring into question God’s goodness and love for his creatures. The tension between these alternatives, and efforts to avoid their negative theological consequences, surface in many of the proposed solutions to this problem.

Creation Corrupted by the Fall

Perfect Creation (Paradise) Corrupted by Human Fall

A fundamental theological commitment of those advocating a young-earth position is that all death, pain, and suffering were a direct consequence of the Fall, and were absent from the originally good creation. For example, theologian John C. Whitcomb, who co-authored the book *The Genesis Flood* with Henry Morris, argues that “there could have been

no death in the animal kingdom before the Fall and the curse” because all physical death is a consequence of Adam’s rebellion. Furthermore, he envisions the kingdom of God that is to be established by Christ at the second coming as a restoration of the pre-Fall earth. Whitcomb states,

During the Kingdom age, which our Lord taught us to pray for (Matthew 6:10), “The wolf also shall dwell with the lamb ... and the lion shall eat straw like the ox ... [and] they shall not hurt nor destroy in all my holy mountain [=kingdom; cf., Isaiah 2:2]: for the earth shall be full of the knowledge of the Lord, as the waters cover the sea” (Isaiah 11:6-9) ... These characteristics of the coming thousand-year Kingdom of Christ (cf., Revelation 20:2-7) show us clearly what the animal kingdom was like in the pre-Fall world.⁶

In this view, an original creation devoid of pain and death would have had to be radically transformed, even remade, as a consequence of human disobedience at the time of the Fall. This position is a difficult one to support from Scripture. Firstly, the consequences of the Fall described in the second chapter of Genesis involve the corruption and distortion of humans’ relationship with God, each other, and the rest of creation. Where once there was a relationship of caring stewardship and loving lordship, now there was an adversarial one of selfish exploitation and forceful subjugation. No mention is made in Genesis of any ill effects of the Fall directly to creation itself. Secondly, Scripture declares that creation as it is now, not a pre-Fall paradise, gives glory and praise to the Creator.⁷ The creation described in Scripture is our own familiar world with lions, eagles, crocodiles, and jackals. Even more significantly, God is described as caring for and feeding the lion and its cubs, and the birds of prey (see Job 38–41). A “fallen” creation undermines this scriptural understanding of God’s continuing creative and sustaining action in nature.

What is the place of natural revelation in the context of such a “fallen” creation? Since all of nature would have been so completely transformed from its original state of “perfection,” the natural world could no longer be a source of praise to God or a revelation of God’s character. It would imply that we should be repulsed by the “fallen-ness” of creation, rather than moved to worship the Creator. Yet the spirits of the prophets and psalmists were moved to wonder and praise.

Creation itself provides overwhelming testimony against a pre-Fall creation without death or pain. Death and pain are more than part of creation; they are woven into its very fabric. Reproduction, the care and protection of offspring, defense, escape from predators, and the pursuit of prey are defining forces that shape the biology and behavior of animal species. Furthermore, the long history of life on Earth clearly demonstrates the existence of death and pain before the advent of humanity. The fossil record documents that the same ecological relationships and organism interactions (e.g., carnivory, parasitism, scavenging, decomposition, disease) we observe today were fundamental aspects of biologic communities throughout Earth history. Hundreds of millions of years of Earth history saw not only the death of individuals, but also the extinction of species and whole taxonomic groups. The view that death and pain in the human creation began with the Fall simply cannot be reconciled with the preserved record of life on Earth.

Beyond its severe theological and scientific flaws, the attribution of all death and pain to the curse resulting from the Fall fails to address, in any way, the problem as set forth by Lewis. This view makes God the direct cause of animal suffering while providing no answer to the question, “Why?”

Creation Corrupted by an Angelic Fall

If natural evil did not first enter the universe with the disobedience of humanity, then the objections raised by the geological and biological records are largely avoided. A number of authors have thus concluded that creation was corrupted by an angelic fall before humans appeared. Supporters of this perspective call upon the existence of fallen angelic beings before even the material universe was brought into being. These evil forces, intent on opposing God’s will, are understood to have been at work twisting God’s creative activity from the very beginning. This preserves the view that pain and suffering were introduced into the creation through the disobedience of free moral beings while recognizing the existence of pain and suffering before Adam’s Fall.

Such a position was advocated by C. S. Lewis. After arguing for the plausibility of an angelic fall, he states,

It seems to me, therefore, a reasonable supposition, that some mighty created power had already been

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at work for ill on the material universe, or the solar system, or, at least, the planet Earth, before ever man came on the scene: and that when man fell, someone had, indeed, tempted him.⁸

Similarly, the Eastern Orthodox theologian David Bentley Hart, when reflecting on the devastation produced by the 2004 Indonesian tsunami, invoked free spiritual forces acting in defiance of God’s will.⁹ Michael Lloyd has further argued for the theological necessity of a cosmic angelic fall that was responsible for the corruption of the originally good creation that God intended. According to Lloyd, if the present creation is as God intended, then there would be no need for a salvation that encompasses all of creation.¹⁰

However, as pointed out by Robert Wennberg, the attribution of suffering and death in creation to an angelic fall does not in itself provide a solution to the problem of “natural evil.” Rather, it is primarily an attempt to distance God from being its direct author—to move God’s role from directly willing animal pain to permitting it in the interests of some greater good. Wennberg states,

To trace the existence of physical evil back to the destructive operations of rebellious Satanic forces is not, however, to provide anything approaching a justification of physical evil; it is only to provide a causal account, not an apologetical one. “Satan did it,” we are told, but the question that must be answered is “why did God allow Satan to do it?”¹¹

While the argument for an angelic fall is not inconsistent with the Bible, finding direct scriptural support is difficult at best. Attributing animal suffering and pain to the actions of such fallen powers is more difficult still. In fact, it runs into many of the same theological problems as the tracing of natural evil to the consequences of human disobedience. A satanic corruption and distortion of God’s creative activity is very difficult, if not impossible, to reconcile with the goodness of creation proclaimed in Scripture. What does the repeated pronouncement of “And God saw that it was good” over creation mean, if that same creation also bore the corrupting imprint of rebellious spiritual powers? Such a creation could not fully represent God’s good and perfect will—so how could it be declared good, in fact, “very good”? In what way could that distorted creation give praise and glory to God?

A serious theological problem is also raised by effectively attributing all manifestations of death

and pain in the natural world to the forces of evil. Satan would be given a power over creation that Scripture places exclusively in God’s providential hands. All natural processes and events are undergirded by the creative and sustaining power of God. Rain or drought, plague or harvest, storm and earthquake are all part of God’s providential action (see Amos 4:6 ff.).¹² More than this, God is understood in Scripture as intimately and actively involved in the continual cycle of death and new life we observe in the natural world.

These all look to you to give them their food at the proper time.

When you give it to them, they gather it up; when you open your hand, they are satisfied with good things.

When you hide your face, they are terrified; when you take away their breath, they die and return to the dust.

When you send your Spirit, they are created, and you renew the face of the earth.

(Ps. 104:27–30, NIV)

If God is thus involved in the death as well as the life of his creatures, how can this death at the same time be attributed to the spiritual forces of evil? Scripture does not seek to distance God from the ongoing death and pain present in the creation, and neither should we.

The Fall Impacts All Time—Past and Future

There are approaches that seek to preserve the view that human disobedience was the cause of natural evil, while recognizing that death, pain, and suffering in the natural world preceded the appearance of humans on the earth. One way is to argue that the consequences of the Fall extended both forward and backward in time.

One recent proponent of this position is William Dembski. Dembski takes as a beginning for his theodicy that *all* evil in the world (personal moral evil as well as physical death, human suffering, and natural disasters) traces back to human sin. This is seen as a nonnegotiable claim rooted in “traditional theology.” Dembski seems not to distinguish theologically between natural and moral evil in developing his response to the problem of evil. He states that “... sin propagates through nature and brings about natural evil, so that the disordered state of nature mirrors the disordered state of our souls.”¹³

Although Dembski's view of the consequences of human sin is similar to those holding a young-earth view, he accepts the overwhelming scientific evidence for an ancient universe and earth, and a long biological history with its concomitant suffering and death. He then asks, "Without a young earth, how can such natural evils be traced back to human sin?" His response is that the answer lies in God's foreknowledge and omnipotence. "An omniscient and omnipotent God who is able to act preemptively to anticipate human actions will certainly do so to anticipate so momentous a human action as the Fall."¹⁴ God thus preemptively acted in creation to form a world appropriate for a fallen humanity. But why must that world contain natural evil?

Dembski argues that the effect of sin must be evident in creation as a testimony to human rebellion.

For redemption to effectively deliver humanity from evil therefore requires humanity to be clear as to precisely what it has consented to in rebelling against God and embracing evil. To achieve this clarity humanity must experience the full brunt of the evil that it has set in motion, and this requires that the creation itself fully manifest the consequences of humanity's rebellion against God.¹⁵

He thus argues that God preemptively brought about natural evils in creation for the purpose of making us realize the gravity of our sin. However, no argument is given as to why natural evil is necessary, or even effective, for this task. Are not the evident multifarious consequences of moral evil sufficient?

In this theodicy, God's activity in creation is focused exclusively on providing a home for fallen humanity. Nowhere does it address the problem of natural evil from the perspective of the nonhuman creation. What benefit arises (either individually or corporately) to the innocent creatures suffering pain and death over hundreds of millions of years before the appearance of humanity? There is nothing here to answer the original challenge made by C. S. Lewis.

Natural "Evil" as God's Good Purpose

It Is the Whole of Creation That Is Good

In what way can we view the death and pain that are part of animal existence as part of God's good creation? One approach can be seen in the argu-

ments of Augustine. Influenced by Greek philosophy, Augustine viewed the eternal God as the only perfect good by virtue of absolute immutability. All of creation is transitory and subject to change, and thus of lesser goodness. However, all things God has made are good. The good of mortal creatures is to be seen in their created natures and in their places within the whole of the created order. If we fail to see the goodness of the whole, it is because we are embedded within it. Augustine argues,

It is, in fact, the very law of transitory things that, here on Earth where such things are at home, some should be born while others die, the weak should give way to the strong and the victims should nourish the life of the victors. If the beauty of this order fails to delight us, it is because we ourselves, by reason of our mortality, are so enmeshed in this corner of the cosmos that we fail to perceive the beauty of a total pattern in which the particular parts, which seem ugly to us, blend in so harmonious and beautiful a way.¹⁶

Furthermore:

All natures, then, are good simply because they exist and, therefore, have each its own measure of being, its own beauty, even, in a way, its own peace. And when each is in the place assigned by the order of nature, it best preserves the full measure of being that was given to it.¹⁷

Those beings designed to die promote the good of the whole by fulfilling their part in God's plan for governing the universe.

This view of the goodness of creation subsumes the experience of pain and suffering of the individual animal life into the goodness and beauty of the creation as a whole. Out of this Augustinian theodicy came the argument of Leibniz that God brought into existence only "the best of all possible worlds."¹⁸ However, this appeal to the goodness of the whole does not address the real core of the theodicy problem with respect to natural evil. It is the suffering of the individual creature that provokes our questions of God's goodness. As pointed out by Christopher Southgate,

the crux of the problem is not the overall system and its overall goodness but the Christian's struggle with the challenge to the goodness of God posed by specific cases of innocent suffering.¹⁹

The suffering of individual creatures is brought into even greater focus by the testimony of Scripture that

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God is not distant from creation, but immanent within it.²⁰ Augustine avoided this tension, by making God, the eternal and unchangeable good, unable to be negatively affected by his mortal creation. But if God does indeed care for the sparrow, then the suffering of the individual created life must matter to God and not just to us.

Creation Given Freedom as an Act of Divine Love

In contrast to the Augustinian view described above, the "free-process" defense for natural evil takes the immanence of God within creation very seriously. As an expression of divine love, God has given the creation freedom in its own creative process. While God actively upholds the processes of nature, the specific consequences of those processes are not dictated. The implication is that the "free-process" defense for natural evil is analogous to the "free-will" defense for moral evil. John Polkinghorne has stated this as "God accords to the processes of the world that same respect that he accords to the actions of humanity."²¹

To give such freedom requires that God has limited his own controlling power over creation and made himself vulnerable to it. The nonhuman creation can act in a manner that grieves God. As emphasized by W. H. Vanstone in his book *The Risk of Love*, authentic love is characterized by the very qualities of self-giving, vulnerability, and precariousness. This "self-emptying" love is central to God's very character—to who God is—and is fully expressed in Christ. Thus, according to Vanstone,

The activity of God in creation must be precarious. It must proceed by no assured programme. Its progress, like every progress of love, must be an angular progress—in which each step is a precarious step into the unknown; in which each triumph contains a new potential of tragedy, and each tragedy may be redeemed into a wider triumph...²²

Nature in its freedom includes pain and suffering, yet these "tragedies" are redeemed. Vanstone states,

Where the destructive potential is activated, we see the tragedy of nature: and we also see, on occasion, that endless inventiveness of nature which, out of the material of tragedy, fashions the possibility of a new kind or level of triumph.²³

The destructive processes that are part of the created order make possible new life—even biological

novelty and a richer, more diverse biosphere. The suffering and death embedded in creation provide the opportunity for new creative possibilities, and so are redeemed. This point is emphasized by Holmes Rolston III who argues that the world is a place of suffering, of "pathos," and that it is through that suffering that the creation is advanced to "something higher." Furthermore, "this pathetic element in nature is seen in faith to be at the deepest logical level the pathos in God. God is not in a simple way the Benevolent Architect, but is rather the Suffering Redeemer." Nature is "cruciform" because the Creator is the Crucified. Suffering creatures participate in the divine pathos, and "... God too suffers, not less than God's creatures, in order to gain for the creatures a more abundant life."²⁴

George Murphy has similarly argued that Christian theodicy must begin with the cross. Our understanding of God's voluntary self-limitation is grounded in the theology of the crucified. As a consequence, we recognize that God shares in the cost that is necessary to secure creation's freedom and integrity. God suffers with the world from the evil taking place within it—"The world's pains are God's stigmata."²⁵

Our world, with its seemingly inseparable qualities of astounding beauty, bursting creativity, and innocent suffering, can perhaps be made theologically intelligible by seeing it as the loving creation of a self-emptying God who has entered into that creation and shared in its suffering. As stated in the poem that began this essay, "the universe for him is like a Crucifixion." Nonetheless, we still, rightly or wrongly, desire to see some purpose to innocent suffering that has meaning at the level of the individual creature's life.²⁶ Is there not something more that can be said?

Creation as an Environment for Human "Soul-Making"

C. S. Lewis argued that a "law-governed" universe with regularity and predictability, and the possibility of suffering and death, is a logical necessity for a world of free embodied souls.²⁷ It has been further suggested that the hand of God must be largely, but not entirely, hidden for true freedom to be exercised. Robert Wennberg has pursued this line of thinking by stating that the presence of animal pain and suffering contributes to the creation of an environment

in which human free decision-making and “soul-making” can best occur. He begins with the assertion that God’s purpose in creating was to “bring into existence spiritual-moral agents capable of freely coming to know and love God.” He then argues that an environment in which God’s power and glory were overwhelmingly present, and all threat of pain and suffering eliminated, would not give adequate “space” for the exercise of fully free choices. Conversely, a world devoid of pointers to God and yet filled with pain and suffering would make commitment to a loving God “difficult beyond measure.” What is required is a middle way,

an ambiguous world, with pointers to God, yet with features, such as physical evil including animal pain, that give us pause, that make one wonder, an environment that does not dictate or coerce what one believes—an environment that makes room for an appropriate human freedom.²⁸

This “soul-making” theodicy is probably best articulated by John Hick in his book *Evil and the God of Love*. God created not only an environment for individual freedom, but also an environment for the development of our God-centered humanity. Humankind was not created in a complete state of perfection, but rather as “raw material” for God’s further work of molding us into his image and likeness. Thus, God’s purpose was not to make a hedonistic paradise but an environment for “soul-making.” Hick states,

... we have to recognize that the presence of pleasure and the absence of pain cannot be the supreme and overriding end for which the world exists. Rather, this world must be a place of soul-making. And its value is to be judged, not primarily by the quantity of pleasure and pain occurring in it at any particular moment, but by its fitness for its purpose, the purpose of soul-making.²⁹

Humankind is perfected through a life of moral choices and challenges, and the struggles and sufferings of life bring out human potentialities.

Hick further challenges us to consider the consequences of a world in which pain not only did not occur, but could not occur. His argument here is worth an extended quotation:

... one of the most striking features of such a rearranged world would be the absence of any need to comprehend nature and to learn to predict and manipulate its movements ... Again, in a painless world man would not have to earn his living by

the sweat of his brow or the ingenuity of his brain. For in banishing all pain we banish violent hunger and thirst and excessive heat or cold, and in excluding these we make needless all those activities ... by which men have staved off those painful conditions. Human existence would involve no need for exertion, no kind of challenge, no problems to be solved or difficulties to be overcome, no demand of the environment for human skill or inventiveness. There would be nothing to avoid and nothing to seek; no occasion for co-operation or mutual help; no stimulus to the development of culture or the creation of civilization.³⁰

Our human virtues and moral potentials are made manifest through our struggles in this creation. The Christ-likeness to which we are called as his image-bearers (self-sacrifice, mercy, compassion, forgiveness) is expressed in the context of the needs and suffering of others. I would suggest that even physical death itself is part of our “soul-making.”

However true, human soul-making does not seem an adequate basis for a theodicy of animal pain. It justifies animal pain only from the perspective of human good. At the same time, the idea of “soul-making” may contain the seeds of a possible approach to addressing the meaning of suffering in the nonhuman creation that has relevance to the individual animal life.

Toward a Possible Solution

The question that continues to arise and needs to be addressed is, How might death, pain, and suffering accrue to the benefit of the individual animal life? In my opinion, Austin Farrer comes closest to directly facing this issue. Farrer focuses on the experience of the individual animal life and its relationship to God. God cares for the life and activity of the individual animal—so God really does care for the sparrow. “... God does not want his creatures for any ulterior aim; he wants them to be, for their sakes, not his.” The life of each individual animal is a work of God. So how does God care for the sparrow? Farrer responds:

God loves his animal creatures by being God to them, that is, by natural providence and creative power; not by being a brother creature to them, as he does for mankind in the unique miracle of his incarnation.³¹

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What role then does pain and suffering have in the life of an animal? Farrer explains that

Animal existence is beset by goods and evils, things needing to be shunned and things asking to be embraced. But animal action is the shunning of the one, and the embracing of the other; and while the animal survives, it is successful rather than the reverse ... Living is its own justification, its own good.

Furthermore,

the God of nature gives his animal creatures pains out of love for them, to save their lives ... Again, out of love for them, God moves his creatures to shun their pains and mend their harms, so far as their sense or capacity allows.³²

God is not just interested in the future of species, but is a participant in the lives of individual creatures.

I would argue that this is not the end of the matter. The "soul-making" theodicy provides a model for considering the fulfillment of animal existence. Like Hick, we can ask—What would animal life be like in the absence of death and pain? It can be argued that it is the presence of death and pain that makes possible the fulfillment of individual animal lives. Death and pain are integral to the functioning of all ecological systems and animal lifestyles. Defense, protection, camouflage, pursuit of prey, and so forth are major forces that shape both animal biology and behavior. The drive to reproduce is one of the most fundamental features of life, yet would not be possible in the absence of death. Without the continued loss of individuals to disease, predation, or injury, the carrying capacity of the environment would be quickly reached and continued reproduction would become impossible. Consider how much of an animal's life is devoted to reproductive activities such as attracting mates, defending territory, preparing nests, caring for young, etc.

What would remain of an animal's life without the search for food, pursuit of prey, need for defense, or the drive to reproduce? In short, essentially all meaningful animal activity and interaction would be rendered meaningless or impossible if death were not a universal certainty. It can thus be reasonably argued that it is the presence of death and pain that make possible the fulfillment of individual animal lives. Natural "evil" thus seems to be a necessary component of the environment for "soul-making" in both the human and nonhuman creation.

The concept of animal fulfillment is one that Christopher Southgate also used in trying to develop a theodicy that applied at the level of the individual creature.³³ Southgate argues that animal lives can be seen as "fulfilled," "growing toward fulfillment," "frustrated," or "transcending self." He defines "fulfilled" as "a state in which the creature is utterly being itself, in an environment in which it flourishes, with access to the appropriate energy sources and reproductive opportunities." "Frustrated" animals are held back in some way from fulfillment, and animals that "transcend self" have explored new possibilities of their being. Southgate envisions God delighting in the fulfillment of creatures, and "inviting" them toward transcendence. This is similar, I think, to Farrer's view of God wanting creatures simply to be who they are. But what about those creatures whose lives are "frustrated"? Here Southgate speculates that "all that the frustrated creature suffers, and all it might have been but for frustration, is retained in the memory of the Trinity."

Finally, many authors see a final and complete answer to the problem of suffering of the nonhuman creation only in the promise of a new creation in which all creation participates. The eschatological hope of a new heaven and a new earth points us to the final redemption of all things in Christ.

Conclusions

So what does all of this mean for us? How do we respond practically to the challenge of theodicy?

I draw the following implications from this contemplation of the God-given character of the non-human creation.

1. Creation is good, and the death and pain embedded within it are part of God's will and purpose for it. Creation is not a fallen thing to be conquered and controlled, but a divine gift we are to serve and rule and enjoy as God's stewards.
2. Rather than focusing on the presumed fallenness of creation as the result of past disobedience, we need to recognize our present abuse of our creation mandate. We need to fulfill our calling to serve and care for creation as God's image bearers.³⁴
3. Since the sole task of animals on this earth is to be, and when they die they can no longer glorify God

in this manner, it is our task as stewards not to inhibit, but rather to aid them in being what they are. We are to encourage the fulfillment of animal existence.

4. Most human suffering due to natural events or processes is a consequence of our free moral choice, or our disregard for natural processes.
5. For the nonhuman creation, pain and suffering provide the context in which animal lives can be rich and fulfilled. For us, physical death, pain, and suffering are opportunities for the expression of Christ-like character. This is not to argue that we are to embrace death and suffering; rather, it is in the struggle to understand and overcome them that our most Christ-like and meaningful thoughts and actions are expressed.
6. The crucified God participates in the suffering and death of his creation. God is not distant, but with us in our life's journey toward becoming like him, and with the creature in its journey toward fulfillment.

It is this last point which I think is the most important. God is present with us, and with all creatures, as we each live out God's call in our lives. It is only in that journey of life, including especially its pain and struggle, that God's purpose for his creation (human and nonhuman) can be expressed. And most profoundly, God is a participant with us, and with the sparrow, in that struggle of life. "Then the universe for him is like a Crucifixion." ❧

Notes

- ¹This poem was included in a collection of poems that was one of two works by Czeslaw Milosz mentioned in a review article by Michael Ignatieff, "The Art of Witness," *New York Review of Books* (March 23, 1995). I thank Carol Regehr for bringing my attention to this work.
- ²Moltmann refers to this aspect of God's creative activity in history as "continuous creation." Jürgen Moltmann, *God in Creation* (Minneapolis, MN: Fortress Press, 1993), 206–14.
- ³I will not address here arguments concerning the degree to which animals experience pain. This issue is considered by Robert Wennberg in "Animal Suffering and the Problem of Evil," *Christian Scholar's Review* 21 (1991): 120–40. It is obvious to me that, for many animals at least, pain and suffering are a very real conscious experience.
- ⁴C. S. Lewis, *The Problem of Pain* (New York: Macmillan Publishing, 1962), 129.
- ⁵As stated by John Hick, in *Evil and the God of Love*, rev. ed. (New York: HarperCollins Publishers, 1977): "For every position that maintains the perfect goodness of God is

bound either to let go the absolute divine power and freedom, or else to hold that evil exists ultimately within God's good purpose" (pp. 149–50).

- ⁶This is from an essay by John C. Whitcomb published by the Institute for Creation Research on June 1, 2003 and entitled "Progressive Creationism." It is available at the ICR website at www.icr.org/article/121 (last accessed March 17, 2011).
- ⁷See chapter 8 of Henri Blocher, *In the Beginning* (Leicester, England: Inter-Varsity Press, 1984). I have also discussed these points in K. B. Miller, "Theological Implications of an Evolving Creation," *Perspectives on Science and Christian Faith* 45, no. 3 (1993): 150–60.
- ⁸Lewis, *The Problem of Pain*, 134–5.
- ⁹David Bentley Hart, *The Doors of the Sea: Where Was God in the Tsunami?* (Grand Rapids, MI: Wm. B. Eerdmans Publishing, 2005). He states,

... it is clearly the case that there is a kind of "provisional" cosmic dualism within the New Testament: not an ultimate dualism, of course, between two equal principles; but certainly a conflict between a sphere of created autonomy that strives against God on the one hand and the saving love of God in time on the other. (Pp. 62–3)
- ¹⁰Michael Lloyd, "Are Animals Fallen?" in *Animals on the Agenda: Questions about Animals for Theology and Ethics*, ed. Andrew Linzey and Dorothy Yamamoto (London: SCM Press, 1998), 147–60.
- ¹¹Wennberg, "Animal Suffering and the Problem of Evil," 134.
- ¹²I discuss "natural hazards" as part of God's renewal of the earth and life in K. B. Miller, "Natural Hazards: Challenges to the Creation Mandate of Dominion?" *Perspectives on Science and Christian Faith* 53, no. 3 (2001): 184–7.
- ¹³From the online essay by William Dembski, "Christian Theodicy in Light of Genesis and Modern Science," (2006): 3–5. Published on the website of "Uncommon Descent" and now available at http://standfirmfortruth.com/wp-content/uploads/2010/01/2006.05.christian_theodicy.pdf. Dembski has expanded the arguments in this essay in his book *The End of Christianity: Finding a Good God in an Evil World* (New York: Broadman and Holman Academic, 2009).
- ¹⁴Dembski, "Christian Theodicy in Light of Genesis and Modern Science," 22, 23.
- ¹⁵*Ibid.*, 19, 29.
- ¹⁶Vernon Bourke, ed., *St. Augustine, City of God* (New York: Doubleday, 1958), Book XII, chapter 4, 249.
- ¹⁷*City of God*, Book XII, chapter 5, 250.
- ¹⁸Leibniz's theodicy is discussed by John Hick in *Evil and the God of Love*, 154–66. Hick quotes the following from Leibniz: "Not only does [God] derive from [evils] greater goods, but he finds them connected with the greatest goods of all those that are possible: so that it would be a fault not to permit them" (p. 158).
- ¹⁹Christopher Southgate, *The Groaning of Creation* (Louisville, KY: Westminster John Knox Press, 2008), 13.
- ²⁰John Polkinghorne, in his book *Science and Providence: God's Interaction with the World* (Boston, MA: Shambhala New Science Library, 1989), has put it this way:

The more strongly one is able to speak of God's particular action in the world, the more firmly one asserts that world to be subject to his purposive will,

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so much the more forceful becomes the problem of the widespread existence of evil within it. (P. 59)

²¹Ibid., 67.

²²W. H. Vanstone, *The Risk of Love* (New York: Oxford University Press, 1978), 62–3.

²³Ibid., 85.

²⁴Holmes Rolston III, "Does Nature Need to Be Redeemed?" *Zygon* 29 (June 1994): 205–29.

²⁵George Murphy, *The Cosmos in the Light of the Cross* (Harrisburg, PA: Trinity Press International, 2003), 87.

²⁶Christopher Southgate raises another problem with trying to apply the concept of a cruciform creation to the experience of suffering by the individual creature. In his book *The Groaning of Creation*, he states,

It is important too to see the profound differences between the Passion of Christ and the "passion play" of evolution. First, the cruciform life was *chosen* by Jesus, and from this *choice* came the saving power of

his love. The plight of the "casualties" of evolution, who have suffering *imposed* on them by God for the longer-term good of others, is very different. The suffering of the myriad casualties of evolution is not freely chosen. (P. 50)

²⁷Lewis, *The Problem of Pain*, 34.

²⁸Wennberg, "Animal Suffering and the Problem of Evil," 137–8.

²⁹Hick, *Evil and the God of Love*, 295.

³⁰Ibid., 342–3.

³¹Austin Farrer, *Love Almighty and Ills Unlimited* (Garden City, NY: Doubleday & Company, 1961), 91–3.

³²Ibid., 74, 92.

³³Southgate, *The Groaning of Creation*, 64–5.

³⁴The concept of actively "imagining God" in creation is developed by Douglas John Hall in *Imaging God: Dominion as Stewardship* (Grand Rapids, MI: Wm. B. Eerdmans Publishing, 1986).

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Dorothy Chappell

is Dean of Natural and Social Sciences at Wheaton College, Illinois. At Wheaton since 1977 in various roles, she spearheaded the building of the \$62 million science center that was awarded the Leed Gold Certification on Oct. 6, 2010.

Dorothy co-edited with E. David Cook, *Not Just Science: Questions Where Christian Faith and Natural Science Intersect* (Zondervan, 2005).



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Naturalistic versus Eschatological Theologies of Evolution

Junghyung Kim



Junghyung Kim

In this article I pose two primary questions. (1) How is God's action in the evolutionary process to be understood with regard to seemingly self-explanatory evolutionary novelties, novelties with no telos inherent within them? (2) How can Christian affirmation of divine action in evolution be reconciled with the massive yet unavoidable evil and suffering involved in the evolutionary process? This article explores the answers to the questions by explicating two major figures in the contemporary science-theology dialogue: Arthur Peacocke and Wolfhart Pannenberg. They represent quite contrasting positions within the camp of theistic evolution. I term them respectively "naturalistic" and "eschatological." I will analyze their positions in terms of their fundamental metaphysical commitments and respective answers to the two questions mentioned above. This analysis aims first to make explicit the contrasting points between two different approaches and then to lay the foundation for a theology of evolution going beyond them.

Can we believe in God and evolution at the same time? Ted Peters and Martinez Hewlett answer: yes, we can. But we can do so only if we do not confuse evolutionary biology with a natural science and atheistic materialism.¹ In other words, given that the distinction between methodological and metaphysical reductionism is kept in mind, the scientific theory of evolution embracing only methodological reductionism is compatible with Christian faith. "Theistic evolution" is the name Peters and Hewlett give to the positions that they take when reconciling Christian faith and evolutionary biology.²

Yet, it is one thing to argue for the formal compatibility of God and evolution; it is quite another to address the substantial challenges that the details of evolutionary biology bring to Christian theology. For instance, Peters and Hewlett identify five issues theistic evolutionists need to deal with: deep time,

natural selection, common descent, divine action, and theodicy.³ This short article cannot address all these important subjects. Nevertheless, with a specific focus on God's relation to the history of biological evolution, I will pay special attention to the issues of divine action and theodicy. I will pose two primary questions. (1) How is God's action in the evolutionary process to be understood with regard to seemingly self-explanatory⁴ evolutionary novelties, novelties with no *telos* inherent within them? (2) How can Christian affirmation

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of divine action in evolution be reconciled with the massive yet unavoidable evil and suffering involved in the evolutionary process?

This article explores the answers to these questions by explicating two major figures in the contemporary science-theology dialogue: Arthur Peacocke and Wolfhart Pannenberg. The former was a British biochemist and theologian with an Anglican background; the latter, a German systematic theologian with a Lutheran background. They represent quite contrasting positions within the single camp of theistic evolution. I term them “naturalistic” and “eschatological,” respectively. I will analyze their positions in terms of their fundamental metaphysical commitments and respective answers to the above-mentioned questions. This analysis aims first to make explicit the contrasting points between two different approaches and then to lay the foundation for a theology of evolution going beyond them.

Arthur Peacocke: A Naturalistic Theology of Evolution

As a hybrid scientist-theologian, Peacocke shows “a deep concern with the *naturalistic assumptions* of the empirical sciences and with the need to find an adequate theological response to them.”⁵ The naturalistic approach in his theology of evolution represents one of the most influential strands among theistic evolutionists.

Naturalistic Theism

Peacocke summarizes his basic theological position with three letters: ENP. ENP refers to Emergent monism, Naturalistic theism, and Panentheism, all of which are closely related to one another.⁶ Among them, this discussion focuses on naturalistic theism.

The first fact to be noted is that Peacocke’s discussion begins with scientific insights and derives from them the implications for our understanding of God’s relation to the world. In other words, he wants to bring to his theological thinking the assumptions underlying today’s understanding of the natural world as it is afforded by the sciences. Of the many significant assumptions, he refers specifically to the ubiquity of regularity in the world, its closure to nonnatural forces, its skepticism about the supernatural, and the self-creative and emergent character of natural processes.⁷ It is important to note that the

assumptions Peacocke derives from the sciences are not merely methodological; but they are also metaphysical in nature, although definitely not atheistic.

In other words, Peacocke embraces not only “methodological naturalism,” but also a sort of “metaphysical naturalism.” In this regard, he follows David Griffin’s proposal of “scientific naturalism.” Like Griffin, Peacocke defines scientific naturalism as naturalism_{ns} (ns: nonsupernaturalist), putting it in antithesis with supernaturalism. At the same time, he distinguishes scientific naturalism from any full-blown metaphysical position, such as materialistic naturalism.⁸ Scientific naturalism is the only type of naturalism assumed by the scientific enterprise. Hence, it is open to Christian theism as well as materialistic atheism.⁹

In this way, Peacocke rejects both supernaturalism, a doctrine that a supernatural being exists outside the otherwise universal web of cause-effect relations and can violate it, and materialistic naturalism, a metaphysical claim that nature is all there is. Since scientific naturalism provides the true account of our world, he believes that there are neither supernatural entities nor miracles that break the regularities of nature discovered by science.¹⁰ Nonetheless, he believes that scientific naturalism is reconcilable with Christian theism, if God is not conceived as a supernatural person who can violate the natural regularities.

When Peacocke defines his theological position as naturalistic theism, scientific naturalism is already presupposed in it. Yet, naturalistic theism, in its genuine sense, means more than scientific naturalism; in fact, it contains a theological claim about a specific mode of divine action in the natural world:

[T]he processes revealed by the sciences are in themselves the action of God as Creator, such that God is not to be found as some kind of additional influence or factor added on to the processes of the world God is creating.¹¹

This position he designates as *theological naturalism*. Once scientific naturalism has excluded all the supernatural forces from the natural processes, the processes of ongoing creation in the natural world are identified with divine action. God is depicted as immanent in the natural processes. Only if it is accepted that God is “more than” the natural processes does this theological naturalism lead to a

panentheistic vision.¹² Hence, Peacocke's naturalistic theism refers to this naturalistic-immanentist-panentheistic approach to divine action in the natural world.

Peacocke's naturalistic understanding of God's relation to the natural world needs a few more comments. First of all, Peacocke affirms that the natural, including the human, world owes its existence to another "entity," a Creator God who is real and personal and has purposes for this world. Yet, he confines the scope of continuous divine activity within the regularities of natural processes, which is, in itself, God's creation. He is explicitly against the idea of miracle:

God does not implement these purposes through "miracles" that intervene in or abrogate the world's natural regularities, which continue to be explicated and investigated by the natural sciences.¹³

Be that as it may, Peacocke does not succumb to the model of a deistic God whose creative activity is found only in the beginning. His explicitly panentheistic idea of God as the circumambient reality emphasizes divine immanence in the world.¹⁴ And he is insistent that God is working "in, with, and under" the natural processes. In addition, he argues that God could, if God so intended, influence particular events in the world without contravening the regularities established by science through the downward causality on the world as a whole.¹⁵ I now turn to how Peacocke develops his theology of evolution within the framework of naturalistic theism.

Interplay of Chance and Law as Creative Origin of Evolution

Peacocke's recent discussion of evolution begins with a remarkable identification of two characteristic features in the evolutionary history: continuity and emergence. First, he notes the *seamless* character of the history of nature as it is described by science.¹⁶ This seamless, continuous feature is especially true of the processes of biological evolution. According to Peacocke, this feature was at first a conjecture of Charles Darwin, yet is now thoroughly validated. As the second feature, Peacocke refers to emergence; namely, new forms of matter appear in the natural processes and constitute a hierarchy of emergent levels. These emergent levels involve not only epistemologically irreducible concepts, but also at least a "putative ontology."¹⁷

These two features of evolutionary history are not separated from each other. Rather, the history of emergent evolution is marked by continuous processes. In other words, even the ontologically strong emergence is to be explained without recourse to any supernatural influences. Peacocke thinks that the emergence of life is no exception in this regard.¹⁸

If both the origin and history of life are to be scientifically explained away as a seamless process of emergent evolution, how can one conceive of divine action within the evolutionary history? Does this scientific explanation obviate any idea of divine action? By no means. On the contrary, evolution has made possible a more dynamic understanding of divine action in the world. In this vein, Peacocke proposes

the model of God *sustaining and giving continuous existence* to a process which has a *creativity built into it* by God. God is creating at every moment of the world's existence *in and through the perpetually-endowed creativity* of the very stuff of the world.¹⁹

To use a sacramental language, God "is 'in, with, and under' all-that-is and all-that-goes-on." Thus, Peacocke does not feel any need to look for additional divine action to explain biological evolution. It should be noted that Peacocke deliberately avoids an intimation of any sort of special divine action in the evolutionary processes.

This naturalistic understanding of divine action within evolutionary processes is further confirmed by Peacocke's more specific discussion of the creativity and propensities in evolution. In this regard, he attempts to respond to Jacques Monod, who argued that everything in evolution went on in an entirely uncontrolled and fortuitous matter. Contra Monod, Peacocke argues that there is no reason to attribute a metaphysical status to chance, for the *chances* at the DNA level of mutation do not preclude *trends* and *inbuilt propensities* at the higher levels of organisms, populations, and ecosystems. Instead, he argues that

it is the interplay of chance and law that is in fact creative within time, for it is the combination of the two which allows new forms to emerge and evolve—so that natural selection appears to be opportunistic.²⁰

And this creative interplay of chance and law presupposes the "potentialities" that the physical world possessed *ab initio*. It is a short step to move from this

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idea of *ab initio* potentialities to that of a sort of divine creation. Peacocke argues that a theist must think of such potentialities as *written into* creation by the Creator's intention and, at the same time, as gradually being actualized by the operation of chance stimulating their emergence. In this sense, God is regarded as the ultimate ground and source of both law and chance and therefore of the creativity in evolution.

In addition, Peacocke argues that there are natural "propensities" in evolution toward the possession of certain characteristics and that these propensities are *inherently built into* an evolutionary process based on natural selection.²¹ Consistent with his scientific naturalism, Peacocke thinks that these propensities do not need any mysterious explanation. They simply reflect the advantages conferred in natural selection by these features. Thus, he says that there seems to be "*overall direction and implementation of divine purpose* through the interplay of chance and law without a deterministic plan fixing all the details of the structure(s) of what emerges possessing personal qualities."²² Probably, he would agree with Niels Henrik Gregersen's idea of God as the designer of the self-organizing universe.²³ No wonder that Peacocke does not see any need to postulate any *special* divine action to explain the overall direction of evolution. In particular, he does not accept the idea of divine manipulation of mutations at the quantum level to ensure the emergence of persons as a result of evolutionary processes.

As I said earlier, one needs to remember that Peacocke does not simply deny special divine action in the natural world. His proposal of God's downward causality on the world as a whole is widely known. Given that our topic focuses upon biological evolution, however, Peacocke seems reluctant, if not opposed, to apply even such a type of special divine action to the evolutionary process, when he says,

If there are any such influences by God shaping the direction of evolutionary processes at specific points—for which I see no evidence (how could we know?) and no theological need—I myself could only envisage them as being through God's whole-part constraint on all-that-is affecting the confluence of what, to us, would be independent causal chains.²⁴

In short, this quotation confirms once again the strongly naturalistic tendency of Peacocke's theology of evolution.

God's Cosuffering Immanence in the Self-Creative Process of Evolution

This naturalistic understanding of the evolutionary history as a seamless process of emergence (scientific naturalism) and of God as acting in and through the natural processes (theological naturalism) underlies Peacocke's natural theodicy.

As regards the ubiquity of pain, suffering, and death in the history of evolution, Peacocke's theological response begins with stressing its biological inevitability in two ways. First, he says, the ubiquity of pain and suffering in the living world appears to be an inevitable consequence of creatures acquiring advantageous properties in natural selection. Next, in a finite universe, the law of new life through death of the old is inevitable. This is "the prerequisite of the creativity of the biological order."²⁵

Then, Peacocke offers his own twofold answer to the problem of evil in evolution. On the one hand, he emphasizes the positive aspect of evolution, such as the diversity and richness of life, insisting that God has joy and delight in creation itself:

The existence of the whole tapestry of the created order, in its warp and woof, and in the very heterogeneity and multiplicity of its forms must be taken to be the Creator's intention.²⁶

As for the negative side of evolution, Peacocke appeals to the recent renewal of the theology of the cross: if God is immanently present in and to natural processes, he says, "God suffers *in, with, and under* the creative processes of the world with their costly unfolding in time."²⁷ To the motif of the cosuffering God, Peacocke adds another motif of teleology found in John Hick's "Irenaean" theodicy.²⁸ Thus, Peacocke argues that when God suffers the natural evils along with the world, God has a specific intention to bring about a greater good thereby—that is, a kingdom of loving people of free-will, in communion with God and with each other.

Peacocke's theodicy, grounded upon naturalistic theism, may be summarized as a combination of the theology of the cross and the defense of a free process for the sake of a greater good. One may note here that Peacocke emphasizes the cross of Jesus and its implication for our understanding of God as the suffering (or cosuffering) God, without any mention of the resurrection of Jesus and its implication for his theodicy.²⁹

Naturalistic Theology of Evolution

Peacocke's naturalistic approach in the theological response to evolution, as thus explored, is widely shared among many contemporary theologians. Among them, several process thinkers, including David Griffin and Philip Clayton, stand out in developing an explicitly naturalistic theology of evolution. Some panentheistic thinkers such as Niels Henrik Gregersen may also be included in this group.³⁰

In my judgment, one may identify several basic ideas shared by these naturalistic theologians of evolution. They prefer a naturalistic approach to evolution and tend to identify the creative process of emergent evolution itself with divine creative activity. In this process, God is depicted as creating in and through the evolutionary processes. This naturalistic-immanentist-panentheistic understanding of divine action in evolution presupposes that the evolutionary world is a seamless or closed web of complex cause-effect relations, even if ontologically strong emergence is maintained. Also, they assume that creative potentiality and trends toward complexity are originally built into natural processes, although not in a mechanistic or deterministic way. In addition, their naturalistic panentheism forces them to reserve their commitment to special divine action in the evolutionary processes, even though they generally do not deny the idea of special divine action altogether. Finally, with regard to the theodicy problem, they tend to prefer the free-process defense as well as the theology of the cross, while ignoring the significance of eschatological redemption for theodicy.

Wolfhart Pannenberg: An Eschatological Theology of Evolution

Wolfhart Pannenberg's theology of evolution is of special significance thanks to his well-refined eschatological perspective. Among theistic evolutionists, his eschatological theology of evolution represents another influential theological option which stands in remarkable contrast with the naturalistic theology of evolution at several important points.

Eschatological Ontology

In "Contingency and Natural Law,"³¹ Pannenberg proposes his original idea of eschatological ontology,

which provides the fundamental framework for his theological interpretation of the evolutionary process.³² He begins with the observation that the Israelites experienced contingent events as the historical acts of God. This fact has two significant implications for Pannenberg's understanding of reality. First, the structure of this biblical experience of reality as history reveals that occurrences are fundamentally contingent, for they are irreversible acts of God. As the following argument will show, this element of contingency is of extreme importance for Pannenberg's view of reality, in which contingency rather than regularity is regarded as the fundamental nature of reality.

Next, the biblical experience of reality as history also shows that the continuity or unity of the historical acts of God is constituted backward from ever new present, for every present event throws new light on earlier occurrences and makes them appear in new connections. This insight into backward continuity lays the foundation for Pannenberg's eschatological ontology.³³ The idea of backward historical continuity implies that every historical occurrence—whether past, present, or future—is open to the ultimate or eschatological future, for its true essence will be determined only within the completed connections of all the occurrences; this is not made possible until the eschatological future. Moreover, the openness of every occurrence to the eschatological future means that the eschatological future is constitutive of every occurrence.

Pannenberg argues that these biblical insights into the fundamental contingency and openness to the future of every occurrence can be applied to natural occurrences. First, in regard to the contingency of occurrences, Pannenberg finds its philosophical support in Carl Friedrich von Weizsäcker's concept of the history of nature. Weizsäcker derives this concept of the history of nature from his philosophical reflection upon cosmological physics. What excites Pannenberg is that this concept involves the idea of the irreversibility, unrepeatability, and thus uniqueness of all natural occurrences.³⁴

The idea of the contingent uniqueness of all natural occurrences enables Pannenberg to relativize the laws of nature in two ways. First, he argues, no scientific model of the history of nature can be immediately identified with the history of divine creative

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action, for by its methodological self-limitation such a scientific model deals only with regularities abstracted from fundamentally contingent occurrences. In this sense, natural laws are no more than abstract approximations to the actual course of nature.³⁵ In addition, the contingent uniqueness of each natural occurrence implies that “natural laws do not exist unchangeably but are related to regularities in occurrences that originate themselves and change in the process of material reality.”³⁶ In other words, natural laws are not eternally abiding laws. In that they originate and may also end in a certain temporal point, natural laws are time dependent, thus contingent.³⁷

Pannenberg’s attempt to relativize the natural laws by appealing to the fundamental contingency of natural occurrences needs a qualification. That is, it is to be noted that Pannenberg still insists on the inviolability of natural laws and rejects the idea of an exception to the normal regulation of events in nature or gaps in the scientific description of nature. Furthermore, he emphasizes that the uniformity of natural processes, as a reflection of divine faithfulness, has an enormous significance for the history of nature as a condition for the emergence of anything new.³⁸

The real point Pannenberg wants to make is that there is “more” to natural occurrences than their uniformity. And in this “more,” he finds a way to apply to natural processes his second biblical insight into the openness to the future of every occurrence. In this regard, he pays special attention to the temporal structure of the natural systems: “the systems observed in nature are always open, for as real systems they are basically temporal, i.e., systems in which temporal processes of change take place.”³⁹ As temporal systems, the natural systems are always open to the future. This idea of the openness to the future of natural systems relates to Pannenberg’s definition of the future as “the field of the possible.” As the field of the possible, the future is the basis of the openness of creation to a higher consummation as well as to the source of what is new or contingent in each event.

Having opened extra “room” for the power of the future in the temporal structure of the natural world, Pannenberg then relates it to the divine Spirit: “in the creaturely power of the future as the field of

the possible, the dynamic of the divine Spirit in creation expresses itself.”⁴⁰ While noting the biblical idea that the Spirit is the creative origin of the new life of resurrection, he further argues that one has to regard the dynamic of the Spirit in creation from the very outset in terms of the coming consummation, that is, as an expression of the power of his eschatological future. In this way, Pannenberg seems to find a convergence between the philosophical idea of the power of the future as the field of the possible and the theological idea of the dynamic of the divine Spirit as the power of the eschatological future. Finally, it is noteworthy that it is primarily the contingent or novel aspects, rather than the regular aspects, of the natural processes that the dynamic of the divine Spirit or the power of the future concerns.

Omega, Spirit, Field of Energy as Creative Origin of Evolution

As we have seen, Pannenberg derives from the biblical experience of reality as history a metaphysical conclusion about the nature of reality: that is, every natural occurrence is fundamentally contingent as well as open to the future. Now I will examine how Pannenberg develops his theology of evolution within this framework of eschatological ontology.

Pannenberg thinks that the theory of evolution has given theology an opportunity to see God’s ongoing creative activity in the constant bringing forth of things that are new. Also, he argues that the Darwinian theory of evolution legitimately replaced a teleological view of nature (as it is found in William Paley’s *Natural Theology*) by its emphasis on the contingency of events in the interplay of inheritance and natural selection.

Here one needs to be careful. What of Darwinism, in particular, does Pannenberg speak highly of? In fact, it is not Darwin’s discovery of the mechanism of natural selection, but his opening of a historical view of nature that Pannenberg acclaims. He does not think that it is possible to give a purely mechanistic explanation of evolution through the theory of natural selection. Yet the new evolutionary worldview provides him with “the possibility of thinking of the dynamic process of creation as a process that is open in time.”⁴¹ In short, Pannenberg’s eschatological understanding of reality as contingent and open to the future finds consonance with the historical view of nature implied in Darwin’s theory of evolution.

When one enters the details of Pannenberg's theology of evolution, it would be helpful to know that behind his theology of evolution there are two significant dialogue partners: the tradition of emergent evolution and Teilhard de Chardin.

First, Pannenberg traces the tradition of emergent evolution back to *Lux Mundi* (1889), a collection of twelve essays from liberal Anglo-Catholic theologians who hailed the theory of evolution as liberation from a mechanistic view of nature and took it to describe a historical, rather than mechanical, process. In his judgment, this work anticipated a later concept of emergent evolution, which was explicitly proposed in 1923 by Lloyd Morgan.⁴²

For Pannenberg, emergence refers to the appearance of something new at each stage of the evolutionary process. And, he says, that emergent novelty does not merely "result" by mechanical necessity from past conditions. In other words, the concept of emergence cannot conform to the mechanistic, reductionist way of describing Darwin's theory; rather, the former overcomes the latter. Pannenberg calls this idea of the arrival of something totally new at each stage of evolution the *epigenetic*⁴³ character of evolution. He argues that this idea has been further confirmed by the recent discovery that major steps in evolution cannot be explained by a sequence of small steps of cumulative variations, yet need "fulgurations" (or sudden brightening) of new schemes of organization.

In this regard, Pannenberg finds great interest in Michael Polanyi's interpretation of the emergence of more or less durative forms of finite reality in terms of phases of equilibrium within the context of a field. In his view, the description of the evolution of life in terms of a *generalized field theory* must be extremely suggestive to theologians, because it seems to offer a modern language that possibly can express the biblical idea of the divine spirit as the power of life that transcends the living organism and at the same time is intimately present in the individual.⁴⁴

Next, the second primary source of Pannenberg's theology of evolution is Teilhard de Chardin's idea of the Point Omega. It is worthwhile to note that Pannenberg engaged himself with Teilhard's works at an early stage when he began to develop his own theology of nature. In 1971, he wrote an article on Teilhard's phenomenology entitled "Spirit and

Energy." Briefly speaking, this short article aims to reveal the decisive weakness of Teilhard's hypothesis of the inner "Within" of a thing (or radial energy) in that it has no idea of the "field" nature of energy and still adheres to the "classical" bodily oriented concept of energy. For Teilhard, as a result, radial energy as the inner Within of a thing represents itself only as something inherent to the body itself, not as "a self-transcending power" standing independently over against it.

This criticism leads Pannenberg to a revision of Teilhard's concept of energy in terms of the concept of field. Pannenberg suggests that Teilhard's other hypothesis of the Point Omega might be of great help to supplement his weakness:

[I]f Omega as the power of the future shapes the creative origin of evolution, then the energy that moves this process is not to be understood already by itself as the energy dwelling in the phenomena.⁴⁵

That is, like the energy as a field, Omega is, at the same time, immanent and transcendent to the process of evolution.

One year later (1972) Pannenberg developed his earlier discussion of Teilhard and made more explicit his own pneumatological interpretation of evolution. This time, he emphasized the divine Spirit as a transcending principle, which transcends every given reality but activates it in the direction of a creative unification. No wonder that he identifies the divine Spirit with the Point Omega. In a similar vein, in *Systematic Theology*, he also says that the divine Spirit as the origin of creaturely life works through all *fields* of force and that in the working of the Spirit, the *future* of the consummation in the kingdom of God predominates.⁴⁶ In sum, it seems evident that Pannenberg locates the creative origin of evolution in the energy as a field, understood futuristically as the attractive power of the Point Omega, on the one hand, and understood pneumatically as the dynamic power of the divine Spirit, on the other.

Based upon this preunderstanding of two primary sources of Pannenberg's theology of evolution, I will explore his own reformulation of the crucial theological problem related to the scientific theory of evolution and his answer to it.

As far as the modern scientific theory of evolution is concerned, Pannenberg sees the problem in the

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apparent conflict between the modern “immanentist” view of evolution as self-organizing process and the biblical “transcendentalist” view of the origin of life in the divine Spirit.⁴⁷ Pannenberg fully accepts the modern immanentist view of evolutionary processes and argues for its compatibility with the biblical witness to the transcendental origin of life. His argument consists of two lines of thought: one appealing to the biblical tradition and the other to the scientific theory.

On the one hand, since God’s creative activity does not exclude the employment of secondary causes in bringing about creatures, creationists should not have any objection to the emergence of organisms from inorganic matter, nor to the descent of the higher animals from those initial stages of life. Thus, only if it is noted that the activity of creatures is not on the same level with that of the creator, there is no need to reject the immanentist explanation of evolution in modern sciences. On the other hand, as regards the scientific theory of evolution, Pannenberg argues for the compatibility between the epigenetic theory of evolution and the biblical idea of divine creative action. Unlike a mechanistic interpretation of Darwinism, the epigenetic theory speaks of the process of evolution within which something new occurs in virtually every single event. And the element of contingent novelty in the concept of epigenetic emergence, as already suggested in the eschatological ontology, secures its openness to the creative activity of God in this process. Moreover, the modern scientific view of the field of energy as the origin of the creative self-transcendence of life resonates with the biblical view of the Spirit as the transcendental origin of all life.

Finally, if one were to ask specifically how the immanent creativity of creatures relates to the transcendent creativity of the divine Spirit, Pannenberg would say that the spontaneous creativity of life is the *form* of God’s creative activity.⁴⁸ The creative self-organization of life in the process of evolution *corresponds* to the Spirit of God who breathes life into ever new creatures and thus blows through the evolution of life. For Pannenberg, however, the “breath” of the divine Spirit is not just a metaphorical expression, but as a field of energy also a “constitutive” part of the creative existence of living creatures, corresponding to the “ecstatic” character of their transcendent tendency. Moreover, in that the Spirit is not

only the source of life as seen in the Old Testament, but also the power of the resurrection of the dead as witnessed in the New Testament, he suggests that the divine Spirit works in the creative process of emergent evolution as the power of the eschatological future.⁴⁹

Eschatological Consummation as an Answer to the Question of Theodicy

In *Systematic Theology*, Pannenberg identifies two theological challenges introduced by the biological theory of evolution: (1) “the independence of creaturely forms and processes which leave the impression that they need no divine Creator to explain them” and (2) “the apparently senseless suffering of creatures and the entrance and at least temporary success of evil in creation.”⁵⁰ Pannenberg argues that these two issues are closely related to each other and are, in fact, two aspects of one and the same fact of creaturely independence. Creaturely independence is nothing other than the very goal of God’s creative activity:

For the autonomous creature self-independence conceals dependence on God, just as for the scientific observer the autonomy of natural processes hides their origin in God. At the same time, the results of creaturely autonomy in the form of suffering and iniquity seem to refute belief in a good Creator of this world.⁵¹

Pannenberg is convinced that the problem of theodicy can find its final answer only in the real overcoming of evil through the eschatological consummation of creation. Hence, only the union of creation and redemption against the background of eschatology makes possible a tenable answer to the question of theodicy. In this sense, he agrees with Wolfgang Trillhaas that “there is no theodicy without eschatology.”⁵² Meanwhile, he criticizes the traditional treatment of the problem of theodicy, in particular that of Leibniz. Traditional theodicy attempts to give a proof of the righteousness of God in his works “exclusively from the standpoint of the origin of the world and its order in God’s creative work,” while not taking into consideration “the history of God’s saving action and the eschatological fulfillment.”⁵³

Pannenberg concedes, however, that the promised eschatological redemption cannot answer the

question of why the Creator did not create a world in which there could be no pain or guilt. With the precaution that concern to absolve the Creator has been a mistake in Christian theodicy, he appeals to the so-called “free will defense” within the broader context of the doctrine of divine providence oriented to the reconciliation and redemption of the world. In short, he argues, if the Creator wanted free and independent creatures, then the decision to create carried with it the risk of a misuse of this creaturely freedom. In other words, the Creator accepts the “risk,” not necessity, of sin and evil as a “condition,” not means, of realizing a free fellowship of the creature with himself.⁵⁴ In this way, Pannenberg defends the traditional thesis of divine “permission” of evil for the purpose of salvation, sharply distinguishing it from the erroneous thesis of evil as an indispensable part of the perfect and beautiful creation.

But why did God permit evil in the first place? In his answer to this question, Pannenberg speaks first of the theological necessity of the finitude of creaturely existence: “it would involve contradiction to demand that God should have created creatures without creaturely limits.” Yet, he qualifies this statement by saying that the true basis of the possibility of evil is not limitation but “the independence for which creatures were made,” for the finitude is not yet itself evil.⁵⁵

Pannenberg’s theodicy may be summarized as a combination of free will defense and eschatological hope. He takes eschatological redemption and the resurrection of Jesus Christ much more seriously than Peacocke, while paying little attention to such themes as the cross of Jesus Christ and the suffering God, which is prominent in Peacocke’s theodicy.

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In addition to Teilhard de Chardin, one can see the eschatological perspective playing a decisive role in the theistic evolutionary schemes of Philip Hefner, Jürgen Moltmann, John Haught, Ted Peters, Martinez Hewlett, Robert John Russell, Thomas Tracy, and John Polkinghorne. Pannenberg has company.⁵⁶

Eschatological theologians of evolution share several insights in common. Of them, the most fundamental is the eschatological understanding of God as the attractive power of the eschatological future. The God of the future is the ultimate source of all the

contingency, temporality, creative novelty, and even emergent orders in creaturely existence, and thus the true origin of emergent evolution. As a result, the whole creation is revealed as the fundamentally historical reality which is influenced not just from the past, but also from the future new creation. Moreover, the current “laws” or regularities of natural processes are regarded not just as abstractions from the concrete reality of radical contingency, but also as open to the eschatological transformation. Finally, eschatological theists take seriously the biblical report of the bodily resurrection of Jesus Christ and interpret it as divine promise and anticipation of the eschatological consummation of creation. In this vein, they argue that without eschatology there is no definite answer to the theodicy problem.

A Theology of Evolution beyond Peacocke and Pannenberg

The scientific theory of evolution provides us with a picture of the biological world replete with apparently self-explanatory emergent novelties and their accompanying evils. Theistic evolutionists argue that this evolutionary theory is reconcilable with belief in God the Creator. Thus far I examined two representative theologians within the camp of theistic evolution, asking specifically how they conceive divine action in relation to both the evolutionary novelties and the accompanying evils. And I analyzed their divergences basically grounded upon their different metaphysical understandings of God’s relation to the natural world, which I term “naturalistic” and “eschatological,” respectively.

Let me briefly summarize the divergences between these two different approaches. Arthur Peacocke, representative of naturalistic theology of evolution, puts great emphasis upon the *regularity* and *closed causal web* of natural processes as they are discovered by sciences. Therefore he assumes that scientific naturalism in its materialist or physicalist version offers us the true account of the natural world. In this vein, Peacocke suggests a naturalistic-immanentist-panentheistic idea that God acts in and through the natural processes, or that the latter are themselves divine action. On the contrary, Wolfhart Pannenberg, an eschatological theologian of evolution, emphasizes the *contingency* and *openness to the future* of natural processes as they are implied in the

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biblical view of reality, and supposes that the laws of nature explored by scientists are limited approximations to the fundamentally contingent natural world. In this regard, Pannenberg proposes an eschatological understanding of divine action as the attractive or retroactive power of the eschatological future.

This divergence in approach between Peacocke and Pannenberg underlies their different explanations of the evolutionary novelties. The former believes that the interplay of chance and necessity is sufficient enough to explain the creative process of evolution. Hence, God is depicted only as the sustainer of, and continuous giver of the existence to, the evolutionary process in time.⁵⁷ For Pannenberg, meanwhile, the process of emergent evolution always presupposes the creative field of the divine Spirit. In other words, the divine Spirit as the attractive power of the Point Omega explains the general contingency as well as the evolutionary novelties of evolutionary process.

Likewise, with regard to the problem of evil in evolution, Peacocke's commitment to naturalistic panentheism not only enables him to embrace the theology of the cross in which God suffers with creatures, but also makes it difficult for him to conceive the eschatological redemption as a viable answer to the problem. On the other hand, Pannenberg appeals to the idea of the transformative power of the transcendent Omega and suggests the eschatological consummation as the ultimate answer to the problem of evil, while not explicitly affirming the thesis of the suffering God—at least, in his theodicy.

I suspect that all these divergences may be traced back, although by no means reducibly, to the difference of the starting points in their participation in the theology-science dialogue. One starts from the *scientific* insights into the natural world, derives from them a metaphysical assumption of reality as a closed web of causal relations (namely, *scientific naturalism*), and then construes the mode of divine action according to that view of reality; the other starts from the *biblical* insights into the God of history, derives from them a metaphysical assumption of reality as history open to the future (namely, *eschatological ontology*), and then applies that view of reality as an overarching framework to interpret the natural world.

To begin with, I want to state that these two different starting points themselves are not mutually exclusive. As Robert John Russell suggests, they may be brought to a creative mutual interaction in one form or another. However, the real problem arises at the metaphysical level; Peacocke and Pannenberg come from different starting points to mutually incompatible understandings of the nature of reality. If so, how can I resolve the conflict?

In my opinion, two points need to be made clear. First, Peacocke's scientific naturalism is not a scientific claim, but a metaphysical claim based on a philosophical reflection of scientific insights. In this vein, as Ronald Numbers and others argue, I think that the distinction between methodological naturalism and scientific naturalism ought to be retained.⁵⁸ Second, the gospel of Jesus Christ, the material norm of Christian theology, presupposes a particular view of reality. And, in my view, the gospel must be interpreted primarily as God's promise for the eschatological consummation of the whole creation. According to this explication of the gospel, reality is revealed as fundamentally contingent and open to the radical transformation in the future. While the distinction between methodological and scientific naturalism may confirm the distinction between the scientific theory of biological evolution and the philosophical position of evolutionism, a widespread assumption among many theistic evolutionists,⁵⁹ the eschatological explication of the gospel of Jesus Christ will challenge them to take seriously the eschatological perspective that is central to Christian faith, a thus far relatively neglected aspect.

These two points, in the final analysis, encourage me to prefer Pannenberg's approach to Peacocke's. If not only the naturalistic view of reality (scientific naturalism), but also the historical view of reality (eschatological ontology) is reconcilable with scientific insights, then it would be wiser to embrace the latter, for it is more faithful than the former to the norm of Christian theology, namely, the gospel of Jesus Christ.

Furthermore, addressing the question of God's relation to the evolutionary novelties and the accompanying evils, I think that eschatological theology gives more comprehensive theological answers than does naturalistic theology. In this aspect, I disagree with both Peters' and Hewlett's critical comments

concerning theistic evolutionists. They point to two weaknesses in most versions of theistic evolution: first, the neglect of the doctrine of redemption; and second, the collapse of the theodicy problem into natural processes. These criticisms are especially true of Peacocke's naturalistic theology of evolution. In agreement with Peters and Hewlett, I believe that it is important to emphasize the openness of the evolutionary process to the redemptive future, and that without the eschatological redemption of the whole creation there is no final answer to the theodicy problem.

Still, Pannenberg's eschatological theology of evolution is not complete in itself. In particular, as Peters rightly indicates, Pannenberg's *literal* identification of the force field with the divine Spirit is highly problematic.⁶⁰ Also, unlike the motif of the resurrection, the motif of the cross plays too small a role in his theology of evolution. In my opinion, the theology of the cross could bring more depth to his evolutionary theodicy by supplementing the eschatological vision of redemption with the idea of God's solidarity and compassion with the victims of the evolutionary process. Hence, I expect that further research will be needed in the direction of incorporating the theology of the cross into the eschatological theology of evolution. ∞

Notes

- ¹Ted Peters and Martinez J. Hewlett, *Can You Believe in God and Evolution? A Guide for the Perplexed* (Nashville, TN: Abingdon, 2006), 21.
- ²Ted Peters and Martinez Hewlett, *Evolution from Creation to New Creation: Conflict, Conversation, and Convergence* (Nashville, TN: Abingdon, 2003), 115.
- ³*Ibid.*, 118.
- ⁴Cf. also Francisco J. Ayala, "Darwin's Devolution: Design without Designer," in *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action*, ed. Robert John Russell, William R. Stoeger, and Francisco J. Ayala (Vatican City State: Vatican Observatory/Center for Theology and the Natural Sciences, 1998), 101-6.
- ⁵Philip Clayton, introduction to *All That Is*, ed. Philip Clayton (Minneapolis, MN: Fortress, 2007), xi.
- ⁶Arthur Peacocke, "A Naturalistic Faith for the Twenty-First Century," in *All That Is*, 5-56.
- ⁷*Ibid.*, 6.
- ⁸*Ibid.*, 8.
- ⁹Cf. David Ray Griffin, "Comments on the Responses by Van Till and Shults," *Science and Theology* 2, no. 2 (2004): 182-3.
- ¹⁰Peacocke, "Naturalistic Faith," 9.
- ¹¹*Ibid.*, 20.

- ¹²For Peacocke's defense against the charge of pantheism, see Arthur Peacocke, "Biological Evolution: A Positive Theological Appraisal," in *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action*, 359, n.5.
- ¹³Peacocke, "Naturalistic Faith," 9.
- ¹⁴Arthur Peacocke, "Articulating God's Presence in and to the World Unveiled by the Sciences," in *In Whom We Live and Move and Have Our Being*, ed. Philip Clayton and Arthur Peacocke (Grand Rapids, MI: Eerdmans, 2004), 146.
- ¹⁵Peacocke, "Naturalistic Faith," 9, 45-7. See also Arthur Peacocke, *Theology for a Scientific Age* (Minneapolis, MN: Fortress, 1993), 135-83.
- ¹⁶Peacocke, "Biological Evolution," 358. Emphasis is mine.
- ¹⁷*Ibid.* In this regard, the ontology of Peacocke's emergent monism comes close to Philip Clayton's concept of ontologically strong emergence: cf. Philip Clayton, *Mind and Emergence: From Quantum to Consciousness* (Oxford: Oxford University, 2004), 9. Also see Clayton's later qualification of the categorization of the concept of emergence: "Emergence from Physics to Theology: Toward a Panoramic View," *Zygon: Journal of Religion and Science* 41, no. 3 (2004).
- ¹⁸Peacocke, "Biological Evolution," 358, n.4.
- ¹⁹*Ibid.*, 359. My italics. We may compare this position with Robert John Russell's argument for the ontological gaps at quantum level. Cf. Russell's critical proposal of "top-down-through-bottom-up" divine action and Peacocke's appreciative response to it: *All That Is*, 146-51 and 186-8.
- ²⁰Peacocke, "Biological Evolution," 363.
- ²¹Peacocke appropriates Karl Popper's notion of "weighted possibilities," which are more than mere possibilities because of the notion's dependence on the total situation. He draws this notion from Karl Popper, *A World of Propensities* (Bristol: Thoemmes, 1990). See Peacocke, "Biological Evolution," 364-5.
- ²²Peacocke, "Biological Evolution," 368.
- ²³Niels Henrik Gregersen, "From Anthropocentric Design to Self-Organized Complexity," in *From Complexity to Life*, ed. Niels Henrik Gregersen (Oxford: Oxford, 2003), 206-34.
- ²⁴Peacocke, "Biological Evolution," 368-9. In this regard, Philip Clayton is more explicit than Peacocke, for Clayton argues in *Mind and Emergence* for the fundamental difference between physics-level and thought-level divine action (p. 191). In the same book, Clayton says,
- If theism implies that God influences the physical evolution of the cosmos or guides evolution at the biochemical level in order (say) to produce human beings, then it is committed to the strong notion of physical miracles that I have otherwise eschewed (p. 201).
- Instead, he suggests that "God does not begin influencing the world until organisms complex enough to manifest mental causality appear on the scene" (p. 201).
- ²⁵Peacocke, "Biological Evolution," 369.
- ²⁶*Ibid.*, 371.
- ²⁷*Ibid.*, 374. My italics. Note that the same sacramental prepositions are used to describe God's creative acts in evolution as well. See Peacocke, "Articulating God's Presence," 146.
- ²⁸Peacocke finds especially acceptable John Hick's earlier position in *Evil and the God of Love* (London: MacMillan, 1966). See Peacocke, "Biological Evolution," 372, n.43.

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²⁹Peacocke accepts the basic insight of Moltmann's *The Crucified God* (London: SCM, 1974), yet seems to have no or little interest in his earlier work, *Theology of Hope* (London: SCM, 1967). Also, it is noteworthy that Peacocke does not mention Hick's emphasis on the eschatological motif in his later theodicy.

³⁰For Clayton's presumption in favor of "metaphysical naturalism," see Clayton, *Mind and Emergence*, 164. Also, cf. David Ray Griffin, *Reenchantment without Supernaturalism* (Ithaca, NY: Cornell, 2000); Niels Henrik Gregersen, "The Emergence of Novelty: Exploring Five Theological Models," in *Christian Thought and Culture 2*, ed. Choi YunBae (Seoul: PCTS, 2007).

³¹Wolfhart Pannenberg, *Toward a Theology of Nature: Essays on Science and Faith*, ed. Ted Peters (Louisville, KY: Westminster/John Knox, 1993), 72–122.

³²We may trace the origin of this thesis back to his earlier work, "Revelation as History," in *Revelation as History*, ed. Wolfhart Pannenberg (New York: Macmillan, 1968), 123–81. As for the development of Pannenberg's eschatological understanding of God as the power of the future up to his *Systematic Theology II* (Grand Rapids, MI: Eerdmans, 1991), see "The God of Hope," in *Basic Questions in Theology 2* (New York: Augsburg Fortress Publishers, 1971), 234–49; *Theology and the Kingdom of God* (Philadelphia: Westminster Press, 1969); *Metaphysics and the Idea of God* (Grand Rapids, MI: Eerdmans, 1990). Also, cf. Christiaan Mostert, *God and the Future: Wolfhart Pannenberg's Eschatological Doctrine of God* (London: T&T Clark, 2002).

³³Pannenberg, *Theology of Nature*, 83. For a criticism of Pannenberg's ontology of the whole, see Miroslav Volf, "Enter into Joy! Sin, Death, and the Life of the World to Come," in *The End of the World and the Ends of God*, ed. John Polkinghorne and Michael Welker (Harrisburg, PA: Trinity Press International, 2000), 267. On the contrary, for a defense of the ontology of the totality, see Benjamin Myers, "The Difference Totality Makes: Reconsidering Pannenberg's Eschatological Ontology," *Neue Zeitschrift für Systematische Theologie und Religionsphilosophie* 49, no. 2 (2007): 141–55. Meanwhile, what Pannenberg means is not only epistemological (semantic), but also ontological determination by the future (or anticipation of the future). Cf. Clayton's distinction of two senses of anticipation and preference of the epistemological sense and also Pannenberg's response to Clayton in support of the ontological sense of anticipation in Carl E. Braaten and Philip Clayton, eds., *The Theology of Wolfhart Pannenberg: Twelve American Critiques, with an Autobiographical Essay and Response* (Minneapolis, MN: Augsburg, 1988), 131–41, 319–21.

³⁴Pannenberg, *Theology of Nature*, 86–7.

³⁵*Ibid.*, 96–7. Cf. Wolfhart Pannenberg, *Systematic Theology II*, 59.

³⁶Pannenberg, *Theology of Nature*, 108.

³⁷For more sophisticated analysis and critique of Pannenberg's concept of contingency, see Robert John Russell, "Contingency in Physics and Cosmology: A Critique of the Theology of Wolfhart Pannenberg," *Zygon: Journal of Religion and Science* 23, no. 1 (March 1988): 23–43. In his response to Russell, Pannenberg defines the contingency of event as "that which is not necessary in terms of the past and presup-

poses openness to the future." See Pannenberg, *Systematic Theology II*, 66–7.

³⁸Pannenberg, *Systematic Theology II*, 65 and 71–2.

³⁹*Ibid.*, 65. Particular reference is given to Hans-Peter Dürr, "Über die Notwendigkeit in Offenen Systemen zu Denken," in *Die Welt als Offenes System: Eine Kontroverse um das Werk von Ilya Prigogine*, ed. G. Altner (1986), 9–31.

⁴⁰Pannenberg, *Systematic Theology II*, 98.

⁴¹*Ibid.*, 120.

⁴²Wolfhart Pannenberg, "Human Life: Creation versus Evolution," in *Science and Theology: The New Consonance*, ed. Ted Peters (Oxford: Westview, 1998), 139. Peacocke is introduced as the most recent representative of this tradition of emergent evolution in Pannenberg, *Systematic Theology II*, 121. Also, note that Pannenberg's celebration of *Lux Mundi* in terms of its overcoming of mechanism is comparable, even if in a slight difference in nuance, with Peacocke's appreciation of it in terms of its overcoming of deism. Cf. Peacocke, "Naturalistic Faith," 18.

⁴³In today's biology, "epigenesis" describes the morphogenetical process of the development of an organism, and "epigenetics" refers to changes in phenotype or gene expression caused by nongenetic factors. In this discussion, however, I assume Pannenberg's definition of epigenesis as the appearance of something new which does not result simply mechanically from the past conditions.

⁴⁴Pannenberg, *Theology of Nature*, 47, 23–4. Referring to Michael Polanyi's "acknowledgment of a field as the agent of biotic performances," Pannenberg points out the convergence between Polanyi's thought and Teilhard's "vision of point Omega at work in the process of evolution as the power of the divine spirit" (p. 24). Cf. Polanyi, *Personal Knowledge*, 2d ed. (New York: Harper and Row, 1962).

⁴⁵Pannenberg, *Theology of Nature*, 143–4. My italics. Pannenberg perceptibly notes that, in his early years, Teilhard contrasted Bergson's idea of the *vis a tergo* (a force acting behind) of the élan vital, a thrust of life without finality, to the idea of a *vis ab ante*, a power of the future, quoting from him that "the power that creates the world can only be a *vis ab ante*, a uniting power" (p. 143). Cf. Teilhard de Chardin, "Die Schöpferische Einigung" (1917), in *Frühe Schriften* (Freiburg/Munich, 1968), 181–92.

⁴⁶Pannenberg, *Systematic Theology II*, 109.

⁴⁷Pannenberg, "Human Life," 139.

⁴⁸*Ibid.*, 144.

⁴⁹Pannenberg, *Systematic Theology II*, 98, 145.

⁵⁰*Ibid.*, 162.

⁵¹*Ibid.*, 173. Though he applies the idea of kenosis only to Christology, this observation here seems close to a sort of free process defense found in the current kenotic view of God's creation: cf. John Polkinghorne, ed., *The Work of Love: Creation as Kenosis* (Grand Rapids, MI: Eerdmans, 2001).

⁵²Pannenberg refers to Wolfgang Trillhaas, *Dogmatik*, 3rd ed. (1972), 172ff. See Pannenberg, *Systematic Theology II*, 173.

⁵³Pannenberg, *Systematic Theology*, 164–5.

⁵⁴*Ibid.*, 166–7.

⁵⁵*Ibid.*, 171.

⁵⁶Teilhard de Chardin, *The Phenomenon of Man* (New York: Harper & Row, 1975); Philip Hefner, *The Promise of Teilhard* (Philadelphia: Lippincott, 1970); Jürgen Moltmann, *God in Creation* (Minneapolis, MN: Fortress, 1993) and *The Way*

of *Jesus Christ* (Minneapolis, MN: Fortress, 1993); Peters, *Anticipating Omega* (Göttingen, Germany: Vandenhoeck and Ruprecht, 2006); Peters and Hewlett, *Evolution from Creation to New Creation* (Nashville, TN: Abington Press, 2003); John F. Haught, *God after Darwin: A Theology of Evolution* (Boulder, CO: Westview, 2000); Thomas Tracy, "Evolutionary Theologies and Divine Action," *Theology and Science* 6 (2009): 107-16; John Polkinghorne, "Evolution and Providence: A Response to Thomas Tracy," *Theology and Science* 7 (2009): 317-22.

⁵⁷Peacocke, "Naturalistic Faith," 20.

⁵⁸Ronald L. Numbers, "Science without God: Natural Laws and Christian Beliefs," in *When Science and Christianity Meet*, ed. David C. Lindberg and Ronald L. Numbers (Chicago: University of Chicago, 2003), 266. According to Numbers,

the phrase "methodological naturalism" was first coined by Paul de Vries, who introduced it in 1983 in a conference paper that was later published as "Naturalism in the Natural Sciences," *Christian Scholar's Review* 15 (1986): 388-96. See "Science without God," 320, n.2.

⁵⁹Cf. Jacob Klapwijk, *Purpose in the Living World? Creation and Emergent Evolution*, trans. and ed. Harry Cook (Cambridge: Cambridge University, 2008), esp. chapter 4. Meanwhile, I cannot but see that eschatology does not play as significant a role in his philosophical reflection on evolution as the gospel of the kingdom of God and the resurrection of Jesus suggest.

⁶⁰Ted Peters, "Introduction" in Wolfhart Pannenberg, *Toward a Theology of Nature: Essays on Science and Faith*, ed. Ted Peters (Louisville, KY: Westminster/John Knox, 1993), 14.

66th ASA Annual Meeting

Science-Faith Synergy: Glorifying God and Serving Humanity

North Central College
Naperville, IL

Pre-Meeting Workshops

FRIDAY, July 29, 2011, 9:00 AM-4:00 PM

WORKSHOP 1: Science and Scripture: Interpreting the Information —Terry Morrison, Leader

Scientists, as well as scholars studying Scripture, Church History, etc., have a common task: dealing with "information," that is, the experimental data and the interpretations of the scientists and the biblical data and interpretations of the theologians. This also involves questions of critiquing the sources of the data, etc. And, of course, there is the question of "The Question," i.e., what is it you want to know/understand?

For the Christian in science, e.g., ASA members, these constitute an overlap of the foci of our lives. Can we learn from appropriate approaches in either Scripture/theology studies or philosophy of science and from theologians and science practitioners, things that will advance our work, our understanding, and our living as effective Christians?



John
Walton



Kevin
Vanhoozer



Del
Ratzsch



Denis
Lamoureux

Four scholars will address these issues. They are

- John Walton, www.wheaton.edu/Theology/faculty/walton
- Kevin Vanhoozer, www.wheaton.edu/Theology/faculty/vanhoozer
- Del Ratzsch, www.calvin.edu/academic/philosophy/faculty/ratzsch
- Denis Lamoureux, www.ualberta.ca/~dlamoure

To register, go to
www.asa3.org/ASA/meeting/ASA.php

FRIDAY, July 29, 2011, 1:00 PM-4:30 PM

WORKSHOP 2: Helping Your Congregation Deal with Religion-Science Issues —George Murphy, Leader



George
Murphy

Christians with expertise in science-related fields are called to serve God in their daily work. We'll reflect a bit on this aspect of vocation but our goal here is to help scientists use their knowledge and experience in local congregations. God can use us in several areas of a church's work to further his mission in an increasingly scientific world.

Many Christians don't see the need to deal with issues raised by scientific and technological developments, while others see them as threats. Neither attitude is healthy. We'll discuss the following ways to nurture better understanding.

Scientists can contribute to the church's work in education. Leading a class on faith and science or some specialized topic could be done alone or together with other leaders. We'll discuss how to develop such classes, think about possible areas of controversy, and look at some resources.

Preachers can be uneasy about addressing scientific questions, but they need to proclaim the gospel to people in a scientific world. Pastoral counselors may need awareness of medical technologies to understand decisions people are faced with. Scientists can provide encouragement, support and resources for these ministries.

Medical personnel have long been involved in church-related activities—e.g., as medical missionaries or parish nurses. Ecologists and engineers can contribute to environmental stewardship (e.g., in improving a church's energy efficiency) and thus help people to see a practical dimension of the doctrine of creation.

George Murphy, <http://home.roadrunner.com/~scitheologylm>, will share his knowledge of these issues, drawing upon his experience as a scientist and as a parish pastor, including extensive work in adult education in congregations, and will suggest print and online resources.

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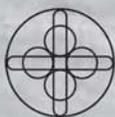


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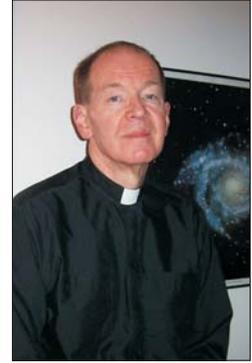


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CHRIST ABOVE ALL
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Does the Earth Move?

George L. Murphy



George L. Murphy

Einstein's theory of relativity means, among other things, that a modified version of Tycho Brahe's earth-centered model of the planetary system is, in principle, as good as Copernicus' sun-centered model. The question of whether the earth or the sun "really" moves is meaningless in this theory. After dealing with challenges to this claim, implications of relativity for understanding biblical texts that were involved in historical debates about the planetary system, as well as some further theological issues, are considered. An appendix provides some mathematical details.

Why This Topic Again?

I have gotten strange looks or emails when I have suggested that the answer to the title question is not simply "Yes," but "It depends." It is not hard to guess why. Copernicus' theory that the earth and other planets orbit the sun was a major factor in the development of science, and opposition to it in some parts of the church helped to create the "warfare model" of the science-religion relationship. Many scientifically literate people today "know" that the earth goes around the sun, not the sun around the earth, and any qualification of that claim by appeal to Einstein's relativity theory may seem reactionary. That concern is not entirely baseless, for at least one theologian thought, hopefully, that Einstein's theory might "give the death blow to Copernicanism."¹

Nevertheless, general relativity really is general. One of its basic principles is that the laws of physics have the same form in all space-time reference frames — i.e., systems of spatial and temporal coordinates. A reference frame fixed with respect to the sun's center is no better in principle than one fixed with respect to the earth or, for that matter, with respect to Halley's Comet.

One might think that since relativity theory has been studied well and widely enough, these results would be generally

known, at least among physicists, so that further discussion would be unnecessary. This would be too optimistic, for there has been disagreement on the question, even among experts.² Einstein and Infeld said that if physics is fully relativistic, the struggle "between the views of Ptolemy and Copernicus would then be quite meaningless," and Born agreed that "from Einstein's point of view Ptolemy and Copernicus are equally right," though the latter view is "certainly more convenient." However, Whittaker called the idea that "the Copernican conception of the universe" is "not preferable to the Aristotelian conception" a misunderstanding, while Fock argued against "the inadmissible view that the heliocentric Copernican system and the geocentric Ptolemaic system are equivalent." Physicist and philosopher Mario Bunge summoned up the shades of "the enemies of Galileo" to support his argument against the possible equivalence of geocentric and heliocentric

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coordinate systems. As surprising as their disagreement is the fact that all these writers mentioned only the Ptolemaic (or Aristotelian) system as an alternative to the Copernican one, with no reference to the system of Tycho Brahe.

There is even less general agreement on this matter among those without training in physics, as informal conversations will show. Among physics students and others interested in the field, there is also misunderstanding. We may note, for example, recent statements on two websites. On “Physics Forums,” where we can probably assume that participants are either students of physics or at least interested in the field, “a copernicus/relativity question” was posted in 2009.³ Some of the responses to this question are satisfactory, but numbers 9, 10, and 20 employ different incorrect arguments against the equivalence of earth-centered and sun-centered frames.

Then, in a discussion of geocentrism by “Answers in Genesis,” it is said that “common misconceptions include the beliefs that general relativity does not allow for a preferred standard of rest and that general relativity leads to moral relativism.”⁴ Linkage of Einstein’s theory with moral relativism is indeed a misconception, but the claim that it allows a preferred reference frame is (in spite of an appeal to Mach’s principle) wrong.

The historical controversy about the Copernican system strongly influenced religion-science relations in the past and continues to do so today. Thus it seems wise for people interested in those relations, and not just those trained in physics, to understand how matters stand in the light of modern science. Of course, it would be anachronistic to judge Galileo and his contemporaries in terms of a theory that lay three centuries in their future, and in any case, this article will not detail the history of the sixteenth- and seventeenth-century debates. But discussions about the truth of astronomical statements in the Bible continue in the Christian community, and it would also be anachronistic to talk about relationships between biblical texts and science with only the physics of 1600. Our study will not rehabilitate “enemies of Galileo,” but it will suggest that our conclusions be more nuanced than many popular accounts suggest.

Ptolemy, Copernicus—and Tycho

The historical debate is often pictured as one between the earth-centered system of Ptolemy and the sun-centered view of Copernicus, but there was a third contender. The greatest observational astronomer of the time, Tycho Brahe, proposed that the earth was at rest, the sun orbited the earth, and the other planets orbited the sun.⁵

Ptolemy’s system conflicts with observations. Venus is never seen from Earth to be more than 40° from the sun, and with the Ptolemaic arrangement of orbits, could never appear fully illuminated to us. In the Copernican system, however, Venus should go through a full range of phases as the moon does. Galileo could see with his telescopes that Venus does imitate the moon in this regard.⁶ Tycho’s theory, however, predicts the same apparent planetary motions as that of Copernicus. Galileo’s observations of the phases of Venus show the theories of Tycho and Copernicus to be superior to Ptolemy’s to the same extent but do not decide between those two theories.

The Tychonic theory has often been ignored or treated as a historical footnote because of an important idea that originated with Kepler and was given definitive form by Newton, that the force responsible for the planetary orbits comes from the sun.⁷ This suggests that the sun is really at rest and the planets, including Earth, are in motion. Acceptance of Newton’s ideas about absolute space reinforced that idea. While velocity is a purely relative concept in mechanics, Newton thought his experiment with a rotating bucket of water showed that *acceleration* has absolute significance: The acceleration in his second law of motion is with respect to absolute space.⁸ If that is so, and if the planets rather than the sun are accelerated, then it is the planets that really move.

Accelerated reference frames can be used in Newtonian mechanics at the cost of introducing “fictitious forces.” These are simply the negative of “mass times acceleration” terms in Newton’s second law moved to the other side of the equation and called forces. Centrifugal and Coriolis forces are examples. Planetary orbits can then be calculated in a fixed-earth frame, but within the Newtonian worldview, the earth is still thought of as “really” moving.

Some Things Really Are Relative

The popular notion that relativity theory says that everything is relative is badly mistaken. In Einstein's theory, there are absolutes, things that will be observed to be the same in all reference frames: The local speed of light in a vacuum, space-time intervals, and the electric charge of an isolated system are a few examples. However, many things *are* relative. The velocity of an object differs for observers moving in different ways, and therefore only relative velocities are important. Einstein enshrined this idea in his special theory of relativity, stating that all the laws of physics (and not just mechanics, as in classical physics) are the same for observers in uniform motion with respect to one another. There is no way to tell which are "really" moving or at rest.⁹

Einstein then extended this idea to accelerated reference frames and provided an explanation of gravitation in his general theory. In special relativity, there is no preferred reference frame for determination of velocities. In general relativity, there are no preferred frames at all and no absolute space. Any system of space-time coordinates is, in principle, as good as another, though for a given problem some systems will be more convenient than others. Thus we can use a reference frame in which the sun is stationary (Copernicus) or one in which the earth is fixed (Tycho). Einstein's equations for the curvature of space-time due to the sun's mass and the geodesic equations for the worldlines of planets have the same form in both frames and could, in principle, be solved in either one.

Actually, there is not just one reference frame with the sun stationary, but an infinite number of them. We can, for example, rotate the spatial coordinate system about the sun by various angles. The coordinates that are most convenient for calculating orbits around a star can be transformed in many ways, such as to coordinates that are helpful in the study of black holes. There is similar freedom in choosing a fixed-earth frame.

It is also worth noting that use of a particular reference frame does not require an observer to adopt it as her or his rest frame. As Schrödinger put it in making this point,

It is the very gist of relativity that anybody may use any frame. We study, for example, particle collisions alternately in the laboratory frame and

in the centre-of-mass frame without having to board a supersonic aeroplane in the latter case.¹⁰

We do not have to be on the sun in order to use the Copernican model, and an observer on Mars could use a frame in which the earth is at rest.

Tycho wanted to have not only an earth whose center was fixed but also a nonrotating one. The "sphere of the fixed stars" was to turn around the earth every twenty-four hours, just as in Ptolemy's model. This would require use of a co-rotating frame, one that turns with the earth, so that in it, the earth's rotation has been eliminated. We usually do adopt such a frame for everyday terrestrial phenomena, tacitly ignoring the earth's rotation.¹¹ But the linear velocity across our line of sight of an object in such a frame would increase in proportion to its distance from the earth, and an object farther than about 4×10^9 km (somewhat beyond the orbit of Neptune) would be moving faster than light.

Thus a frame with a nonrotating earth cannot be used for phenomena beyond a certain distance. However, what historians of science have called a "semi-Tychonic" system, in which the earth rotates but its center is at rest, is possible.¹² Tycho's contemporary Nicolaus Bär (who may have stolen the idea of Tycho's system from him), in fact, proposed such a modification long ago.¹³

This type of limitation is not unique to rotating frames. It is often the case that a single coordinate system cannot cover an entire manifold. For example, the coordinate system of latitude and longitude on the surface of a sphere breaks down at the poles, where longitude is undefined.

Stellar parallax, the possible shift in position of stars over the course of a year, also has to be considered. In Ptolemy's model, with the stars fixed on a celestial sphere centered on the earth, there is no annual parallax, whereas in Copernicus' model, with a celestial sphere centered on the sun, the earth's annual motion should result in shifts in stellar positions. Stellar parallaxes are so small that astronomers in 1600 were unable to detect them, but when this became possible in the 1830s, it was seen as another triumph of the Copernican theory over the Ptolemaic.

How do things look with Tycho's theory? That depends on where the sphere of the fixed stars is

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centered. But just stating the matter in that way should make us realize that our understanding of the universe has now developed to a point where some concepts common to all three original theories are obsolete. There is no sphere of the fixed stars and, in fact, there are no fixed stars. Stars move with respect to the sun, and the motion of many across our line of sight (their proper motion) is larger than their annual parallax. If we adopt coordinates moving with the earth, as a semi-Tychonic model requires, there will be annual shifts in position after proper motions and stellar aberration are subtracted, just as in Copernicus' theory. For Copernicus these shifts are due to our change in position as the earth orbits the sun; for Tycho they are due to an annual back and forth motion of the stars themselves in the coordinates we have adopted.

What was at issue in the historical debate is often described as the question of whether a heliocentric or a geocentric model was correct, but to put things that way today really misses the point. Neither the earth, the sun, nor the whole solar system is at the center of the universe, a concept that does not even have any meaning in modern cosmology. The real issue is not "centricity" but whether we can adopt a fixed-earth or a fixed-sun reference frame. The answer relativity gives is that we can use either one. Either type of reference frame, or in fact, a frame moving in any way at all, is legitimate. And even when we want to think of the sun at the "center" of the solar system, we must recognize that it is accelerated because of the gravitational influence of the planets. It is actually the center of mass of the whole system that is "at rest"—or, more precisely, that moves under the influence of the rest of the galaxy and ultimately the universe.

Earth and Sun in Biblical Texts

For readers of this journal, the implications of the previous discussion for the interpretation of Scripture and the relationship between science and theology will be important. Opponents of Copernicus and Galileo could quote biblical passages in support of their claim that the sun, not the earth, moved. Does relativity's validation of a semi-Tychonic model mean that they were right?

It is important, first of all, to understand that relativity does not say that one of these models, the Copernican or semi-Tychonic, is right and the

other wrong. The whole thrust of the relativistic argument is that *both* are valid. We can say that the earth is stationary as long as we do not then say that the sun cannot be considered stationary, or vice versa. But we cannot say that both are stationary in the same reference frame. In Einstein's theory, there are absolutes (i.e., things that are the same for all observers) but there are no reference frames that are, in principle, better than others. Relativity does not deal a "death blow to Copernicanism."

Most of the biblical material that has any relevance to these issues has to do with diurnal rather than annual motions. What would be in question would be whether the earth turns on its axis every twenty-four hours, not whether it goes around the sun once a year. Biblical references to the sun rising or setting (e.g., Eccles. 1:5) cannot be considered "wrong." Modern astronomers still use the same language. We should remember that reference to a diurnal motion of the sun implies use of a frame in which the earth's rotation has been eliminated, and that, as we noted, such usage encounters problems for objects far from the earth. But the fact that use of such a frame would imply a speed for the sun of about 4% that of light does not mean that there is any fundamental problem with it.

More to the present point is the fact that modern astronomers can, if they need to, justify their use of such language on the basis of Einstein's theory. But the fact that biblical writers spoke of the sun rising and setting does not mean that they knew anything about that theory, and they could have argued in the same way. There is no hidden reference to modern science in such texts.¹⁴ The biblical writers were simply using a common way of speaking about the appearance of the phenomena from the earth.

The language about the sun and moon standing still at the Battle of Gibeon in Josh. 10:12-14 "for about a whole day" (v. 13, NRSV) also involves diurnal rather than annual motions. Again the language implies that the sun and moon normally move (and that presumably the earth does not) but temporarily stopped. One question we have to ask today about this text is not whether it was those celestial bodies or the earth that stopped moving, but whether there was any actual stoppage of the *relative* motions of these bodies. Are we to read this text as if it were an account of an astronomer's observations?

The text as we have it in Joshua is a combination of poetry (vv. 12b–13) from “the Book of Jasher” and later prose interpretation. The very nature of poetry suggests that we may not be required to understand the language literally. If we were, then we would have to insist that the stars really did fight from heaven against Sisera, as the Song of Deborah says in Judges 5:20. Since there are a number of ways of understanding these lines, we are hardly compelled to read them as an accurate scientific account of astronomical events.¹⁵ Nevertheless, ancient Israelites may indeed have thought that the sun and moon temporarily stopped their motions across the sky.

Then we should consider Ps. 93:1b and Ps. 104:5, which speak of the earth as being immovable. This is a tautology in a fixed-earth frame, but again it would be a mistake to see here an indication of a knowledge of relativity. If these texts were anachronistically thought to be claims about a preferred physical reference frame, then we would have to regard them, like the dome over the earth or the cosmic ocean above it in Genesis 1, as accommodation to an ancient cultural understanding of the world.¹⁶ But there is no reason to think that the writer of the psalm was thinking in those terms. The point of these texts is the praise of God, and the emphasis is really on the durability of God’s reign.¹⁷

Further Implications of Relativity

It has sometimes been suggested that the microwave background provides a preferred reference frame (or more precisely, a set of such frames). A frame in which this radiation is uniform over the sky (averaging over small temperature fluctuations) is the most convenient one for discussion of cosmological phenomena and is tacitly used when we say that the elapsed time since the big bang is about 13.7 billion years. In answer to our title question, the earth and sun are both moving with respect to this preferred frame.

Polkinghorne has made use of this reference frame to deal with a question raised by his theological approach.¹⁸ Having said that “God knows now all that can be known now, but God does not yet know all that will eventually become knowable,” he confronts the question of which “now” defines the boundary of divine knowledge. A basic result of

relativity is that observers in relative motion keep time differently and generally do not agree on whether two events are simultaneous, so that the sets of events they judge to be “now” differ. Polkinghorne suggests that “it would not be surprising” if the Creator chose to use the reference frame defined by the microwave background.

Polkinghorne’s suggestion should not be misunderstood. He knows that the microwave background does not define a preferred reference frame in contradiction to the ideas of relativity theory. While such a frame is very useful, it is not privileged in the sense that the form of basic laws of physics is valid only in it (as was the case with the aether before Einstein). Polkinghorne says explicitly that God has *chosen* a limitation on divine knowledge and thus of a particular reference frame in which that limit is specified. What is at issue here is the concept of kenosis, divine self-limitation, which has to be considered on its theological merits, not a matter of some external necessity imposed upon God.¹⁹ The point here, however, is simply to be clear about the physics.

Finally, we should note that the way in which the structure of relativity theory enables us to relate the appearance of the physical world in different reference frames might provide some guidance for dealing with the variety of Christian theologies that arise from different historical traditions and various social, economic, racial, and gender contexts. An earlier article dealt with this possibility.²⁰

Conclusions

Controversies about the Copernican system played an important role in the development of attitudes about science and religion, and the results of those historical debates continue to influence such attitudes today. While nothing really new has been said here, an accurate statement of the implications of relativity theory for celestial mechanics should contribute to a better understanding. As we have seen, these implications have not been appreciated by all physicists, let alone by non-experts. And while there is no need to think that biblical writers were aware of concepts of modern science, it is helpful to see what the differences really are between their picture of the world and current scientific views.

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Appendix: Details of a Semi-Tychonic Model

The idea of a fixed-earth reference frame in general relativity is not new but the mathematical details supporting it are not easily available, so it may be helpful to sketch them here. In principle, the equations of the theory could be solved in such a frame to begin with, but that would be difficult. It suffices here to show that we can transform from a fixed-sun frame to a fixed-earth one in the Newtonian limit of general relativity.

We put $M = Gm/c^2$, with m the sun's mass, G the gravitational constant and c the speed of light, and omit terms beyond those needed to calculate Newtonian orbits. The approximate Schwarzschild metric of general relativity in a coordinate system with the sun at rest at the origin ($x = y = z = 0$) can then be written

$$ds^2 = - (1 - 2M/r)c^2dt^2 + (dx^2 + dy^2 + dz^2),$$

where $r = (x^2 + y^2 + z^2)^{1/2}$.²¹ The earth's orbit in the x - y plane can be approximated by a circle with radius a , angular velocity Ω , and equations $x = a\cos\Omega t$, $y = a\sin\Omega t$. (Elliptical orbits can be defined with more general parametric equations.²²) In space-time, this describes a helical worldline about the straight worldline of the stationary sun.

We transform to a frame whose origin moves with the earth by writing

$$X = x - a\cos\Omega t, Y = y - a\sin\Omega t, Z = z, T = t.$$

(This is *not* a rotating frame, which would give superluminal speeds to distant objects.²³) The line element is then

$$ds^2 = -[1 - 2M/D - (a\Omega/c)^2]c^2dT^2 + (dX^2 + dY^2 + dZ^2) + 2(a\Omega/c)(\cos\Omega T dY - \sin\Omega T dX)cdT,$$

where $D = [X^2 + Y^2 + Z^2 + a^2 + 2a(X\cos\Omega T + Y\sin\Omega T)]^{1/2}$. This has no coordinate singularity at large distances, as for a rotating frame, but ds^2 does not have the Minowski form at spatial infinity.

The geodesic equations for motion in the X - Y plane give approximately

$$d^2X/dT^2 = -GmX/D^3 + a\cos\Omega T(\Omega^2 - Gm/D^3) \text{ and}$$

$$d^2Y/dT^2 = -GmY/D^3 + a\sin\Omega T(\Omega^2 - Gm/D^3).$$

The curve $X = Y = Z = 0$ (so that $D = a$) satisfies these equations with $d^2X/dT^2 = d^2Y/dT^2 = 0$ if $\Omega^2 = Gm/a^3$, which is Kepler's third law.

Another planet with an orbit given by $x = a'\cos\Omega't$, $y = a'\sin\Omega't$ in the fixed-sun frame (so that the planet, the earth, and the sun are aligned at $t = 0$) will have a path in the X - Y plane defined by $X = a'\cos\Omega'T - a\cos\Omega T$, $Y = a'\sin\Omega'T - a\sin\Omega T$. These satisfy the geodesic equations if $\Omega'^2 = Gm/a'^3$ —i.e., if Kepler's law holds for this planet also. ∞

Notes

¹Francis Pieper, *Christian Dogmatics* 1 (St. Louis, MO: Concordia, 1950), 474. This is a translation of the German edition of 1924.

²For this and the following quotations, see respectively: Albert Einstein and Leopold Infeld, *The Evolution of Physics* (New York: Simon and Schuster, 1938), 212; Max Born, *Einstein's Theory of Relativity*, rev. ed. (New York: Dover, 1962), 345; Edmund Whittaker, *From Euclid to Eddington* (Cambridge: Cambridge University, 1949), 120; V. Fock, *The Theory of Space, Time, and Gravitation* (New York: Macmillan, 1964), 375; Mario Bunge, *Foundations of Physics* (New York: Springer-Verlag, 1967), 216.

³www.physicsforums.com/showthread.php?t=311143 (last accessed November 17, 2010).

⁴www.answersingenesis.org/tj/v15/i2/geocentrism.asp (last accessed November 17, 2010).

⁵For the history, focused on the work of Tycho and Kepler, see Kitty Ferguson, *Tycho and Kepler: The Unlikely Partnership That Forever Changed Our Understanding of the Heavens* (New York: Walker and Co., 2002). Diagrams of the three systems are on p. 142. Speaking of "other planets" in Tycho's system is not strictly correct because the word "planet" referred originally to "wandering stars." The distinctive claim of the Copernican system is that the earth is a planet in this sense. But I forego pedantic circumlocutions.

⁶Galileo Galilei, "History and Demonstrations Concerning Sunspots and Their Phenomena" in Stillman Drake, *Discoveries and Opinions of Galileo* (Garden City, NY: Doubleday Anchor, 1957), 93-4 and 133.

⁷For Kepler, see Ferguson, *Tycho and Kepler*, 308-11.

⁸Sir Isaac Newton, *Principia* 1 (Berkeley, CA: University of California, 1934), 10-1.

⁹There are many popular and many technical treatments of relativity available. Albert Einstein, *Relativity: The Special and General Theory* (www.bartleby.com/173/ [last accessed March 15, 2011] and other editions) is still a good introduction, though out-of-date in its treatment of cosmology.

¹⁰Erwin Schrödinger, *Expanding Universes* (Cambridge: Cambridge University, 1957), 20.

¹¹For some phenomena such as meteorology, precise measurements of the acceleration of gravity, or long-range artillery, Coriolis and centrifugal forces are significant.

¹²*Dictionary of the History of Science* (Princeton, NJ: Princeton University, 1981), s.v. "Tyconic systems," by Michael A. Hoskin.

¹³Ferguson (*Tycho and Kepler*, 147-8) is sure that Bär did indeed plagiarize Tycho's basic idea, although Arthur Berry, *A Short History of Astronomy* (1898; reprint of the John Murray edition, New York: Dover, 1961), 138, thought it quite possible that he came up with it independently.

¹⁴George L. Murphy, "Possible Influences of Biblical Beliefs upon Physics," *Perspectives on Science and Christian Faith* 48, no. 2 (1996): 82.

¹⁵Richard D. Nelson, *Joshua, A Commentary* (Louisville, KY: Westminster John Knox, 1997), 141-5 is a helpful discussion of this text.

¹⁶Denis O. Lamoureux, *Evolutionary Creation: A Christian Approach to Evolution* (Eugene, OR: Wipf and Stock, 2008), 120-5. George L. Murphy, "Couldn't God Get It Right?" *Covalence* (March 2006), www.elca.org/faithandscience/

[covalence/story/default.asp?Copyright=06-03-15&Author=murphy&Pages=1](http://www.elca.org/faithandscience/covalence/story/default.asp?Copyright=06-03-15&Author=murphy&Pages=1).

¹⁷Arthur Weiser, *The Psalms* (Philadelphia, PA: Westminster, 1962), on Psalm 93, p. 619.

¹⁸J. C. Polkinghorne, *Science and the Trinity: The Christian Encounter with Reality* (New Haven, CT: Yale, 2004), 108-10.

¹⁹Cf. George L. Murphy, "Science as Goad and Guide for Theology," *dialog* 46, no. 3 (2007): 225.

²⁰George L. Murphy, "What Can We Learn from Einstein about Religious Language?" *Currents in Theology and Mission* 15 (1988): 342.

²¹E.g., Steven Weinberg, *Gravitation and Cosmology* (New York: John Wiley and Sons, 1972), chap. 9.

²²E.g., L.D. Landau and E.M. Lifshitz, *Mechanics* (Reading, MA: Addison-Wesley, 1960), 38.

²³A transformation to a rotating frame would be given by equations of the form

$$\xi = x \cos \omega t + y \sin \omega t, \eta = -x \sin \omega t + y \cos \omega t, \zeta = z, T = t.$$

ASA BLOGS

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Robert Boyle, *Certain Physiological Essays* (1661)

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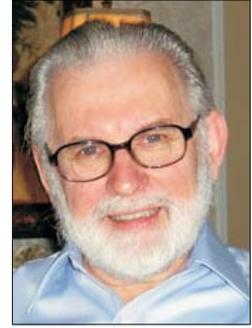
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Walter Makous

Biblical Longevities: Empirical Data or Fabricated Numbers?

Walter Makous

Whether the biblical longevities have biological or cultural significance depends on whether they represent actual longevities or are fabricated. As the properties of fabricated numbers differ from those of natural phenomena, this paper examines these properties, particularly in light of those differences. The results show (1) an exponential decline toward contemporary longevities, following approximate constancy at nearly 1,000 years; (2) a Gaussian distribution of deviations from this relationship; (3) no reliable deviations from statistical independence; (4) reliable differences from the properties of fabricated numbers, and instead adherence to Benford's law; and (5) rounding. Results 1 and 4 are difficult to reconcile with fabrication. Result 5 accounts for the inability to reconcile biblical chronologies exactly. Historical records and archeological data appear to conflict with such longevities, but their quality and quantity are insufficient to completely exclude them, perhaps during a brief period in a small subpopulation.

The Hebrew Scriptures are replete with specific numbers, detailing, for example, the patriarchs' ages when their first sons were born, how long they lived afterwards, the ages at which the reigns of kings and judges began, how long they reigned, and at what ages they died. To understand the significance of these numbers, one must know their source. It is possible that they represent just what they purport to represent: natural data on actual ages and longevities; or else they may be artificial, made up to serve a presently unknown purpose. If the numbers are natural, they carry information on ancient history and biological phenomena; if they are artificial, they may reveal something about the people who produced them, such as the numerological as opposed to the numerical significance of numbers in their culture and religion.¹ The purpose of this work is to examine the properties of the numbers, particularly those properties that might shed light on which of

these alternatives is more likely to be true.

Numbers have properties not shared by other symbols, such as words, and the properties of numbers that represent natural phenomena tend to differ from those of fabricated numbers. For example, numbers derived from natural phenomena follow Benford's law (described below),² they represent systematic processes perturbed by random error, these perturbations tend to be mutually independent,³ and the distribution of these numbers about their mean values tends

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to be Gaussian. The properties of artificial numbers depend on the purposes, knowledge, and skill of those who generate them. However, certain properties are rare in artificial numbers. For example, artificial numbers do not have the properties of randomness unless those generating the numbers (1) understand randomness, (2) desire to make the numbers appear to be random, and (3) benefit either from extensive training⁴ or the use of mechanical aids like dice. The following analysis begins with a description of the properties of the numbers and then goes into a discussion of what this tells us about their origin, whether natural or artificial.

Methods and Results

The Data

Method

To find longevities, the entire contents of the NIV were searched electronically (at www.biblegateway.com) for the following words: *died*, *slept*, *rested*, *years*, *old*, and *age*. In addition, the books, Genesis through 2 Chronicles, were scanned visually for relevant references.

This analysis is based only on the ages of the forty-one males said to have died of natural causes. For example, the NIV uses the word *died* with reference to all those whose ages are given in Genesis except Enoch, who instead "... was no more, because God took him away" (Gen. 5:24, NIV). His age at that time is 12 standard deviations shorter than the longevities of the rest of the first ten named and by any criterion qualifies as an outlier; therefore, although it is plotted in figure 1, it was not used for the computations. The analysis also excludes those who were killed or died in battle, and Ahaziah, who died from a fall (2 Kings 1:2-17). The analysis includes deaths from illness, even when said to be imposed by God, as in the cases of Jehoram (2 Chron. 21:18) and Uzziah (2 Kings 15:5-7; 2 Chron. 26:20-3). A supplementary table containing a list of the judges and kings, their ages at the beginning of their reigns, the duration of their reigns, and the causes of their deaths, is available from the author on request.

Genesis typically gives the ages from the patriarchal era either as the age at death or as two numbers: the age at which a man had his first son, and the number of years he survived after that. Samuel,

Kings, and Chronicles typically give the ages at which a man's reign began and the number of years from then until his death. The analysis excludes those whose ages, when they were deposed, are given, but whose deaths were not clearly at the same time (Jehoahaz of Judah [Shallum], Jehoiakim, Jehoiachin, and Zedekiah).

Results

These resulting ages are listed in table 1 (p. 119); those stated directly in the text are in bold print, and those inferred by addition or subtraction are in plain print.

Systematic Properties: Ordinal

Method

Assigning dates to the events listed in table 1 is problematic, and even establishing the dates of the reigns of the kings and judges is complicated by ambiguities and mutual contradictions in the text and by the fact that the list is not exhaustive.⁵ None of the attempts to derive a chronology of these events has been completely successful (reviewed by Galil).⁶ Thiele's chronology reconciles all the data on the reigns of the kings and judges,⁷ but only by making implausible and unconvincing assumptions. The most recent attempt, by Galil,⁸ accounts for only about 90% of these data. However, the minimum assumption, on which there is universal agreement, is that the list is in temporal sequence. Therefore one can plot longevity as a function of relative position in time, as in figure 1 below.

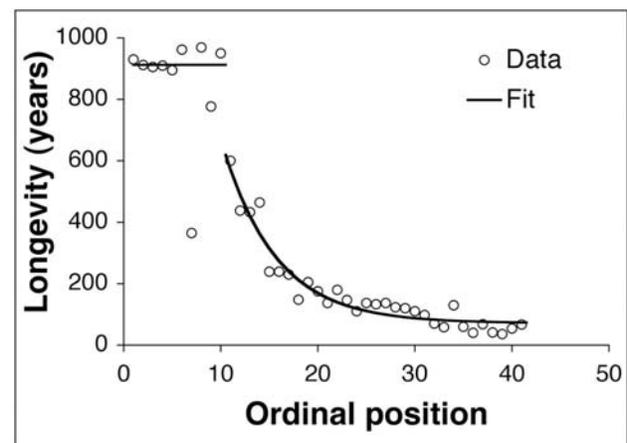


Figure 1. Longevities from different generations, arranged in temporal sequence, from Adam to Manasseh. The points are from table 1, and the curves are maximum likelihood fits of a horizontal line and the exponential decay function specified in the text.

Walter Makous

Table 1. Longevities from the Hebrew Bible. “Before” is the age at the birth of the first son (for numbers 1–22) or the age at which the individual’s reign began (numbers 32–41). “After” is the additional number of years lived. “Total” is the total number of years lived.

	No.	Before	After	Total	Source
Adam	1	130	800	930	Gen. 5:3–5
Seth	2	105	807	912	Gen. 5:6–8
Enos	3	90	815	905	Gen. 5:9–11
Cainan	4	70	840	910	Gen. 5:12–4
Mahalaleel	5	65	830	895	Gen. 5:15–7
Jared	6	162	800	962	Gen. 5:18–20
Enoch	7	65	300	365	Gen. 5:21–3
Methuselah	8	187	782	969	Gen. 5:25–7
Lamech	9	182	595	777	Gen. 5:28; 5:30–1
Noah	10	500	450	950	Gen. 5:32; 7:6; 9:28–9
Shem	11	100	500	600	Gen. 11:10–1
Arphaxad	12	35	403	438	Gen. 11:12–3
Salah	13	30	403	433	Gen. 11:14–5
Eber	14	34	430	464	Gen. 11:16–7
Peleg	15	30	209	239	Gen. 11:18–9
Reu	16	32	207	239	Gen. 11:20–1
Serug	17	30	200	230	Gen. 11:22–3
Nahor	18	29	119	148	Gen. 11:24–5
Terah	19	70	135	205	Gen. 11:26–32
Abram	20	86	89	175	Gen. 16:16; 25:7
Ishmael	21			137	Gen. 25:17
Isaac	22	60	120	180	Gen. 25:26; 35:28
Jacob	23			147	Gen. 47:28
Joseph	24			110	Gen. 50:22,26
Levi	25			137	Exod. 6:16
Kohath	26			133	Exod. 6:18
Amram	27			137	Exod. 6:20
Aaron	28			123	Num. 33:39
Moses	29			120	Deut. 34:7
Joshua	30			110	Josh. 24:29; Judg. 2:8
Eli	31			98	1 Sam. 4:15–18
David	32	37	33	70	2 Sam. 5:5; 1 Kings 2:11; 1 Chron. 29:27
Rehoboam	33	41	17	58	1 Kings 14:21–31; 2 Chron. 12:13,16
Jehoiada	34			130	2 Chron. 24:15
Jehoshaphat	35	35	25	60	1 Kings 22:42–50; 2 Chron. 20:31; 21:1
Jehorem	36	32	8	40	2 Kings 8:16–17; 2 Chron. 21:5, 20
Uzziah	37	16	52	68	2 Kings 14:21; 15:2; 2 Chron. 26:1, 3; 2 Chron. 26:21
Jotham	38	25	16	41	2 Kings 15:33; 2 Chron. 27:1, 8, 9
Ahaz	39	20	16	36	2 Kings 16:2; 2 Chron. 28:1, 27
Hezekiah	40	25	29	54	2 Kings 18:1, 2; 20:21; 2 Chron. 29:1; 32:33
Manasseh	41	12	55	67	2 Kings 21:1; 2 Chron. 33:1, 20

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Results and discussion

Even without knowing the time span between points, one can draw three conclusions from these longevities: (1) they were approximately constant through the 10th number (Noah) with a mean of 912 years; (2) they decrease after the 10th number; and (3) the decrease tends to be progressive (e.g., the Spearman rank correlation coefficient = 0.9998, $p < 0.01$). These conclusions hold regardless of how the numbers are spaced on the x-axis (i.e., the amount of time between the lives of the individuals listed, or how many generations intervene between samples).

Systematic Properties: Equal Interval

Method

One would hope to have some estimate of the time between points in figure 1 (p. 118). There is little useful information on the dates of the patriarchs before Abraham; then one possible approach is to assume that the time between the individuals listed does not change systematically over time and use the chronologies of Thiele and Galil to check the validity of this assumption over the time span that they cover. (No assumption need be made about the scale of the x-axis, whether it spans 10,000 or 1,000,000 years, for example.) Figure 2 below shows, for the time span covered by these two chronologies, when each of the reigns ended. It shows that, over this time span at least, the assumption that the reigns are equally spaced over time is a reasonable approximation, and suggests that it may not be a bad assumption for the entire curve. Using either of these chronologies for the abscissae in figure 1 fails to improve the regularity of the data or decrease the error variance.

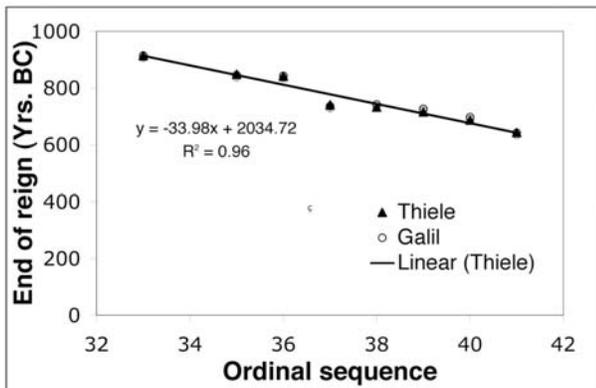


Figure 2. The ends of the reigns of the kings and judges, according to Thiele's (black triangles) and Galil's (white circles) chronologies.

Results and discussion

Use of the assumption that the time between the individuals listed in table 1 (p. 119) does not change systematically over time allows other conclusions. First, it allows quantitative refinement of the conclusions above: (1) there is no detectable trend before Noah ($r = 0.13$, 7 df excluding Enoch, $p = 0.75$); and (2) the numbers do decrease after Noah ($r = 0.83$, 29 df, $p < 0.05$).

Further, one can draw conclusions about the time-course of the decrease. There are several plausible ways to describe this time-course: (1) it might have been abrupt, as if a tendency to exaggerate ages had ended suddenly; (2) it might simply be linear; (3) it might follow a complicated time-course that could be described by a polynomial; (4) it might be a power function, as reported previously;⁹ or (5) it might be an exponential decay, also reported previously.¹⁰ Although this list is not exhaustive, it is a reasonable sample of the leading candidate functions.

Table 2 below shows these functions, the order of the polynomials, the residual squared errors, the F ratio formed by dividing the residual for each function by the residual for the exponential function (explained below), and the probabilities corresponding to the F ratios. The abrupt or discontinuous decrease clearly does not fit the data, by any criterion. The linear decrease (first order) likewise is a poor fit. The second order polynomial, which has three degrees of freedom, the same number as the power function and the exponential function, is a significantly worse fit than either of those functions. Although the third order polynomial fits as well as the power function and the exponential function, it is less preferred because it requires an added

Table 2. Candidate Functions and Their Goodness of Fit

Function	Order	r	Residual	F	P
Discontinuous	0	0.000	571693	13.94	<<0.0001
Polynomial	1	0.832	175596	4.28	0.0001
Polynomial	2	0.927	80773	1.97	0.0391
Polynomial	3	0.960	44633	1.09	0.4105
Polynomial	4	0.973	30996	0.76	0.7577
Polynomial	5	0.973	30959	0.76	0.7544
Polynomial	6	0.973	30934	0.75	0.7648
Power			39348	0.96	
Exponential			40999		

degree of freedom. Adding more degrees of freedom to form the higher order polynomials does not reliably improve the fit. Although the power function, $y = 1068 x^{-0.222} - 453$, and the exponential function, $y = 500 e^{-x/5.5} + 71.7$, fit approximately equally well, the exponential function is preferred for two reasons. First, it describes a relationship often observed in natural science, from heat exchange curves in thermodynamics to learning curves in psychology: a change of external conditions produces changes that follow an exponential time-course whenever the rate of change of the system is proportional to the distance to the final value.¹¹ Second, the best estimate of the asymptotic longevity of the exponential curve, 71.7 years, is consistent with contemporary values, whereas the asymptote of the power function is negative 453 years, a meaningless figure as a longevity.¹² An exponential time-course for these longevities has been reported before,¹³ but the data in these past reports are incomplete and not always accurate.¹⁴

Consequently, an exponential decay function, fit to the data by maximum likelihood, is used in figure 1 (p. 118):

$$L = 500 e^{(11 - \gamma)/5.5} + 71.7,$$

where L is longevity, and γ is ordinal sequence. The break between the horizontal line and the exponential curve was chosen between the 10th and the 11th points because it minimized the total residual variance.

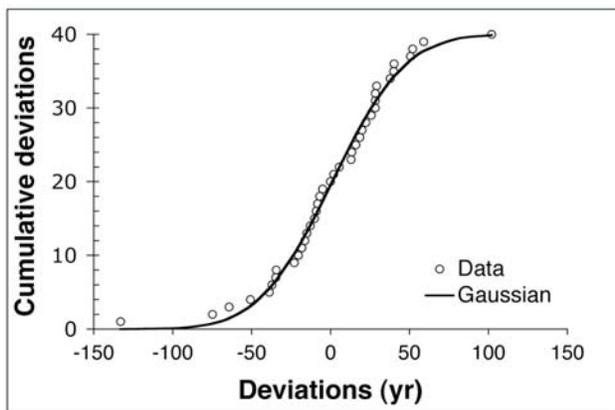


Figure 3. Cumulative deviations as a function of the magnitude of deviations. Deviations (also called errors) are the value of the data minus the corresponding value of the function fitted to the data in figure 1 (p. 118). In this figure, the height (ordinate) of a point at any given deviation on the x-axis (the abscissa of that point) is equal to the number of deviations of that size or less, i.e., the number of points below that point, plus one. (See the section on “Error Distribution.”)

Thus, the exponential curve provides a reasonable description of the data, using 3 degrees of freedom to account for 93% of the variance of 31 data.

Error Distribution

It is worthwhile to check the form of the error distribution, i.e. how the numbers in table 1 (p. 119) are distributed about the theoretical curve in figure 1 (p. 118), for it may contain information on the processes that produced them. Natural processes produce only certain kinds of error distributions, such as Gaussian, log Gaussian, and Poisson distributions, each of which is the signature of a different class of process. Artificial numbers can have whatever error distribution its creator chooses, and therefore observation of one of these will not discriminate between natural and artificial origin. However, certain distributions, such as a bimodal distribution or those with gaps or discontinuities, are not characteristic of natural processes, and observation of any of these distributions would be evidence against the naturalness of the numbers. Hence, the test below is warranted to check for any such evidence.

Method

Errors are defined as the value of the data minus the corresponding value of the function fitted to the data in figure 1. The conventional way to form an error distribution is to segment the continuum of error values into discrete intervals, count the number of errors within each interval, and present the counts as a frequency histogram. The disadvantage of this approach is that the shape of the distribution depends on arbitrary choices of size and placement of the intervals, especially when the data are sparse, as they are here. The present analysis avoids these disadvantages by working with cumulative errors. That is, the deviations are arranged from lowest to highest value and plotted left-to-right, each point one unit higher than the preceding one.

Results and discussion

The resulting cumulative error distribution is shown by the symbols in figure 3. The curve is a cumulative Gaussian distribution fit to the data by maximum-likelihood. The data do not differ reliably from the theoretical curve ($p = 0.49$, according to linear interpolation of table 6 of Shapiro and Wilk; $W = 0.971$, $n = 30$);¹⁵ hence, the numbers are well described by a Gaussian distribution. As discussed in the preceding section, this result is consistent with either

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a natural or artificial origin of the numbers and so fails to reject either.

Distribution of Initial Digits

The human tendency to overuse certain digits and underuse others produces another difference between natural and artificial numbers.¹⁶ For reasons explained below, a particularly important difference lies in the frequency with which different digits occur as the first (most significant) digit in the numbers.

It seems almost self-evident to many (it did to me) that each of the nine, nonzero digits would be equally likely to occur as the first digit (or second or third or any other digit) in natural numbers, producing a uniform frequency distribution. It is the assumption made by C. A. Hill in evaluating biblical longevities, for example, and it survived peer review of her paper.¹⁷ Therefore, one who is trying to mimic natural data might well strive for such a uniform distribution. However, as explained below, this is a fallacy. In figure 4 below, one can compare the frequencies of first digits of the biblical longevities in table 1 (black bars, p. 119), with the frequencies of the uniform distribution (indicated by the horizontal line) required by the false assumption of equal probability. The first digits from table 1 deviate reliably from a uniform distribution ($\chi^2 = 30.1$, $p < 0.0002$, $df = 8$). Therefore, either these numbers were not made up, or else whoever made them up was more sophisticated about such probabilities than the typical contemporary scientist.

However, T. P. Hill (not C. A. Hill) has shown that humans attempting to produce random numbers do

not tend to produce a uniform frequency distribution; rather, they favor certain numbers, and avoid others.¹⁸ On the basis of the probabilities reported by Hill, the frequencies they would be expected to produce here are shown in figure 4 (gray bars).

The biblical frequencies observed in table 1 deviate reliably not only from a uniform distribution but also from those observed by Hill ($\chi^2 = 24.1$, $p = 0.002$, $df = 8$). Therefore, either these biblical longevities were not made up, or else whoever made them up was able to perform better than Hill's students did.

However, contrary to intuition, the frequencies of the first digits of naturally occurring numbers are not uniformly distributed but follow Benford's law;¹⁹ that is, the first digit is more likely to be a low number than a high number. For example, in natural data, the probability that the first digit is a 1 is 0.301, whereas the probability that it is a 9 is 0.046. The numbers humans generate in the attempt to mimic naturally occurring data deviate from Benford's law.²⁰ As a consequence of this property, Benford's law is used to detect fabrication of data.²¹ Hill's data, for example, do deviate from Benford's law ($\chi^2 = 24$, $df = 8$, $p < 0.002$).

However, when one compares the biblical longevities of table 1 with Benford's law (the black bars versus the gray bars in figure 5 below), the longevities follow the predictions of Benford's law without significant deviation.²² When the entire data set is considered collectively, the deviations of the overall distribution of the observed frequencies from those of Benford's law do not depart from those attributable to chance ($\chi^2 = 10.61$, $p = 0.23$, $df = 8$). And when

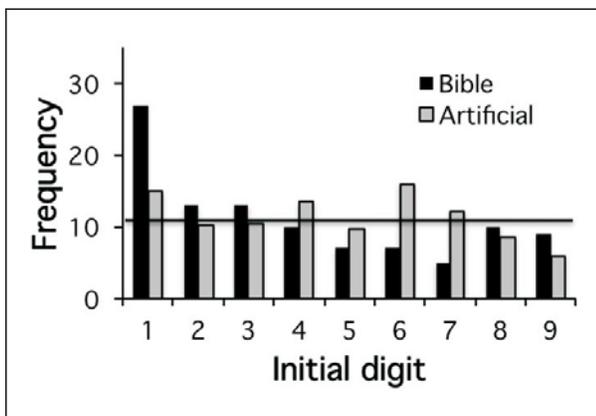


Figure 4. Frequency distribution of first digits from table 1 (black bars, p. 119), compared with those of artificially generated numbers (gray bars) and those of a uniform distribution (horizontal line).

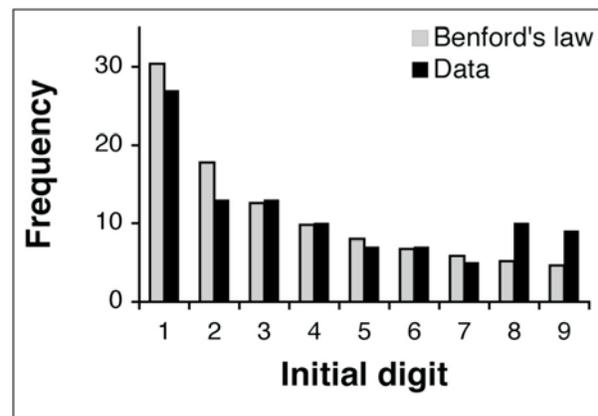


Figure 5. Frequency distribution of first digits from table 1 (black bars, p. 119), compared with Benford's law (gray bars).

the frequency of occurrence of each of the digits (1–9) is considered specifically, they all fall within the 0.95 fiducial limits of the frequency predicted by Benford's law for that digit, as determined by the z-statistic.²³

Thus, the frequencies of first digits in table 1 differ reliably from the best empirical estimate of the frequencies used by those attempting to generate random numbers, and they differ reliably from those of a uniform distribution, which is almost universally assumed to be characteristic of naturally occurring numbers; however, they do conform to Benford's law, as natural numbers do.

Independence

One way in which artificial and natural numbers differ is that artificial numbers lack several properties of randomness that characterize natural numbers: for example, even when trying to generate random numbers, humans seldom use any given digit twice in succession.²⁴ So, if one "makes up" the digits in sequence from left to right, then one is less likely to follow a 4 with another 4 than with another digit, and so the number 44 is less likely than other numbers in the 40s. As this form of independence is the most consistent deviation from randomness exhibited by humans,²⁵ it would seem to be a useful way to distinguish natural from artificial numbers here, but it turns out that the data are too sparse for it to be useful.

Specifically, there are six instances of identical digits adjacent to one another (i.e., 33, 55, 119, 133, and twice in 777) in the 63 bolded numbers of table 1 (p. 119). (Numbers containing zeros were excluded because when a zero was the least significant digit, it could have been produced by rounding, as demonstrated below, and a zero anywhere else in a two- or three-digit number cannot be preceded by a zero.) This is close to the expected frequency (6.45) for a set of numbers that follow Benford's law, as all natural data do. However, to reliably detect such a bias against repetition in a set of 63 numbers, the probability of a repetition would have to be about 0.03 instead of 0.102. As there are no good estimates of this probability, one can only say that this test reveals no evidence of such a bias, but that these data do not allow a powerful test.

Another related form of independence is independence of the magnitude of an error on the magni-

tudes of the preceding errors. It may be, for example, that a human making up numbers would add variable errors to some theoretical value, and if humans have a tendency to alternate magnitudes,²⁶ then a large error is more likely to be followed by a smaller error than by another large error. This would show up in autocorrelograms or power spectra. However, owing to problems with autocorrelograms or power spectra,²⁷ this form of independence was also examined here by plotting the value of each error against the value of the preceding error. The autocorrelogram and power spectrum showed no reliable regularities, nor did the plot just described show any relationship between successive errors. However, again, the sparsity of the data limits the power of the tests; thus, although there is no evidence of characteristically human deviation from independence, the test is too insensitive to warrant any conclusions.

Rounding

Although there is no evidence that these numbers are artificial, they clearly have been rounded. After excluding those numbers from table 1 that have been inferred by addition or subtraction, ten of the 32 remaining two-digit numbers have 0 as the last (least significant) digit; and 17 of the 38 remaining three-digit numbers have 0 as the last digit. Both frequencies are significantly higher ($\chi^2 = 9.88$, $p = 0.0017$, 1 df; and $\chi^2 = 44.6$, $p = 2^{-11}$, 1 df; respectively) than those in a Benford distribution (four expected zeros in both cases, corresponding to probabilities of 0.120 and 0.102, respectively). Although rounding adds to the error variance, its contribution to the total error variance is less than one-tenth of one percent; therefore, its effect on the data in figure 1 (p. 118) is negligible.

Galil argues that one cannot assume "that the data in the Bible regarding the years of reign were rounded off ..." ²⁸ However, the analysis here clearly shows that some numbers have been rounded, although one cannot say with confidence that any specific number has been rounded.

To round numbers, of course, is neither misleading nor suspicious. However, such rounding does prevent one from reconciling all the data on biblical chronologies exactly, as Thiele would do;²⁹ and it invalidates the computation of probabilities based on the assumption that the final digits of these numbers are random.³⁰

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General Discussion

This is the first general examination of the numerical properties of the longevities recorded in the Hebrew Bible. It confirms previous descriptions of the general shape of the transition from antediluvian to contemporary longevities, but it also refines and corrects errors in those descriptions. It shows that the deviations from this systematic, temporal trend form a Gaussian distribution. Neither the magnitudes of these deviations nor the sequence of digits in the numbers representing longevities show detectible departures from stochastic independence. The longevities also have been rounded. Finally, and most important, the properties of the numbers representing longevities differ reliably from those characteristic of the two most likely forms of fabrication, and the numbers conform to Benford's law.

However, the main purpose of the analysis was to shed light on the origin of these numbers. Either these numbers represent natural phenomena, or at least some of them are fabricated. As one cannot prove the null hypothesis, one can prove one hypothesis only by disproving its alternative (or all the alternatives, if there be more than one). Here we use the differences between the properties of natural and fabricated numbers to evaluate these two alternatives.

Natural Origin

Specifically, numbers derived from natural phenomena follow Benford's law,³¹ they represent systematic processes perturbed by random error, these perturbations tend to be mutually independent,³² and the numbers tend to be normally distributed about their mean values. If biblical longevities lack any of these properties, they cannot be true, and at least some must be fabricated. All efforts to show that the numbers lack the properties of natural numbers failed; therefore, one cannot reject the hypothesis that the numbers have a natural origin. This, of course, does not prove a natural origin; it simply fails to disprove it.

Arguments against Natural Origin

It seems surprising that natural origin is so difficult to disprove, since it seems so improbable. But why does it seem improbable? It is worthwhile to review here the reasons.

1. *Inconsistency with contemporary longevities.* The main reason that these longevities seem implausible is that they are inconsistent with contemporary human longevities: the longest documented life so far is 122 years and 164 days.³³ Moreover, there is a consensus that even under optimal living conditions, and with all fatal diseases cured, life expectancy at birth is not likely to exceed about 90 years.³⁴ However, the assumption that conditions that limit longevity were the same in antediluvian times as they are now is not necessarily true. The principal process that limits longevity in humans is aging,³⁵ and the fact that some animals show no evidence of aging (i.e., show *negligible senescence*),³⁶ means that aging is not necessarily a universal and immutable characteristic of living organisms, necessarily applicable to all humans under all conditions. The possibility of such longevities is supported by de Grey's argument that human life expectancy can, even now, be extended to a thousand years, although the strength of his argument is mitigated by its dependence on technologies that are only now being developed or have yet to be developed.³⁷ In any case, the argument against these biblical longevities on the basis of contemporary experience is not conclusive.

2. *Dearth of corroborating records.* Another reason why these longevities are implausible is that the more reliable surviving texts tell of longevities that are consistent with, or shorter than, contemporary data.³⁸ However, the records considered reliable do not extend back far enough in time to be relevant here. Many of those records that do go back far enough lend support to the biblical longevities but are considered unreliable. In some cases, such as that of the Weld-Blundell prism,³⁹ the argument may be circular, for the main reason that they are considered unreliable is that they tell of unbelievably long lives. Josephus says, "All who have written antiquities ... relate that the ancients lived a thousand years," and he lists eleven specific authors as examples.⁴⁰ But Josephus's accuracy, particularly with respect to numbers, has been widely challenged on other grounds.⁴¹ This epitomizes the dilemma here, for, unreliable as Josephus may be, he may be "more reliable than most historians of his day."⁴² The historical record, then, is of little help in resolving this issue.

3. *Absence of supporting archeological evidence.* The absence of archeological evidence of skeletal remains

of extremely aged individuals may seem to be the strongest evidence against their existence, but here other problems arise. The first lies in the limitations of the methods. According to Acsádi and Nemeskéri,

The methods of age determination generally employed in historical anthropology include ... the closure of cranial sutures, abrasion of teeth, and regressive signs in the external morphology of skeletal bones at young adult, middle adult and old adult ages ... [J]ustifiable doubts may arise on the accuracy of age determination based on the closure of cranial sutures and on the so-called classical anthropological methods in general (and) ... in historical anthropology usually only the basic distinction between child, juvenile or adult is made.⁴³

One can see from their table 30 that closure of the cranial sutures approaches an asymptote in middle age, and the variability is so great that one cannot reliably discriminate a 30-year-old from the oldest specimens examined. As for abrasion of the teeth, they state,

The abrasion of teeth at adult age ... depends primarily on living conditions ... Stomatologists have shown that the degree of abrasion is more often indicative of the individual's way of eating than of the period of time during which the teeth have been used.⁴⁴

A second problem follows from excavators' practice of culling the skeletal evidence, discarding all but the best skeletons.⁴⁵ The skeletons of the very old, lacking teeth, for example, may be excluded from the sample; an individual who has lived for a millennium may not have many surviving teeth.

Third, there are no data from the relevant time and place. As Finch has pointed out,

We cannot know the actual trajectory of change (in human life spans), which could have included fluctuations with decreases, as well as increases, in life span during these several hundred thousand generations of Darwinian selection.⁴⁶

To exclude the biblical account, one must exclude the possibility that there was a time, perhaps brief in historical perspective, in which a particular sub-population, including but not necessarily limited to the Hebrews, enjoyed extraordinarily long life. The most nearly relevant data are from Anatolia⁴⁷ and Jericho,⁴⁸ but both populations differ from the long-lived Hebrews of the Bible, who lived in Mesopotamia.⁴⁹

Finally, use of skeletal evidence of aging begs the question. As Acsádi and Nemeskéri point out, archeologists can measure only biological age, not chronological age.⁵⁰ Longevities of several centuries could have been achieved only if biological aging were somehow retarded.

Thus, while these objections carry considerable weight, none of them conclusively confutes the possibility that the reports of the biblical longevities are true.

Possible Explanations Consistent with Natural Origin

Several efforts have been made to preserve the validity of these numbers without accepting implausible longevities.

1. *Changes in the ways of expressing or measuring time.* For example, attempts have been made to account for biblical longevities by changes in the way of expressing or measuring time.⁵¹ However, no such scheme can work. To be conservative, suppose that the biblical life span of 969 biblical years (Methusaleh) were actually equal in time to the contemporary life span of 122 contemporary years.⁵² Then a biblical year would have to be $122/969 = 0.126$ contemporary years. If so, Saleh, Peleg, and Serug would each have to have been less than 4 years old ($30 \times 0.126 = 3.8$) when their first sons were born, and Mahalaleel and Enoch would have to have been about 8 ($65 \times 0.126 = 8.2$) when their first sons were born. These consequences of this hypothesis are at least as implausible as a 969-year life span.

2. *Dynasties, not individuals.* Others have suggested that the ages refer not to individuals but to "an individual and his direct line by primogeniture."⁵³ For example, Adam and his direct line are supposed to have held sway for 930 years, after which Seth and his family assumed control for the next 912 years. Archer points out, however, that as Seth was the oldest surviving son of Adam aside from exiled Cain, there was no other son to carry on Adam's line until Seth's line took over.⁵⁴ Borland lists some eight problems with such dynastic theories that render them untenable.⁵⁵ Moreover, there are not enough plausible gaps between the individuals listed to account for the required lapsed time, and there are too many instances of coexistence

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of individuals that, according to this explanation, would have to have been successive dynasties.⁵⁶

3. *Physical explanations.* Yet other attempts have been made to make these longevities plausible by offering physical explanations. There may once have been a set of conditions that fostered great longevity in humans. If so, figure 1 (p. 118) suggests that these conditions changed abruptly at about the time of Noah to bring longevities progressively closer to contemporary values. The question is, then, what changed? Unfortunately, it is hard to say.

One suggestion is that a protective canopy protected antediluvian humans from harmful radiation.⁵⁷ A gradual decay of the canopy could explain the gradual shortening of the duration of life. However, this is entirely speculative and adds nothing to the description of the phenomenon except the idea that radiation is what limits contemporary longevities.

Ross has suggested that “higher telomerase activity in concert with other slight biochemical adjustments, combined with a just-right diet (low calorie, low oxidant, high antioxidant) and the avoidance of (radioactive) igneous rocks ...” may help explain the long lives of the first humans, and that irradiation of Earth by the remnants of a recent supernova may explain the subsequent shortening of life.⁵⁸ The Monogem supernova may be a possible candidate, remnants of which even now account for some 60% of the cosmic irradiation of Earth at the “knee” of the cosmic ray spectrum, but its timing, 86,000 years ago, is problematical.⁵⁹ In any case, this hypothesis leaves much unexplained. Astronomical explanations such as this and the one in the preceding paragraph are inconsistent with the possibility that these extraordinary longevities occurred only in a small subpopulation of humans.

As mentioned above, aging constitutes the principal limitation on longevity; hence, a difference in the genes controlling aging seems a necessary condition for extreme longevity.⁶⁰ Although the *principle* of extending life by manipulation of genes has been demonstrated, retardation of the aging of humans by gene manipulation has yet to be demonstrated, and such effects as have been observed in animals so far are modest compared to the requirements here. What might have caused such genes to change

also remains unknown. Nevertheless, the limits on the magnitude of such effects are unknown, and so the possibility that changes in genes account for the putative changes in longevities remains open.

Artificial Origin

The properties of artificial or fabricated numbers depend on the conditions and purposes of fabrication, and therefore one cannot disprove fabrication in general but only specific forms of fabrication. The first possibility to consider is that the author or authors of the numbers deliberately intended to mimic natural data, and here there are three levels of sophistication with which the task might have been approached.

Deliberate Mimicry

1. *Naïve mimicry.* Mathematically naïve humans trying to mimic natural data show specific preferences for the first digits of numbers.⁶¹ The present analysis shows that the biblical longevities do not follow those preferences; therefore, it is unlikely that these longevities resulted from a mathematically naïve effort to mimic natural data.

2. *Sophomoric mimicry.* A more sophisticated yet fallacious approach to fabrication is based on the false assumption that in natural data all digits are equally probable. Actually, as described above, these probabilities follow Benford’s law. However, biblical longevities do not follow the assumption of equal probability either (and do follow Benford’s law), and therefore it is unlikely that these longevities arose from this more sophisticated attempt to mimic real data.

3. *Sophisticated mimicry.* The most sophisticated form of fabrication would be to mimic Benford’s law. However, one can exclude that possibility because there is no known way to mimic Benford’s law without knowing about it, and what has come to be called Benford’s law was not discovered until 1881, by Newcomb,⁶² millennia after these longevities were recorded.

It follows, then, that one can exclude all three forms of intentional mimicry of natural data. However, one cannot entirely exclude the possibility that other, unknown forms of intentional mimicry might exist.

Time-Course of the Changes

The gradualness of the progression of longevities from antediluvian to contemporary values is entirely consistent with natural processes, but it does impose stringent constraints on hypotheses based on fabrication. The nature of the constraints depends on whether a single individual fabricated all the longevities, whether different individuals independently fabricated each of the longevities, or whether some combination of the two is responsible for them.

1. *A single author.* If a single individual fabricated all the longevities, that individual would be subject to biased numerical preferences, such as those documented by T. P. Hill, as discussed above. However, that individual's biases may not necessarily be the same as those of the contemporary college students used in Hill's study, and, without knowing that individual's biases, one cannot entirely exclude the possibility that a single individual fabricated these longevities.

However, this hypothesis does require the fabricator to have a particular function in mind to mimic and to have a motive for mimicking it. According to a consensus among historians of mathematics,⁶³ exponential and related functions were not suggested until the fourteenth century, and therefore the fabricator could hardly have had it in mind while fabricating the numbers. However, this conclusion is vitiated by the existence of cuneiform tablets from Mesopotamia containing tables of exponential series,⁶⁴ including those entailing the use of fractional exponents,⁶⁵ the consensus of mathematical historians notwithstanding. These, along with the reciprocal numbers also found among the tabulated numbers, theoretically could have been used to generate an exponential function such as that in figure 1 (p. 118). These mathematical advances appear to have been made at about 1800 BCE,⁶⁶ after the time of Abraham⁶⁷ and after most of this exponential decay had occurred, but possibly before the numbers were generated.

The most likely motivation for attempting to mimic such a function is to make them appear real, an act of deliberate deception that conflicts with the view many have of the Bible and the motives of its authors. Thus, the time-course of the change in longevities does not allow one to exclude a single fabricator, but it does place heavy demands on such a fabricator.

2. *Multiple independent authors.* Different individuals independently fabricating different longevities could not, of course, intentionally mimic any particular decay function. There is no known mechanism by which numbers generated by different individuals could produce an exponential-like function.

3. *A combination of these two possibilities.* That is, different individuals could have fabricated the numbers, but some could have fabricated more than a single number. This possibility is subject to both of the above sets of constraints to a varying extent, depending on the particular combination.

Thus, the time-course of the change poses substantial challenges for any hypothesis based on fabrication, but it does not entirely exclude it.

Fabrication without the Intention to Mislead

Even if the numbers were not deliberately fabricated, one must consider the possibility that some process other than true longevities might have given these numbers these properties. Among such proposals is the idea that the numbers were not meant to convey quantitative information but were instead intended to have cultural significance. For example, large numbers may have conferred honor on the individuals with whom they were associated, or the numbers might have had numerological rather than numerical significance.

Such hypotheses are hard to evaluate without a specific interpretation of the meaning of the numbers, although the systematic properties evident in figure 1 are not consistent with a set of numbers completely devoid of numerical significance. The most specific and best supported hypothesis in this category is the idea that the Mesopotamians preferred the numbers 60 and 7, considering them sacred, for example.⁶⁸ Such numbers are artificial, then, instead of representing natural data, but they do not represent an effort to fake or mimic natural data.

In general, such numerological arguments are unconvincing. To show why, take a specific example cited by C. A. Hill, the most rigorous proponent of a numerological interpretation of these ages. She points out that each of the ages in Genesis from before the flood is equal to the sum of a multiple of

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5 years (60 months) and a multiple of 7 years, and she attributes this to the special significance of these numbers for Mesopotamians. However, numerological arguments are hard to evaluate without considering the relevant probabilities. In this case, the fact that all these ages are the sum of multiples of 5 and 7 is irrelevant, since this is true of *all* numbers from 24 to 1000. For example, $24 = 2 \times 5 + 2 \times 7$; $25 = 5 \times 5$; $26 = 5 + 3 \times 7$; $27 = 4 \times 5 + 7$; and similarly up to and beyond $999 = 5 \times 197 + 2 \times 7$.⁶⁹ In other words, no matter what the ages, they would nevertheless all be equal to the sum of a multiple of 5 and a multiple of 7. The numbers 5 and 7 are not unique in this respect: for example, all the numbers above 20 are equal to the sum of multiples of 3 and 11. Possibly any pair of prime numbers has analogous properties.

The present example notwithstanding, Hill did significantly advance the rigor of this line of argument by actually comparing the probabilities of occurrence of the numbers representing the ages of the patriarchs to their frequency of occurrence.⁷⁰ For example, she analyzed the 60 numbers describing, for each of the first twenty patriarchs, his age when his first son was born, his remaining years of life, and his total years. She states that none of these numbers ends in 1 or 6, “a chance probability of one in about one-half million.”⁷¹ Unfortunately, she is not clear about what the probabilities refer to or how she arrived at them, and her computations err in several ways.

First, the probability that two specific final digits (1 and 6, in this case) would fail to occur by chance is $1.5325(10^{-6})$, or one chance in 652,530, close to the “chance of one in about one-half million” that she states. However, the appropriate probability to apply here is that *any* two digits would fail to occur; if, for example, 3 and 8 had failed to appear as final digits she would have drawn the same conclusions. Since 10 digits can form 45 different pairs, the probability that any of those pairs would fail to occur is $6.89623(10^{-5})$ or 1 in 14,500, not 1 in about half a million.

Although this difference does not vitiate her conclusion that one can exclude chance as an explanation of such numbers, it typifies computational errors in this paper. Moreover, the conclusion is moot because the statement that none of the numbers ends in 1 or 6 is false: Abraham’s age was 86 when

his first son, Ishmael, was born. Hill excludes this number by breaking her own rule, using Abraham’s age at the birth of his second son, Isaac, instead of his age at the birth of his first son, Ishmael.

Second, Hill’s computations are based on the false assumption (p. 244) that the ages should be random numbers; instead, they should conform to Benford’s law (explained above). Also, her computations do not take into account the effects of rounding (demonstrated above). Finally, her choice of which patriarchs to include in her sample (the first twenty) and which subset to select for separate analysis (the first ten) is arbitrary and post hoc, and it therefore inflates the significance of her probabilities.

However, estimating the probabilities of the final digits of these numbers, as Hill has attempted, is unnecessary in this case, for her point—that the final digits of these numbers are not natural—clearly follows from the fact that some have been rounded (shown above). Moreover, not all the numbers have been rounded. Choice of which numbers to round allowed whoever did the rounding wide latitude in determining the properties of the remaining final digits. Whether such choices were guided by their supposed sacredness or by other considerations is not clear from present data.

Note (see the discussion of rounding above) that any manipulation of these least significant digits would have a negligible effect on the systematic properties of the numbers, the error distribution, the independence of the numbers, and conformance to Benford’s law; that is, these properties are insensitive to the values of the least significance digits, which, by definition, have relatively small effects. Therefore, the fact that the least significant digits have been manipulated does not affect the conclusion that the numbers represent natural phenomena; nor, conversely, does the fact that these numbers have these natural properties exclude the possibility that the least significant digits have been manipulated.

Conclusions

These biblical longevities admit to but two possibilities: at least some are true, or all are false. The frequencies of first digits in table 1 (p. 119) differ from the frequencies used by those attempting to generate random numbers, but do conform to Benford’s law.

Also, the time-course of the longevities is difficult to reconcile with deliberate fabrication or with any other form of fabrication. Like any empirical finding, the results are not absolutely conclusive, but the mathematical properties of these numbers favor natural origin. In other words, the biblical longevities, as a set, are likely to be true. ∞

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Notes

- ¹Carol A. Hill, "Making Sense of the Numbers of Genesis," *Perspectives on Science and Christian Faith* 55, no. 4 (2003): 239–51.
- ²F. Benford, "The Law of Anomalous Numbers," *Proceedings of the American Philosophical Society* 78 (1938): 551–72; Mark John Nigrini, *Digital Analysis Using Benford's Law: Tests and Statistics for Auditors* (Vancouver, BC: Global Audit Publications, 2000).
- ³W. A. Wagenaar, "Generation of Random Sequences of Human Subjects: A Critical Survey of Literature," *Psychological Bulletin* 77 (1972): 65–72; M. Bar-Hillel and W. A. Wagenaar, "Perception of Randomness," *Advances in Applied Mathematics* 12 (1991): 428–54.
- ⁴Allen Neuringer, "Can People Behave 'Randomly?': The Role of Feedback," *Journal of Experimental Psychology: General* 115, no. 1 (1986): 62–3.
- ⁵Gleason L. Archer, *A Survey of Old Testament Introduction* (Chicago: Moody Press, 1994), 211–2.
- ⁶Gershon Galil, *The Chronology of the Kings of Israel and Judah, Studies in the History and Culture of the Ancient Near East*, vol. 9 (New York: E. J. Brill, 1996).
- ⁷Edwin R. Thiele, *A Chronology of the Hebrew Kings* (Grand Rapids, MI: Zondervan, 1977).
- ⁸Galil, *The Chronology of the Kings of Israel and Judah*.
- ⁹John C. Sanford, *Genetic Entropy and the Mystery of the Genome*, 2d ed. (Lima, NY: Elim Publishing, 2005), 152.
- ¹⁰Hugh Ross, *The Genesis Question* (Colorado Springs, CO: NavPress, 1998), 122; P. M. Holladay and J. M. Watt, "De-Generation: An Exponential Decay Curve in Old Testament Genealogies." Paper presented at the 52d National Conference of the Evangelical Theological Society, Nashville, TN, 2000, 4–7; Sanford, *Genetic Entropy and the Mystery of the Genome*.
- ¹¹Eli Maor, *e: The Story of a Number* (Princeton, NJ: Princeton University Press, 1994), 98–103.
- ¹²The upper 95% confidence interval on this estimate does extend to positive 54 years; the 95% confidence interval for

the asymptote of the exponential curve is from -95 to 132.2 years.

- ¹³Ross, *The Genesis Question*; Holladay and Watt, "De-Generation: An Exponential Decay Curve in Old Testament Genealogies."
- ¹⁴Holladay and Watt, "De-Generation: An Exponential Decay Curve in Old Testament Genealogies," 152.
- ¹⁵S. S. Shapiro and M. B. Wilk, "An Analysis of Variance Test for Normality (Complete Samples)," *Biometrika* 52, no. 3/4 (1965): 591–611.
- ¹⁶Wagenaar, "Generation of Random Sequences of Human Subjects: A Critical Survey of Literature"; Bar-Hillel and Wagenaar, "Perception of Randomness."
- ¹⁷See C. A. Hill, "Making Sense of the Numbers of Genesis," 244.
- ¹⁸Theodore P. Hill, "Random-Number Guessing and the First Digit Phenomenon," *Psychological Reports* 62 (1988): 967–71.
- ¹⁹Benford, "The Law of Anomalous Numbers"; Nigrini, *Digital Analysis Using Benford's Law: Tests and Statistics for Auditors*; Simon Newcomb, "Note on the Frequency of Use of the Different Digits in Natural Numbers," *The American Journal of Mathematics* 4 (1881): 39–40.
- ²⁰T. P. Hill, "Random-Number Guessing and the First Digit Phenomenon," 970.
- ²¹Nigrini, *Digital Analysis Using Benford's Law: Tests and Statistics for Auditors*.
- ²²*Ibid.*, 14.
- ²³*Ibid.*, 42–3, 73–6.
- ²⁴Wagenaar, "Generation of Random Sequences of Human Subjects: A Critical Survey of Literature," 70.
- ²⁵*Ibid.*
- ²⁶Alphonse Chapanis, "Random-Number Guessing Behavior," *The American Psychologist* 8, no. 332 (1953).
- ²⁷Wagenaar, "Generation of Random Sequences of Human Subjects: A Critical Survey of Literature," 68–9.
- ²⁸Galil, *The Chronology of the Kings of Israel and Judah*, 10.
- ²⁹Thiele, *A Chronology of the Hebrew Kings*.
- ³⁰C. A. Hill, "Making Sense of the Numbers of Genesis," 244.
- ³¹Benford, "The Law of Anomalous Numbers"; Nigrini, *Digital Analysis Using Benford's Law: Tests and Statistics for Auditors*.
- ³²Wagenaar, "Generation of Random Sequences of Human Subjects: A Critical Survey of Literature"; Bar-Hillel and Wagenaar, "Perception of Randomness."
- ³³Jean-Marie Robine and Michel Allard, "The Oldest Human," *Science* 279, no. 5358 (1998): 1831.
- ³⁴S. Jay Olshansky, Bruce A. Carnes, and Christine Cassel, "In Search of Methuselah: Estimating the Upper Limits to Human Longevity," *Science* 250 (1990): 638; D. Harman, "Aging: Overview," *Annals of the New York Academy of Science* 928 (2001): 2.
- ³⁵*Ibid.*; also Leonard Hayflick, "The Future of Ageing," *Nature* 408, no. 6809 (2000): 267–69.
- ³⁶Caleb E. Finch, "Variations in Senescence and Longevity Include the Possibility of Negligible Senescence," *Journal of Gerontology* 53A, no. 4 (1998): B235–9; —, *The Biology of Human Longevity: Inflammation, Nutrition, and Aging in the Evolution of Life Spans* (Burlington, ME: Academic Press, 2007), 47–8; Hayflick, "The Future of Ageing," 268.
- ³⁷Aubrey J. N. J. de Grey, "Escape Velocity: Why the Prospect of Extreme Human Life Extension Matters Now," *Public*

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- Library of Science Biology*, no. 6 (2004): 5 www.plosbiology.org/article/info:doi/10.1371/journal.pbio.0020187 (last accessed April 26, 2011); —, “A Strategy for Postponing Aging Indefinitely,” *Studies in Health Technology and Informatics* 118 (2005): 218; — and Michael Rae, *Ending Aging: The Rejuvenation Breakthroughs That Could Reverse Human Aging in Our Lifetime* (New York: St. Martin’s Press, 2007), 327–34.
- ³⁸Edwin M. Yamauchi, “Attitudes toward the Aged in Antiquity,” *Near East Archeological Society Bulletin* 45 (2000): 2–7.
- ³⁹Patrick Moore, *Atlas of the Universe* (New York: Rand McNally, 1970), 146.
- ⁴⁰Josephus, *Antiquities*, 3.9.
- ⁴¹Paul L. Maier, “Introduction,” in *The New Complete Works of Josephus* (Grand Rapids, MI: Kregel Publications, 1999), 14.
- ⁴²*Ibid.*
- ⁴³Gy Acsádi and J. Nemeskéri, *History of Human Life Span and Mortality*, trans. K. Balás (Budapest: Akadémiai Kiadó, 1970), 101.
- ⁴⁴*Ibid.*, 104.
- ⁴⁵J. Lawrence Angel, “The Length of Life in Ancient Greece,” *Journal of Gerontology* 2 (1947): 19.
- ⁴⁶Finch, *The Biology of Human Longevity: Inflammation, Nutrition, and Aging in the Evolution of Life Spans*, 373.
- ⁴⁷M. S. Senyürek, “The Longevity of the Chalcolithic and Copper Age Inhabitants of Anatolia,” *Belleten* 15 (1951): 447–68.
- ⁴⁸G. Kurth, “Vorbericht über Anthropologische Beobachtungen bei der Jerichograbung,” *Homo* 6 (1955): 145–56.
- ⁴⁹Carol A. Hill, “A Time and a Place for Noah,” *Perspectives on Science and Christian Faith* 53, no. 1 (2001): 28–38.
- ⁵⁰Acsádi and Nemeskéri, *History of Human Life Span and Mortality*, 102.
- ⁵¹James A. Borland, “Did People Live to Be Hundreds of Years Old before the Flood? Yes,” in *The Genesis Debate: Persistent Questions about Creation and the Flood* (New York: Thomas Nelson Publishers, 1986), 170–1; C. A. Hill, “Making Sense of the Numbers of Genesis,” 239.
- ⁵²Galil, *The Chronology of the Kings of Israel and Judah*, 10.
- ⁵³Archer, *A Survey of Old Testament Introduction*, 211; see Borland, “Did People Live to Be Hundreds of Years Old before the Flood? Yes,” 173–7.
- ⁵⁴Archer, *A Survey of Old Testament Introduction*, 212.
- ⁵⁵Borland, “Did People Live to Be Hundreds of Years Old before the Flood? Yes,” 174–6.
- ⁵⁶*Ibid.*, 175; C. A. Hill, “Making Sense of the Numbers of Genesis,” 240.
- ⁵⁷John C. Whitcomb and Henry M. Morris, *The Genesis Flood: The Biblical Record and Its Scientific Implications* (Philadelphia, PA: Presbyterian and Reformed Publishing, 1961), 399–405.
- ⁵⁸Ross, *The Genesis Question*, 117–22; —, “New Clues to a Genesis Mystery,” *Connections* 7, no. 1 (2005).
- ⁵⁹S. E. Thorsett, R. A. Benjamin, W. F. Briskin, A. Golden, and W. M. Goss, “Pulsar PSR B0656+14, the Monogem Ring, and the Origin of the “Knee” in the Primary Cosmic-Ray Spectrum,” *Astrophysical Journal* 592, no. 2 (2003): L71–L73.
- ⁶⁰M. C. Haigis and L. P. Guarente, “Mammalian Sirtuins—Emerging Roles in Physiology, Aging, and Calorie Restriction,” *Genes and Development* 20, no. 21 (2006): 2913–21; Matt Kaeberlein and Pankaj Kapahi, “Aging Is Risky Business,” *Science* 326 (2009): 55–6.
- ⁶¹T. P. Hill, “A Note on Distributions of True Versus Fabricated Data,” *Perceptual and Motor Skills* 83 (1996): 777.
- ⁶²Newcomb, “Note on the Frequency of Use of the Different Digits in Natural Numbers,” 38–40.
- ⁶³Maor, *e: The Story of a Number*, 9.
- ⁶⁴Otto Neugebauer, *Mathematische Keilschrift-Texte, Herausgegeben und Bearbeitet von O. Neugebauer*, ed. O. Neugebauer, J. Stenzel, and O. Toeplitz. 3 vols., Vol. 1, *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik* (Berlin: J. Springer, 1935), 77.
- ⁶⁵Otto Neugebauer and A. Sachs, *Mathematical Cuneiform Texts*, American Oriental Series, vol. 20, ed. S. Harris Zellig, Murray B. Emeneau, and George A. Kennedy (New Haven, CT: American Oriental Society and the American Schools of Oriental Research, 1945), 35–6.
- ⁶⁶Otto Neugebauer, *The Exact Sciences in Antiquity*, 2d ed. (New York: Dover, 1969), 29, 34.
- ⁶⁷Archer, *A Survey of Old Testament Introduction*, 227.
- ⁶⁸For summary, see C. A. Hill, “Making Sense of the Numbers of Genesis,” 241–3.
- ⁶⁹One can easily check this for oneself. In MS Excel, list the numbers from 0 to 200 in column A, starting in row 2. List the numbers from 0 to 4 in the first row, starting in column B. Type “=5*\$A2+7*\$B\$1” in cell B2, and copy it in all the empty cells of the 6 by 201 cell matrix; this forms a set of numbers consisting only of the sums of multiples of 5 and 7. Change the cell entries from formulae to values (i.e., copy the entire matrix and select “Paste special” from the “edit” menu and select “values” from the submenu). Delete row 1 and column A, leaving a 5 by 200 matrix consisting only of sums of multiples of 5 and 7. Copy column B and paste it at the end of column A. Copy column C and paste it at the end of column A. Do the same with columns D and E, so that all the numbers are in column A. Sort column A in ascending sequence. The result is that in cells A12 to A988 all the numbers from 24 to 1000 are arranged in sequence. Therefore, all the numbers from 24 to 1000 can be formed by the sum of multiples of 5 and 7.
- ⁷⁰C. A. Hill, “Making Sense of the Numbers of Genesis.”
- ⁷¹*Ibid.*, 244.



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ENVIRONMENT

TENDING TO EDEN: Environmental Stewardship for God's People by Scott C. Sabin. Valley Forge, PA: Judson Press, 2010. 174 pages. Paperback; \$18.00. ISBN: 978-0817015725.

Caring about the poor finally seems to be a mainstream concern in the large, suburban, evangelical churches of North America. While this caring is directed at poverty—both local and distant—we tend to have more contact and experience dealing with the poor in our own towns and cities. The poverty in other countries that we may see on the news or read about in other media seems more extreme and perplexing. What, exactly, do poor subsistence farmers in Africa, Asia, or Latin America need? How can our efforts make a difference, producing opportunities rather than dependency, for those we would like to help in the name of Jesus?

Scott Sabin, director of Plant with Purpose, sets out to answer these questions in *Tending to Eden*. Sabin has much experience working with small farmers in the Dominican Republic, Central America, and elsewhere, and his answers will challenge. Sabin locates poverty in a web of broken relationships: with God, neighbors, self, and with creation. He outlines the work of justice in repairing these relationships, which he argues is best done simultaneously—all levels at once.

Since mission and development work has often overlooked the broken relationship with creation, Sabin helps readers envision what this could look like, constantly anchoring his ideas with stories of the lives of villagers in the developing world. The daily dependency of these billions of people on productive soil, flowing springs, and healthy forests makes the inclusion of creation care urgently necessary in any program of community development.

Of course, all of us are dependent on these things, but as North Americans we tend to underestimate our dependency. We also tend to grossly underestimate our own role in causing the environmental problems that disproportionately impact the poor. Sabin devotes the second half of the book to showing how our own relationship to creation is broken. What would it look like for us to live out the gospel as good news for the poor, and for all creation? The book ends with many practical ideas for how we can stay motivated and make a difference, repairing relationships both locally and globally. This holistic approach unites rich and poor in a common cause. At the same time, we have to admit that as North Americans we have more choices available to us, and therefore we have a greater responsibility to act.

What will Christians gain from reading this book? For those who are already green, most will get a more international perspective. For those hearing God's call to serve the poor—if they realize this book is written for them—they will be challenged to respond more holistically and effectively. (For both groups, Sabin includes a Bible study for small groups.) Some chapters are less interesting to those not managing Christian development

organizations, especially a fairly technical one about sustainable agriculture and forestry methods. However, it is important to realize that, given the right opportunities, the poor can and will find ways out of poverty while protecting creation.

Reviewed by David O. De Haan, Associate Professor of Chemistry, University of San Diego, San Diego, CA 92110.



HEALTH & MEDICINE

PARTNER TO THE POOR: A Paul Farmer Reader by Haun Saussy, ed. Berkeley, CA: University of California Press, 2010. 662 pages, index. Paperback; \$27.50. ISBN: 9780520257139.

Paul Farmer is best known for his work as the founding director of Partners in Health. Through this organization, Farmer has demonstrated the need to provide medical care to the poorest and most vulnerable people on Earth, such as HIV-AIDS patients in Haiti and TB patients in Russian prisons. But even more, he has demonstrated the feasibility of providing care for these persons when one holds a clear ethic of justice and equity and a conviction that health care is a human right. This reader is an argument for these convictions.

Partner to the Poor is one in a series published by the California Series in Public Anthropology. The twenty-five readings included are previously published material, organized in a chronological manner, but also by theme. The three themes are Ethnography, History, and Political Economy; Anthropology amid Epidemics; and Structural Violence. The readings are not scientific publications, but read more like an exposé of a besetting health-care injustice, followed by stories of his experiences in seeking to redress that issue, and then concluding with his straightforward recommendations for how the world and health-care organizations should change the way they function in response to this heightened awareness. For example, after exposing the problem of TB among Russian prisoners, he then goes on to argue that TB is as much punishment for these people as is their incarceration.

Farmer is eminently qualified to straddle the disparate worlds of power and wealth over against poverty and inequality. His professional life has been spent nearly equally between the developing world (Haiti, Peru, Rwanda, Russia, and inner city Boston), and the academic setting in which he works in Boston, at Harvard University and Brigham and Women's Hospital. For those who enjoyed the Farmer biography, *Mountains beyond Mountains: The Quest of Dr. Paul Farmer, a Man Who Would Cure the World* by Tracy Kidder, the present book would be a good next step toward fully appreciating the ideology that drives him.

Farmer shares economist Jeff Sachs' argument that developing countries need more aid money. Working in the field of global health myself, I am sympathetic to his argument, but the recent book *Dead Aid*, by African Dambisa Moyo, shows that this point is arguable. ASA readers will also notice that Farmer's approach to ethics and justice is highly relativistic. For example, we are

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meant to sympathize with drug-addicted HIV-AIDS patients as victims of *structural violence*, in which the individual is absolved of personal responsibility for her or his condition.

The book is not one sustained argument; individual readings can be read alone. However, for readers new to Farmer, one or two essays alone are unlikely to draw one in to the ethos and perspective that is unique to Farmer. The section New Agenda for Health and Human Rights, beginning on page 457, is meant to guide our thinking on global health, but is equally needed in the USA as we continue our national debate on health-care reform. Sections of this book should be required reading in all schools of public health.

As a compilation, the book can be a bit repetitive. For example, the history of Haiti is introduced several times. Additionally, the focus on Haiti, which is a rather unique country, left me wondering at several points whether his conclusions can be applied to the majority of the countries in the world who do not share Haiti's convoluted and tragic history.

Farmer is as effective as a politician as he is as a scientist. Although he patches together evidence to buttress his arguments, most of his arguments are made through highly personal stories and anecdotes. I could not help but see the similarity he bears to missionaries who are likewise driven by a passion for their cause, and often too busy to do the critical evaluation necessary to validate their work, and so resort to moving stories. On the other hand, his mastery of the literature in politics, history, medicine, anthropology, and public health allows him to make solid arguments with persuasive, multidisciplinary defense. He has coined highly communicative phrases such as *structural violence*, *stupid deaths*, *microbial El Nino*, and *socio-medicine*. His writing is highly engaging and intellectually satisfying. His writing style is one which ASA authors might emulate in seeking to make our cause known in a more accessible way to a wider public.

Reviewed by Mark A. Strand, China Director, Shanxi Evergreen Service, Shanxi Province, China.



ORIGINS & COSMOLOGY

THE GRAND DESIGN by Stephen Hawking and Leonard Mlodinow. New York: Bantam, 2010. 181 pages, illustrations, glossary, index. Paperback; \$28.00. ISBN: 978-0533805376.

Stephen Hawking's *A Brief History of Time* remains a top seller after 22 years, paralleling his surprising longevity with amyotrophic lateral sclerosis. This new book, written with Mlodinow (also a theoretical physicist and trade-book author), despite its grand claim, says little new, except for providing a surface-level update on the speculative M-theory as well as joining the fashionable trend of Dawkins and Hitchens in providing naïve jabs at religion (and the ID community).

The book provides an accessible and at times witty introduction to a few of the distinctive characteristics of quantum physics, largely in the style of Feynman's *QED*:

The Strange Theory of Light and Matter (Princeton, 1985). Its emphasis is on the (questionable) application of a sum-over-histories interpretation of quantum theory to the universe as a whole, and how this indicates that the Theory of Everything—that “holy grail of physics”—is unattainable as a result. The authors usually present the details of physics reasonably well, but at times one wonders why connections are not made. For example, they mention that the smallness of Planck's constant results in the phases of neighboring paths varying wildly (p. 78 f.), but fail to point out that this is due to division by this small value. Many of the glossy color figures are misleading or unclear; for example, a graph (p. 92) shows two waves supposedly representing red and violet light with no indication of what is actually being plotted on either axis. As such, experts are at best reminded of basic QED while others are left with the perception that physics is weird and difficult.

Half of the *The Grand Design's* chapter titles invite, but disappoint, the curious reader: The Mystery of Being, What Is Reality? Choosing Our Universe, The Apparent Miracle. Hawking and Mlodinow approach deep spiritual, metaphysical, ontological, and existential questions, but instead of seriously engaging them, they apply superficial physical-reductionistic answers. This is not surprising, given Hawking's habit of ridiculing religion as outmoded myth, but it is sad nevertheless; I had hoped that he and Mlodinow would have learned from both atheist and Christian critiques of Dawkins and Hitchens. Apparently there remains a significant market for sloppy dismissal of anything to do with faith.

A key element of the book is its introduction of “model-dependent realism,” a new word for the old idea of instrumentalism of which they are apparently unaware, saying that “it is pointless to ask whether a model is real, only whether it agrees with observation” (p. 46). They awkwardly advance their self-defeating idea that “model-dependent realism solves, or at least avoids ... the meaning of existence” (p. 47) while ironically claiming that humans employ the notion of object permanence because it “is much simpler [than alternatives] and agrees with observation” (p. 47), not because it is the real state of affairs. As a result, Hawking and Mlodinow cannot tell the difference between model and reality; for them, these are one and the same. Because one can imagine multiple universes each with its own set of physical laws and constants, these multiple universes necessarily exist. Much more sensible, even under M-theory, is critical realism, which asks the question of whether the model does a reasonable job of describing or explaining reality all the while acknowledging that reality comes at us through the mediation of our inherited or devised conceptual frameworks. Their conflation of model and reality also appears in their helpless comments regarding Genesis and the big bang. Instead of critiquing the idea of some that “Genesis is literally true even though the world contains ... evidence that makes it look much older” (p. 50), they say that “neither [this nor the big bang] model can be said to be more real than the other” (p. 51). The question is not whether a model is real, but whether it faithfully represents reality.

Hawking and Mlodinow display extreme philosophical and theological naïveté beginning with their announcement that “philosophy is dead” (p. 5). They characterize

the notion that “the laws were the work of God [as] no more than a definition of God as the embodiment of the laws of nature” (p. 29), suggest that “scientific determinism ... is the modern scientist’s answer” to the question of miracles (p. 30), reductionistically claim “we are no more than biological machines and ... free will is just an illusion” (p. 32), ask very poorly formulated questions such as “Did the universe need a creator?” (p. 5) and write that a “model is a good model if it ... [a]grees with and explains all existing observations” (p. 51)! The authors show no evidence that they have taken so much as a quick glance into the pages of any academic journal on these topics.

The authors like to poke fun at Christianity, usually painting simplistic pictures. They equate biblical belief with young-earth creationism, for them sufficient to dismiss the Bible. More significantly, they get the Condemnation of 1277 wrong, saying that “Bishop Tempier ... published a list of 219 errors or heresies that were to be condemned [including] the idea that nature follows laws, because this conflicts with God’s omnipotence” (p. 24 f.). In fact, it was the logical necessity of the laws of nature taking their specific forms, not the idea of laws of nature *per se*, which was being condemned; by God’s choice they could have been otherwise. [For more on this, see Russell Maatman, “The Galileo Incident,” *PSCF* 46, no. 3 (1994): 179–82.] Curiously, that the world could have been otherwise is precisely the point of Hawking and Mlodinow in this book, except that for them there is no god and every possible universe actually exists. It is indeed unfortunate that some who correctly acknowledge God as the Law Giver believe that the specific form of natural laws is an emanation of God’s nature, or of logical necessity the only possible laws, and thus deny God’s sovereignty. God chose to create this particular world in this particular way and was not bound by his own nature or by “nature” itself in the manner of his creation; however, once having created, God commits himself to a faithful sustaining of reality. The authors promulgate a false dichotomy, writing that “eclipses were not dependent on the arbitrary whims of supernatural beings, but rather governed by laws” (p. 15), ignoring the Christian recognition that patterns show the faithfulness of the divine Law Giver, recognized by scholars as a key driver of early modern science.

Perhaps the most striking example of unsophistication outside of physics is the authors’ oft-repeated claim that science shows that laws can produce universes apart from a Creator: “Because there is a law like gravity, the universe can and will create itself from nothing ... Spontaneous creation is the reason there is something rather than nothing, why the universe exists, why we exist” (p. 180); “M-theory predicts that a great many universes were created out of nothing. Their creation does not require the intervention of some supernatural being or god. Rather, these multiple universes arise naturally from physical law” (p. 8 f.); “the beginning of the universe was governed by the laws of science and doesn’t need to be set in motion by some god” (p. 135). Clearly, these laws and theories function for the authors as an unarticulated divine self-existence and omnipotence, rather than human formulations of divine providential faithfulness.

The goal of the book was to answer “the Ultimate Question of Life, the Universe, and Everything,” which they

state as: “Why is there something rather than nothing? Why do we exist? Why this particular set of laws and not some other?” (p. 10). These are good questions, but scientists and the general public, Christian or otherwise, will not receive reliable answers in this failed attempt by Hawking and Mlodinow.

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THE PRISM AND THE RAINBOW: A Christian Explains Why Evolution Is Not a Threat by Joel W. Martin. Baltimore, MD: Johns Hopkins University Press, 2010. 107 pages, appendix, notes, recommended reading, helpful websites, index. Paperback; \$20.00. ISBN: 9780801894787.

Joel W. Martin offers a book to an audience of students and parents (and presumably to other nontheological experts). Its purpose is to make a case supporting the thesis that evolutionary biology is consistent with Christian theology, and further, that evolution supports major biblical themes. Martin also wants to inform his readers of the nature of science, some areas of past conflict (and eventual resolution) between science and faith, and some cautionary advice for Christian laity in their Bible reading as they attempt to discern the Bible’s message to us today. In our opinion, Martin does all of this effectively in a concise package.

Martin, Chief of the Division of Invertebrate Studies and Curator of Crustacea at the Natural History Museum of Los Angeles County, specializes in systematic biology. He is also active in church youth work.

Martin opens the book with a claim that most American Christians regard the scientific status of evolution as valid and not in conflict with faith. However, he uses statistics that he has personally gathered, and admits that they fall short of representing all of Christian opinion. His conclusions are contrary to public opinion expressed, for example, in Gallup and Barna polls, that seem to indicate a more substantial number (if not a majority) of American Christians find evolution and Christianity incompatible. However, the value of the book does not depend on Martin’s accurate assessment on this question. We believe that he is correct in concluding that there is enough confusion on this issue of science and faith to warrant careful analysis and response, and that is what Martin focuses on for the remainder of the book.

Martin sets the stage by discussing three examples: the rainbow, the idea of a flat earth, and the handling of poisonous snakes. Later on, he discusses the Galileo controversy with the Catholic Church. In each of these, science and faith play important roles, and considering these examples can illuminate both helpful and unhelpful ways of approaching questions involving science and Christian faith. Martin refers to these examples as he examines the debate surrounding evolution.

He then discusses the nature of science, and carefully specifies the meaning of certain scientific terms that are misunderstood by a significant number of the non-scientific public – terms such as fact, hypothesis, law, rule, and theory. Martin is correct that confusion about these

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terms has led to some unfortunate misunderstandings and invalid conclusions about the status of certain scientific work important to faith issues. His discussion is especially helpful here, and it clearly elucidates one of the more serious problems contributing to the science/faith conflict.

Chapter 7 follows with a summary of important characteristics of the science of evolution. He points out that there is no controversy within the scientific community regarding the occurrence of evolution. Yet he admits that there is much still unknown, and that evolutionary science remains an active area of research. Martin highlights what he considers the principal stumbling block facing Christians when considering evolution—namely, that evolution represents a threat to religion, and especially to Christianity.

In the next three chapters, Martin analyzes and evaluates two classes of responses by a significant number of Christians to this perceived threat—creationism and intelligent design (ID). He suggests that arrogance may play a role in these Christians' opposition to evolution, and he suspects that a similar arrogance seems to have played a similar role in the Galileo/Church conflict about heliocentrism, a scientific finding which the Church eventually conceded was not a threat to Christianity.

He advocates a careful assessment of creation in the Bible, giving emphasis to the two accounts in Genesis 1 and Genesis 2. Martin understands the Bible to advocate unity, and finds that the characteristics of nature, as pointed out through evolutionary science, are completely consistent with the biblical call to unity found in Genesis' creation material.

In the concluding chapters, Martin expresses fear that youth growing up with creationist or ID teaching may face crises of faith. He feels that when the anti-evolution stance that forms the core of creationist and ID thought is challenged by college science courses, many of these youth will feel compelled to abandon their faith, or else decide that contemporary mainstream science is invalid. Martin would prefer that evolution and Christian faith be understood to complement one another, rather than conflict. Martin then gives some positive steps that Christians can take in resolving the science/faith conflict, such as serious study of the Bible and the biological sciences, acquiring the ability to discriminate between science and non-science, and not fearing the acquisition of knowledge or the use of one's mind.

Martin concludes his book with the claim that evolution is the best evidence we have for the existence of God.

What do we find useful or helpful in *The Prism and the Rainbow*? First, the book is written in a style that is compact and readable by Christian laity—in fact, by any interested person. No science or theological background is required for a person to get Martin's main points. Furthermore, the book is short enough to be read in one modest sitting, a real advantage for busy people.

In our opinion, Martin presents accurate portrayals of the scientific enterprise, the state of the game in the evolutionary biological sciences, the meaning of the creation message in Genesis 1 and 2, the threat that some Christians

see in evolution, and the science/faith conflict positions of creationism and intelligent design. In each of these cases, he communicates his position with clarity. He gives cogent advice at the book's end on how an individual could best proceed to investigate the issues raised. And the danger he points out in advocating or teaching anti-evolutionary ideas to youth (or anyone) is something all people should carefully consider.

There are, however, a few negatives. As mentioned earlier, Martin's conclusions about American Christian opinion on science/faith issues may be faulty. In addition, some readers may be put off by Martin's use of the Flat Earth Society and snake handlers as examples of misuse of the Bible. These are weak examples of such biblical misuse and are hardly good analogies to support his point that many Christians also misuse the Bible in their rejection of evolutionary science. To the degree to which he does this, Martin might be accused of the fallacy of weak analogy. Finally, the book is so concise that the inclusion of more details, especially on helpful Bible reading and the presentation of creation in the Bible (including passages other than those in Genesis) would be useful.

Overall, we recommend this book, not so much for those who have experience in thinking about science/faith issues, but for those of less experience. It is especially suitable for college-age youth. We will suggest this book to our inquiring friends.

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PHILOSOPHY & THEOLOGY

DEFINING LOVE: A Philosophical, Scientific, and Theological Engagement by Thomas Jay Oord. Grand Rapids, MI: Brazos Press, 2010. xiii+ 225 pages. Paperback; \$29.99. ISBN: 9781587432576.

Thomas Oord is professor of theology at Northwest Nazarene University and ordained in the Nazarene church. Having already contributed richly to current discussion on the nature of love, his work will be familiar to many ASAers. In this book, he provides both an extensive review of the scientific research and theory germane to the topic of human love, and a rationale for continued research on factors contributing to altruism. His theology places love at the center as the most important, necessary, and essential attribute of God's nature. God cannot *not* love. In the first two chapters, Oord reviews previous theological and philosophical positions while providing us with his own definitions of agape, eros and philia. In contrast to Anders Nygren and other theologians who hold that God only expresses agape, Oord sees all three types contained in God's full-orbed love. Hence all three types of love are good and should be expressed by creatures in God's image.

Oord's later theological conclusions depend heavily on his definition of agape as "intentional sympathetic response to promote overall well-being when confronted with that which generates ill-being" (p. 43). A corollary of this definition is that God's agape—necessary and

essential to God's nature—must be expressed from eternity in relation to something outside the Trinity. In contrast, traditional theology views God's love as existing eternally between the persons of the Trinity. As Oord defines *agape*, however, the persons of the Trinity can only express *philia* within their relationship, because there can be no ill-being within the divine unity. This definition thus allows Oord, in the last chapter, to characterize God's essence from eternity as necessarily creative and in continual relationship with an outside, albeit dependent, creation. Oord insists this relationship is panentheistic rather than pantheistic because creation, although not entirely controlled by God, is outside of and dependent upon God, and no individual element of creation is itself eternal. Although God is the most self-determining of beings, God does not entirely determine creation because total control would not be compatible with total love. This is in contrast to the view of *kenosis* expressed by Polkinghorne and others that God is voluntarily self-limiting while nevertheless controlling the universe's initial conditions. In Oord's theology, God is the most powerful of beings, but where love and power conflict, love trumps omnipotence because God's essence is first and foremost love. Rather than creating *ex nihilo*, Oord therefore holds that God is eternally creating, *creatio ex chaosmos*, from relative chaos of prior universes which were themselves dependent on the divine nature.

In the middle of the book, Oord provides a succinct overview of relevant scientific topics. He delves into biological research on kinship and reciprocal altruism, as well as possible scenarios for group selection of social behaviors. The importance of attachment theory and early relationships for development of caring behavior is thoughtfully discussed. We become truly human in relationship with others, leading Oord to discussion of character formation and virtue ethics. One addition that might have been useful here is the recent research in rodents, showing that good maternal care can actually override genetic disposition through epigenetic mechanisms. Oord might have also noted the contrast many researchers have made between individualistic Western societies and some other more communal societies in which individuals are socialized to a greater extent to work for the common good. Drawing on the cosmology of Ellis and Murphy in *The Moral Nature of the Universe*, Oord uses anthropic fine-tuning to argue that God's *kenosis* is reflected in the characteristics of the universe itself. God's noncoercive activity may be communicated through quantum indeterminacy simultaneously allowing free will and noninterventionist divine action. God woos, but does not coerce.

I found the chapter in which Oord lays out what he calls essential *kenosis* the most interesting. While agreeing partially with open theology that the future is not yet knowable even to God, Oord finds Pinnock's version inadequate to deal with the problem of evil. Similar partial agreement and objection arise over the *kenosis* theology of Polkinghorne and Moltmann. Oord views the acceptance of *creatio ex nihilo* as allowing divine coercion. If coercion were an option, then why did God not create the universe differently? While rejecting an eternal duality of good and evil, Oord accepts David Ray Griffin's view that the loving nature of God by necessity eternally relates to a creation

that has, on all levels from subatomic to human, a measure of freedom to develop its own potentialities. The eternal necessity of love demands an eternal creation free to accept or reject love in ongoing relationship.

As one raised all too familiar with intimations of Jonathan Edwards' angry God, I found Oord's emphasis on One who cannot *not* love deeply touching at a personal level. Still, at the end of the book, I was left wondering whether the rejection of *creatio ex nihilo* really provides an adequate answer for theodicy. Theoretical physics continues to struggle with both the existence and nature of time, suggesting that part of the problem seen from human perspective may be that we, localized and finite, have difficulty thinking of God as omnipresent in both time and space and yet able to interact with our local particularities.

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DARWIN, CREATION AND THE FALL: Theological Challenges by R. J. Berry and T. A. Noble, eds. Nottingham, UK: Apollos, 2009. 208 pages. Paperback; £ 9.99. ISBN: 9781844743810.

This collection of papers was written by evangelical Christians, four scientists and four theologians, on the occasions in 2009 of the bicentennial of the birth of Charles Darwin and the sesquicentennial of his famed *On the Origin of Species*. Historically, the evangelical tradition has struggled with evolutionary theory, and though this book offers many insightful advances, it is clear that evangelical academics are still in the process of coming to terms with evolution.

Evangelicalism boasts of its so-called "high view of Scripture" (p. 150). Unsurprisingly, a paper is dedicated to "interpreting the early chapters of Genesis" by Old Testament scholar Richard S. Hess. But what is surprising is that he offers but a mere thirteen pages for this absolutely essential topic. Hess focuses largely on Genesis 1, and almost as an afterthought, makes a few brief comments about Genesis 2. He does not offer one word on Genesis 3. This is a book with a title that includes the term "the Fall," and it behooves the editors to include a biblical scholar who deals directly and fully with Genesis 3.

This failure to deal directly with the literary genre of Genesis 2-3 renders evangelicals susceptible to a concordist hermeneutic, which is evident throughout most of the book. In the concluding paper, editors Berry and Noble assert, "[W]e accept that there must have been a 'Fall' in time and that we cannot rule out the existence of a historic Adam" (p. 198, my italics). More specifically, Berry contends, "Genesis 1 describes the appearance of *H. divinus*, as a *bārā'* event, a specific act of God, while Gen. 2:7 describes it as a divine in-breathing into an already existing entity" (p. 62). In a similar hermeneutical vein, Noble boldly proclaims, "*To be true to the Christian gospel*, therefore, we must maintain a temporal Fall even though the language used is prophetic and full of imagery" (p. 115, my italics). However, punctiliar events (i.e., an event at one point in time) in the opening chapters of the Bible reflect an ancient understanding of divine action

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and the origin of living organisms, inanimate objects, and conditions experienced by the ancient Hebrews (e.g., suffering and death). Though tacitly embedded in the minds of most leading evangelicals such as Berry and Noble, the concordist hermeneutic leads to the conflation of inerrant messages of faith with incidental ancient Near Eastern categories of origins.

The best part of this book is Noble's summary of "ten facets" of the doctrine of original sin. He underlines the complexity of this doctrine and the interconnective nature of its distinctive features. A. N. S. Lane also offers a helpful review of Irenaeus on the Fall and original sin. The least helpful part of the book is the paper by Henri Blocher. He forces upon readers the position that his views are "consistent," "mature," and "biblical" (respectively, pp. 155, 172, 159) and, in essence, the Christian position. Bloucher is a self-acclaimed "amateur in the sciences" (p. 150), and his rant against evolutionary science being riddled with "conjecture," "opinion-making," and "fallible interpretation" (pp. 160-1) mars a book that honors the scientific achievement of Charles Darwin. I was surprised that the editors included his entry.

Darwin, Creation and the Fall is a valuable book in that it exposes one of the latest attempts by evangelicals to deal with the fact that life evolved, including human life. Ironically, this Christian tradition, which is quick to boast of being so thoroughly "biblical" in its theology, fails to appreciate the incidental Near Eastern categories that the Holy Spirit employed in the revelatory process. In addition, the evangelicals in this book are entrenched in the traditional formulation of the doctrine of original sin; they cannot see that this doctrine was cast within Augustine's fifth-century biology (i.e., the *de novo* creation of Adam). But thanks to Charles Darwin, a new approach to original sin is on the horizon. In the only reference to human evolution in the *Origin of Species*, Darwin writes, "Psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation. Light will be thrown on the origin of man and his history" (1st edition, p. 488). Indeed, in the light of evolutionary psychology, it is becoming evident that a reformulation of the doctrine of original sin is in order from an evangelical perspective.

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THE LAST SUPERSTITION: A Refutation of the New Atheists by Edward Feser. South Bend, IN: St. Augustine's Press, 2010. 299 pages, index. Paperback; \$19.00. ISBN: 9781587314520.

There are broadly two styles of response to today's militant atheist attacks on religion. One is to engage them with grace, balance, and restraint. The other is to return in kind their bombast, aggressiveness, and disdain. The former approach runs the risk of seeming bland and uninteresting, and may be less attractive to the media because it takes the fun, or at least the prize fight atmosphere, out of the argument. Edward Feser's *The Last Superstition* is definitely of the second type. He is in no danger of being bland. He keeps the prize fight in! His motivation,

he says, is "disgust and distress over the largely inept and ineffective ... response ... put forward by many religious and political conservatives." So he is picking a fight not only with atheists, but with a whole lot of other folks as well. He does this with some panache and wit, which relieves what would otherwise be heavy-handed, but even so, the pugnacious approach does sometimes become wearing.

One excellent strength of this book is a very good popular exposition of key parts of Aristotle's philosophy. Feser takes the opportunity to present a primer on Aristotle and Aquinas, which, on its own, is worth the read. Feser, a philosophy professor at Pasadena City College, thinks that the antidote to the secularism of today's society and the refutation of the militant atheists lies in a return to the philosophy of Aristotle, complete with formal and final causes, in addition to material and efficient causes. He charges that ignorance, or even willful misrepresentation, of Aristotle is what permits the New Atheists their undoubted idiocies. And he sets out, very effectively in my view, to explain what Aristotle (and Plato and Aquinas) really taught, in contrast to the "caricatures of it peddled by secularist critics." He also charges, less convincingly I think, that comparable ignorance is rife within professional philosophical circles, and has been (he implies) since the scientific revolution.

Here, we touch immediately on the most notable weakness of Feser's case. His overall argument is that modern philosophy and, indeed, science itself constitute an erroneous rejection of Aristotle. The choice he offers us is either materialism and secularism, whose problematic philosophical status he ably critiques, or else Aristotle. His prescription is natural enough coming from a Roman Catholic and Thomist. But for all the historic, and perhaps continuing, value of Aristotle and Aquinas, this is a false dichotomy. There are other options, options that for the scientist familiar with the power of empirical investigation seem considerably more attractive than scholasticism. One can join Feser in recognizing the philosophical and moral bankruptcy of the position the militant atheists represent without being intellectually compelled to become a Thomist.

Feser is persuasive in characterizing the naturalistic worldview that undergirds the militant atheist movement as effectively religious. It is a rival to the philosophical theism that held sway from the Greeks through the Renaissance. His "crash course" on western philosophy (chapters 2 to 5 from a book of six chapters) that outlines the Greek philosophy and the consequences of its rejection, will appeal, I think, to readers with a little background, though it will be heavy for someone without any prior acquaintance (despite Feser's protests to the contrary). Much of the book is devoted to an attempt to re-establish the plausibility of Aristotelian causation. This is a laudable attempt to offer not only criticisms of enlightenment rationalism (which he sees as the problem), but also a constructive alternative, based on cogent rational grounds.

His dismissal of empiricist philosophers such as Hume and Locke, though, is altogether too facile, even though I share many of his conclusions. It is too much of a caricature, like those of Aristotle he is at pains to correct. In

fact, even the critiques of modern philosophy that are carefully and convincingly drawn do not leave me where Feser says they must. Yes, many of the “classic” philosophical problems arise out of the abandonment of Aristotle. To cite the problem of mind, for example, many of the recent secularist discussions of mind, fancying that neuroscience is about to dissolve the tough questions, appear to me logically utterly incoherent. And this book does a good job of pointing out how inadequate physicalist doctrine is to the task of understanding the mind. But what Feser does not address is the obvious fact that Aristotle also had to face a host of his own unanswered philosophical problems. They were not necessarily the same problems, but they were real and pressing. Indeed, at its best, the new philosophy of the seventeenth century was genuinely trying to solve Aristotle’s problems. However, you could not tell that from reading Feser’s book. What is more, today Aristotle starts at a disadvantage, not just because he is misrepresented, but because modern science really is amazingly successful at telling us about the natural world, successful in a way that Aristotle’s science never could be. In other words, the scientific focus on efficient causation (rather than formal or final) has been astonishingly fruitful in discovering real knowledge.

What ASA members will therefore find lacking in this book is an appreciation of science’s epistemological success, and the extent to which that success is founded upon an empirical emphasis, in contrast with the schoolmen. It is not possible, I believe, to turn back the clock and to return to a thoroughgoing Thomist viewpoint, which appears to be Feser’s preference. We can, especially as Christians, value the philosophical arguments, and recognize that the philosophical theologians of antiquity had carefully considered reasons for their beliefs, some of which are still persuasive. We can and should also repudiate today’s commonplace naive scientism (the presumption that science is all the real knowledge there is) on which the assurance of the militant atheists rests. But we must fashion a synthesis that grants to science, to philosophy, and to all the other sources of knowledge their appropriate weight. *The Last Superstition* gives us important incentive and logical and historical background for that task, but not really a viable solution.

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THE CHRISTIAN FUTURE AND THE FATE OF EARTH by Thomas Berry, ed. Mary Evelyn Tucker and John Grim. Maryknoll, NY: Orbis Books, 2009. 129 pages, appendix, index. Hardcover; \$22.00. ISBN: 9781570758515.

Ecotheologian, cultural historian, Passionist order priest, and self-described geologist, Thomas Berry was one of the best-known Catholic commentators on the environmental crisis. His teaching, speaking, and writing have influenced a generation, and he is perhaps one of the best-known ecotheological scholars. Berry passed away at the age of 94 on June 1, 2009. This small-format book assembles ten essays that survey the “Christian roots” of his ecological thought from 1982 to 2000.

Ecotheology, as Celia Deane-Drummond notes in her textbook, is a newly emerging discipline. It takes as a premise “that it is possible to combine concern with the environment and an understanding of God.”¹ Berry is one of the founders of this new discipline and his thinking has shaped the early debates about its contours. This collection of essays gives the reader a handy entry point into his thinking.

His use of language was filled with neologisms, although he is highly quotable. In all his work, his single-minded goal of telling the “New Story” or the “Universe Story” is clear. “We ourselves,” he writes in the 1994 essay, *Wisdom and the Cross*, “were brought into being through this process. The universe story and the human story are a single story.” So his task is to convince readers that evolutionary theory, in its biological, chemical, and physical manifestations, is a robust lens for interpreting their biblical and cultural stories.

The second thread in Berry’s writing is his view that while humanity has developed moral responsiveness to “suicide, homicide, and genocide,” we lack a sufficient response to “biocide, the killing of the life systems themselves, and genocide, the killing of the planet Earth in its basic structures and functioning.” Berry mounts a sustained and biting ecological critique of his generation. At one point, he says that he considers the twentieth century to be “autistic” with respect to the creation itself. And he goes on to identify a number of social formations—business, economics, universities, and seminaries—as structures responsible for the relentless destruction of life systems. So Berry is clear and uncompromising in staking out his position on the spectrum of ecological debate. Yet he is not simply a doomsayer. He sees hope that Christians will “assume their responsibility for the fate of the Earth.” This is their “Great Work” as he calls it, the work of the church becoming “a power force in bringing about the healing.”

The third major thread in this book is the attempt to bring together the wisdom found in both the sacred and scientific stories. In these essays he says that we are “rewriting *The City of God* of Saint Augustine,” but not, he notes, as two cities. And elsewhere he sees a second Exodus experience emerging that will move humanity into a new relationship with the Earth. Finally, he develops a cosmic Christology by asserting that the “wisdom of the universe and wisdom of the cross are two aspects of the same wisdom.”

These themes, cosmic and human evolution, the warnings of ecological crisis, and the cosmic implications of the biblical narrative, will be familiar to *PSCF* readers. Each has been debated widely in these pages. What is new here is the focus of these essays on Berry’s views about the biblical narrative and the history of Christian thought. The intention of this volume, the editors say, is to fill in this gap. They argue that, “While many people have followed his writings on the story of evolution, few have understood his Christian roots.”

Indeed, part of the problem may be that Berry himself let his great ecological concern overwhelm his views on this point. On more than one occasion, he claimed that it would be good if western Christians “put the Bible on

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a shelf for twenty years.” His thesis throughout is that “the economic rapaciousness is not a trivial fault or a minor error in our thinking and acting. It is the consequence of a profound failure deep in the religious-cultural tradition itself.” And further, he says, “So estranged from the universe have we been over these past centuries that we feel Christian spiritual tradition is independent of any need to be concerned about the universe.” So he wishes to refocus away from the human redemption story and on to the cosmic one. His argument is more subtle than the clever tag-line can bear. It is unfortunate that in this selection of essays there is neither a corrective nor a commentary on this statement. Many have heard it, and it leaves substantial doubt about Berry’s view of the Scriptures. Yet these essays do go some way in showing his knowledge and reliance on the biblical authors.

Throughout these essays, we learn of the intellectual heritage upon which Berry draws. He quotes widely from St. Augustine, Thomas Aquinas (his namesake), and palaeontologist and French Jesuit priest Pierre Teilhard de Chardin. He seems clearly inspired to recast the guiding metaphors of the day. Perhaps his most engaging is that of space: “The immense curvature holds all things together ... in an embrace that is ... sufficiently closed to provide structural integrity and yet sufficiently open to enable the universe to continue its unfolding.” This is a more inviting view of cosmic evolution in which one might be able to locate humanity. And it points to the radical rethinking of the human-Earth relationship that Berry is calling for throughout his work. But these short essays are only indicative of his argument, and not likely in themselves to convince sceptics of his argument. It was interesting to see the influence of Chardin’s thinking throughout Berry’s work. And it reminded me of another popular twentieth-century Catholic thinker, Marshall McLuhan, who was also heavily influenced by Chardin. Both Berry, with his “universe story,” and McLuhan, “the medium is the message,” have given us memorable metaphors for rethinking the challenges of our times.

Now that his work is closed, it will take some years of testing to evaluate its full depth. Some readers will reject his evolutionary stance out of hand. But they were not likely his primary audience. Others will find these probing essays helpful and challenging. No matter what your view these essays will give you a solid introduction to Thomas Berry’s thought. Readers interested in exploring Berry’s thought further should consult the resources available through the Forum on Religion and Ecology at Yale, which is supported by the Thomas Berry Foundation and directed by Mary Evelyn Tucker and John Grim.

Note

¹Celia Deane-Drummond, *Eco-Theology* (Winona, MN: St. Mary’s Press), p. x.

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RELIGION & BIBLICAL STUDIES

THE SEVEN PILLARS OF CREATION: The Bible, Science, and the Ecology of Wonder by William Brown. Oxford: Oxford University Press, 2010. 352 pages. Hardcover; \$29.95. ISBN: 9780199730797.

William Brown, whose work on creation theology is already well represented in his *Ethos of the Cosmos* (Eerdmans, 1999), has now provided an integrative work encompassing aspects of science and biblical theology. He bases his work on seven key creation passages of the Hebrew Bible that he dubs the seven pillars of creation, and invites the reader to join him as he explores points of conversation between the Bible and science. The seven pillars he identifies are (1) Gen. 1:1–2:3; (2) Gen. 2:4b–3:24; (3) Job 38–41; (4) Ps. 104; (5) Prov. 8:22–31; (6) Eccles. 1:2–11; 12:1–7; and (7) Isa. 40–55.

Brown encourages an appreciation of faith and mystery as he charts a constructive rather than confrontational path that walks a line between what some identify as a godless scientism and what others consider a narrow creationism. In the process, he sets out to explore how to read what the Bible says about creation. When it comes to understanding the biblical view of creation, Brown contends that there is no “Grand Unifying Theory” – that different biblical texts offer different perspectives, and we should not necessarily attempt to harmonize them.

The author is not presenting any particularly new idea or theory – just trying to offer a sensible integrative reading based on imaginative associations. At the same time, he insists on recognizing both the resonances and dissonances between science and theology. Brown proceeds by first acknowledging the authority of Scripture (by authority, he refers to the generative power of Scripture to evoke reflection and to shape the conduct and identity of the reader and the reading community, p. 12). He also lays a foundation in hermeneutics in which he asserts that we must pay attention both to what the text meant historically and to what it means to today’s believing community.

His procedure is laid out in the steps that he labels “Elucidate” (observational, descriptive approach to the text), “Associate” (identifying “virtual parallels” between science and text) and “Appropriate” (understanding the text in the light of scientific understanding and vice versa). As he applies this “feedback loop” to the data he finds not a God-of-the-gaps perspective, but a “science of the divine vista” (p. 17). Rather than Gould’s non-overlapping magisteria he prefers a wisdom quilt of “tangentially overlapping magisteria” (p. 17).

Having laid down his methodological foundation, Brown then introduces the reader to the ancient Near Eastern backgrounds before proceeding to the seven biblical creation accounts. He assumes that biblical authors had inherited certain traditions from the ancient world (p. 21), and that the biblical accounts were created in dialogue with the ancient world. He is therefore committed to treating the Bible as ancient literature. Though he considers the biblical accounts as inherited stories, he also asserts

that the Israelites mediated and transformed them as they responded to the traditions of their neighbors.

In his analysis of Genesis 1, which he dates to the post-exilic period, the cosmic temple is seen as the prominent metaphor. Unlike other recent works which suggest that the cosmos is being set up as a temple, Brown's discussion likens the literary design of the account to the architectural design of the temple (days 1 and 4 represent the entry into the portico; days 2 and 5, the entry into the nave; and days 3 and 6, the entry into the Holy of Holies, the seventh day). Creation in this account is seen as the new creation of the post-exilic period that God brings forth out of the chaos of the Babylonian destruction and exile. An example of the dialogues that he assembles can be seen in his likening the dark waters of Gen. 1:2 to the dark matter that is part of modern scientific understanding or to the interstellar gas and dust that form stars and planets. In an appendix (pp. 241-4), he provides a chart for each of the seven biblical passages, aligning the biblical observations with scientific ones. He is not suggesting that the Bible was really talking about those scientific ideas nor that we should read them into the Bible. He is simply trying to bring the Bible and science into conversation through comparison. This approach borders on concordism (especially when he asserts that the *raqia'* of day 2 is what we call the atmosphere), but he is not trying to push his comparisons into vindicating interpretation, as concordists are prone to do when employing a harmonizing hermeneutic. He is simply meandering through a variety of observations. Brown is not trying to identify truth in the biblical account; he is identifying points of convergence between what the biblical writers observed about the cosmos and what we still observe today (e.g., order, structure).

In the end, this book does not offer an interpretation of the biblical accounts nor a defense of them. Neither does it offer a view of science that will be compatible with the biblical text. Brown is interested that we investigate both the biblical text and the world around us and come to appreciate both to a greater extent as we see the commonalities (yet not glossing over the differences).

Readers may often find his comparisons stretched, but I doubt that would faze the author. He is not trying to prove anything. He is stimulating the reader's imagination. He is well read in science (which cannot always be said of theologians writing in this field) and maintains a faith commitment (though readers looking for evangelical assertions will be disappointed).

Does he succeed at what he attempts? Yes, though many might prefer a book that seeks to forge new trails rather than one that encourages the pilgrim to stop and indulge moments of wonder. But if we allow authors to write the book they set out to write rather than the one we might want written, we would have to judge Brown's reflective work a success.

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Faith-Science News
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RELIGION & SCIENCE

WESLEYAN THEOLOGY AND SOCIAL SCIENCE: The Dance of Practical Divinity and Discovery by M. Kathryn Armistead, Brad D. Strawn, and Ronald W. Wright, eds. Newcastle upon Tyne, UK: Cambridge Scholars Publishing, 2010. 195 pages. Hardcover; \$59.99. ISBN: 1443817333.

The revival of scholarly interest in Wesleyan theology continues and in this volume, extends into psychology. As a Christian in the Wesleyan-Arminian tradition, I celebrate this contribution in general and its substantive contents in particular. Do not let the book's brevity suggest that it is slim in substance. The editors successfully pressed chapter authors to discuss theology historically and in a variety of contemporary scholarly and applied extrapolations to psychology.

The book is organized into three parts. The first part establishes the editors' stated design to move from theology to psychology rather than the more usual practice of starting with psychology and attempting to connect with theology. Authors of the first two chapters, Randy Maddox and Michael Lodahl, review the historical John Wesley, including key contexts and influences from the eighteenth century, and then advocate for his theology's compatibility with science in general. In addition to being an eminent Wesleyan scholar, Maddox has long been informed about psychology in general and especially Wesley's moral psychology orientation.

The second and longest part of the book consists of eight chapters. Chapter authors pick up on the tempo established by Maddox and Lodahl and relate Wesleyan theology to a sampling of significant topics in North American psychology: notions of the self (one chapter on Kohut's object relations approach and one on a Bowen family systems theory approach), cognition, nurturing human relationships, the unconscious, and a version of virtue ethics.

Authors of each chapter follow the same format. First, they provide an overview of the chapter topic to orient the reader to the territory. Second, they succinctly review the topic (e.g., notions of self), including pertinent research and alternate perspectives on the topic besides their own. Third, they relate aspects of Wesleyan theology to the topic, including general suggestions for future research, conceptual development, or professional applications. I found the organizational framework straightforward and useful.

The two chapters in the third part consider Wesleyan theology in relation to science in general, much as the first two chapters, albeit with a more contemporary lens. While Maddox and Lodahl framed contexts of a historical Wesley, Blevin and Green considered more current applications of Wesley in areas such as bioethics. Green also wisely observed limitations of Wesleyan theology addressing current sciences, since science and technology are now so different from what Wesley could possibly have imagined.

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While I am a fan of the book, it could have been improved. From the title, I expected a sampling of theologians and social sciences. Instead, the authors were theologians and psychologists at Christian institutions, plus one family therapist. As one whose disciplines are primarily psychology and family therapy, I greatly enjoyed reading and learning from these colleagues' vital thoughts. For clarity with potential readers, however, a title along the lines of "Wesley and Psychology" would have been more apropos.

Longer chapters would have been another improvement. When authors came to the point in each chapter of suggesting research and/or clinical applications of theology and psychology, they had only a sentence or two to spell out their ideas. If the intent was a heuristic leave-them-wanting-more, then it worked. If, though, the intent was to point toward future work, the signage needs to say more than, "You might go this way."

Overall, I deeply appreciate the book's contents and applaud the editors for laboring to bring it forward. A particular point of appreciation is that each author demonstrated understanding of this giant of eighteenth-century theology and sought to bring their understanding to twenty-first century psychology in a manner that connected timeless theological principles to highly different cultural and scientific issues. Hopefully, it will help stimulate related works with a Wesleyan interest on research, conceptual development, and clinical applications in psychology and other social sciences. It has already joined my collection of references that are core to my own scholarship.

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SCIENCE AND SPIRITUALITY: Making Room for Faith in the Age of Science by Michael Ruse. New York: Cambridge University Press, 2010. 264 pages, index. Hardcover; \$30.00. ISBN: 9780521755948.

Prolific philosopher of science and well-known skeptic Michael Ruse has been on a mission as of late to get beyond the vitriolic rhetoric that has marred much of the science-and-religion "conversation" conducted in opinion journals and the blogosphere. It is a noble task. And with *Science and Spirituality*, he directs his efforts especially to people of science. Ruse's overall formula is predictable: demonstrate how the unwarranted hyperbole of the partisans—using shorthand, literalists and creationists on the one hand and the new atheists on the other—harms constructive dialogue and understanding. And he addresses versions of questions he has written about previously: Is science fundamentally antithetical to religious thinking? And more specifically, can a person legitimately "cherish science and its achievements and be a Christian, holding with dignity and proper conviction the things that are central to that religion?" (pp. 7–8). But Ruse has not simply repackaged old arguments, and the book is quite different from others with a similar agenda of effecting mutual respect and civility between science and religion.

Essentially this is an essay on the nature and limits of science. The bulk of the book addresses the important and often under-appreciated fact that science relies heavily on metaphor. Ruse provides a historical survey tracing the dominant scientific metaphors and concludes that "the machine metaphor rules modern science" (p. 118). But there are a number of questions humans pose that the machine metaphor, indeed science, is ill equipped to answer. These include the primordial question, "Why is there something rather than nothing?" as well as "What is the foundation of morality? What is consciousness? What is the point of it all?" (p. 146).

Perceptively, Ruse notes that the real issue is not appreciating that science has limits, but recognizing where and when we have reached them. At this point he includes a brief but utterly fascinating discussion of Colin McGinn's controversial approach to the question of limits as it relates to consciousness and the mind-body problem. McGinn, a leading spokesperson for a group of philosophers who have dubbed themselves the New Mysterians (the Old Mysterians presumably were the dualists), concludes that "there are nontrivial limits on what human beings can come to grasp" and there may well be realities beyond our evolved, spatially-biased conceptual lens (p. 178). Ruse does not necessarily endorse this line of thinking, but he does agree with McGinn that our capacity to think is dictated by our biology. Consequently, "there is no very good reason to conclude that these ways [of thinking we humans have] are necessarily ones that guarantee a path to the understanding of the whole of absolute reality" (p. 180).

After arguing that science runs out of steam in addressing some very important questions humans ask of their existence, Ruse devotes the concluding section of *Science and Spirituality* to faith-based answers offered by traditional Christianity (read Augustine, Aquinas, Luther, and Calvin). His discussion of the attributes of God, the problem of evil, morality, the soul, eternal life, and mystery are not intended to be exhaustive or even convincing. Rather, he makes the case that while the core claims of Christianity go beyond the reach of science, "they do not and could not conflict with science, for they live in realms where science does not go" (p. 234). Believers might be tempted to thank Ruse sarcastically for his conclusion that "in the light of modern science you can be a Christian" (p. 233). But that would miss the whole point of the book. If one is looking for more apologetically oriented argumentation on the compatibility of the Christian faith with modern science, then John Polkinghorne's *Faith of a Physicist* is the book to read. Ruse has an entirely different agenda here, the success of which is something this reviewer, because of his strong faith commitments, is unable to assess properly. What can be said, however, is that this is a thought-provoking book that challenges the reader to consider not only the metaphorical nature of science and its necessary limits, but also the proper relationship between science and religion. Ruse firmly believes that relationship is asymmetrical in favor of science. No doubt that is an accurate description of things—troubling as it is for some of us.

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WHY GODS PERSIST: A Scientific Approach to Religion, 2d ed., by Robert A. Hinde. London: Routledge, 2010. 293 pages. Paperback; \$34.95. ISBN: 9780415497626.

Robert A. Hinde is the Emeritus Royal Society Research Professor of Zoology at the University of Cambridge. His academic credentials are extensive. What might motivate a renowned zoologist to write and then revise a book on religion? The answer is that Hinde envisions “a better world than we have had so far” (p. ix), and that by *better*, he imagines a world in which religion is not necessary (p. 250). He shares with Daniel Dennett and Richard Dawkins the vision of a world without religion, but believes that the “sledgehammer” (p. viii) approach of their ilk is unproductive. His more subtle approach is to attempt to treat religion scientifically: that is, to investigate its antecedents as well as its consequences—including the functional as well as the dysfunctional.

In a series of short (average length: fourteen pages) chapters, Hinde recaps conventional explanations for religious belief: psychological, sociological, anthropological, and biological. The benefit of his approach is that within one volume, a lay reader—the intended audience (p. ix)—holds synopses of different explanations for the fact that people around the world continue to believe in things which “if taken literally, [are] clearly false” (p. 1). Many of the names that one expects to see can be found: James, Malinowski, Milgram, Skinner, and Stark, to name a handful. Durkheim, Marx, and Weber are represented by proxies Lienhardt, Bloch, and Geertz, respectively. Strikingly, Freud is utterly overlooked, unless one elects to count a single reference to Bowlby (p. 165) as representing the psychodynamic perspective.

In addition to this array from the behavioral sciences, Hinde also invokes Darwin and modern biology’s attention to behavior, citing Buss, Hamilton, and Trivers. The intention is to produce a comprehensive catalog of some of the best thinking on the causes and effects of religious belief, and in this regard, the book is a success; the table of contents shows chapters that address the nature and content of religious beliefs, narratives, and ritual. The final hundred or so pages of the book attend to morality, prosociality, and experience before the concluding chapter, “Where Do We Go from Here?”

The question is not entirely a rhetorical one. Hinde is convinced that there will, eventually, be a world without religion, and that his book contributes to the worthwhile effort to “consider what a non-religious society in which we preserved what is best in our present circumstances might be like” (p. 252). He notes that religion “remains a force for a while longer” (p. 251), in part because it works for some: “While it would be wrong, because condescending, to see religion as a panacea for underdogs, so long as there are underdogs there may be need for a panacea” (p. 250).

Hinde sees himself as a voice of reason—different from Dawkins whose position is represented as “total hostility to religion” (p. 252). Hinde sees no reason why, once the causes and effects of religion are understood scientifically, the good (The Golden Rule, for example) cannot be retained while bathwater such as fundamentalism, sectarian violence, and intolerance is disposed of.

A significant drawback of Hinde’s comprehensive interdisciplinary technique is what he refers to as “a continuing dialectic between individuals and their social environments” (p. 218). This distracting “dialectic” is experienced as a chronic shifting to and fro between methodological individualism and methodological holism—that is, between using the individual as the unit of analysis and attending to the individual’s needs and motivations on the one hand, and using the group as the unit of analysis and attending to group functions on the other. This reduces the book’s readability. One other feature that has a similar effect is the promised utility of the “self-system” concept, the value of which “as a model in understanding human behaviour and religion will become apparent” (p. 29). This concept occurs only intermittently, and its utility never became fully apparent.

Christian readers may be put off by an author who sees nothing wrong with a post-religion world. Still, for those who have not yet familiarized themselves with scientific explanations for their own beliefs, this volume is a very good place to begin. Readers in this category would, however, do well to remember that a scientific explanation for a religious belief does not, in itself, make the belief false any more than a scientific explanation for how we come to believe that germs cause illness makes that belief false.

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THE UNIVERSE—Order without Design by Carlos I. Calle. Amherst, NY: Prometheus, 2009. 304 pages, including 46 pages of notes and references, glossary, and index. Hardcover; \$21.00. ISBN: 9781591027140.

Calle devotes much of his book to educating the reader about humankind’s current knowledge of cosmology and the research that has produced this. Calle wishes to “explain ... the revolutionary concepts behind the new scientific theories that are taking us beyond the moment of the big bang” (p. 11). This he does well.

In an often very entertaining manner, Calle retraces the history of cosmology from the early twentieth century to the present. He calls upon a wealth of interesting and/or humorous anecdotes about cosmologists and physicists. There is, however, more to Calle’s intent. His deeper purpose is expressed in the subtitle and preface: to convince the reader that the universe “is fully explained by science” (p. 11), with “explained” meant in the context of ontological materialism.

The book jacket asks,

[I]s the universe designed for life? Physicists have discovered that many seemingly unconnected phenomena, which took place millions of years apart, played a crucial role in the development of life on earth. Does such evidence reveal a purpose behind the order of the universe? ... Calle explores this tantalizing question.

This is misleading, because Calle’s position is clear. The book is not intended to “explore,” but to promote a specific answer. Calle’s underlying goal is to convince the reader

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that the order in the universe is no indicator that a divine being is involved. Rather, Calle argues that scientific discovery has removed any need or place for God.

Although Calle provides a superb “wide ranging introduction to the very latest and sundry ideas about the origins and evolution of the enormous cosmos” (book jacket), this is intended primarily to advance his materialist views. After excellent discussions of forefront science in each chapter, one consistently finds a concluding section expressing an antitheist stance. Calle’s discussions seek to convince the reader that with each advancement, science allows less room for belief in a deity.

Calle is revealing when he expresses admiration of Richard Dawkins’ writings:

Biology has a designer, a watchmaker, but it is a blind watchmaker, a mindless watchmaker without a purpose. Biology’s watchmaker is natural selection. Richard’s Dawkin’s [sic] book *The Blind Watchmaker* explains it clearly and authoritatively. (P. 20)

Calle indicates a desire to do for the interpretation of physical laws, what he believes Dawkins has succeeded in doing for biology. Calle writes that

although biology deals with what may be the most complex system in the universe, physics concerns itself with the ultimate questions of existence: How is the universe made? How does it work? Did it have a beginning and if so how did it start? Equally important: Was the universe designed for life? ... Biology can be explained through natural selection. The universe can be explained with the laws of physics, its watchmaker. (P. 20)

If we cannot find any gap in the consistency of the physical laws and their explanation for the existence and evolution of our universe, Calle’s implication is that God does not exist. Calle’s arguments are a regurgitation of Dawkins’, substituting cosmology for biology. The weaknesses are parallel: Calle mixes science with philosophy and theology. While placing no limits to what he suggests science can discover, he simultaneously constrains portrayal of God to the “god-of-the-gaps” picture.

Calle seeks to eliminate any need for a creator by explaining the universe in scientific terms, furthering his either-God/or-science dichotomy. He does not allow God to act (to be acting) transcendentally, beyond all of spacetime, not depending on whether a universe or multiverse has a finite or eternal past history. Calle cannot perceive God as the primary cause working through secondary (physical law) causes.

Calle adopts his own version of Paley’s watchmaker analog: for Calle the physical laws become the actual watchmaker, self-creating and self-actuating. His watchmaker class of physical laws are those laws that allow and provide for the string/M-theory multiverse or whatever our universe exists within.

With the introduction of M-theory (or its presently only vaguely understood complete nonperturbative version), Calle believes that

the laws of physics ... are now complete. We have gone from the well-understood depiction of the matter and force particles of the Standard Model,

guided by the rules of quantum mechanics, to the frontiers of knowledge, where we encounter a master theory that promises to unify all the forces of nature and explain how the universe is put together. (P. 149)

For Calle, the watchmaker is an impersonal concept, the underlying physical rules that allow and produce the universe and its forces:

The laws of physics are the watchmaker ... These laws controlled the evolution of the universe, the forces of nature, and the way these forces evolved and operated. Everything that happens in the universe happens because the laws of physics allow it to happen. The watchmaker governs the entire universe and not only its evolution, but its own evolution. The question that remains is, did this watchmaker make itself exist forever, or was it created? (P. 129)

He devotes little space to considering whether more than physical laws are required for existence of a universe. He seems to draw on a faith, based on the past successes of science, that one should trust whatever the ultimate physical law is; it is self-existing and self-creating, responsible in and of itself for all that exists.

Calle examines three cosmological issues that big bang theory could not resolve: (1) the 1-part-in- 10^5 uniformity of the cosmic microwave background (CMB), (2) the origin of structure within the universe in spite of the CMB uniformity, and (3) the flatness problem and critical mass density. Calle discusses pre-big-bang inflation resolutions to these. For him, the success of inflation theory narrows the gaps allowed God.

Calle provides possible explanations for the apparent fine-tuning of the cosmological constant and also proffers these as arguments against any activity of God. Calle further mixes science with theology when he asks, “What about God?” Calle describes the Euclideanized Hartle-Hawking universe, which is claimed to be

completely self-contained and not affected by anything outside itself. It would neither be created nor destroyed. It would simply BE ... Who [then] created the laws of physics? Can they simply be? (P. 26)

Calle answers, “If the universe is self-contained, with no beginning and no end ... there is nothing left for a creator to do” (p. 26).

Calle considers chaotic inflation theory and the cyclic ekpyrotic model. He concludes, “If either the eternal inflation or the eternally oscillating model is correct, the creator doesn’t have a job to do either” (p. 28).

Calle summarizes the problem of origins as threefold:

first, we need to understand how the universe—or multiverse—came to be; second, we need to understand the origin of the laws of physics; and third, we need to explain the fine-tuning that we observe. We want a satisfying answer to all three problems. (P. 250)

He asks, “How do the models that we have considered stand on these three issues?” (p. 250) “... Do the models [discussed herein] solve the problem of origins in full? Or does the Creator still have a job to perform?” (p. 253) and responds with “a word of caution regarding these models: they are not full-fledged theories ... We must, therefore, take them as

works in progress, some ... with a great deal of promise" (p. 250) ... "The models, proposals, scenarios, and constructs we have examined are just what their names imply: tentative but serious and precise models" (p. 253).

However, since "science has an impressive track record" (p. 254), Calle believes that

there is little doubt that science can explain the universe, as evidenced by the extraordinary advances in our understanding of the evolution of the early universe right up to an instant after the big bang. If one of the present models or a more advanced one yet to be developed turns out to be the correct one, the problem of origins would be fully explained and the creator wouldn't have a job to do. The universe and its laws of physics would have no origin and would not need a supernatural designer. The fine-tuning observed would be the result of the laws of physics—the universe's watchmaker—that evolved purposelessly and mindlessly to create the equilibrium and order that we see. (P. 255)

Calle assumes that scientific investigation will show the ultimate physical laws to be self-explanatory. He avoids discussion of Gödel's theorem, which contradicts this belief on mathematical grounds. The multitude of structures within Max Tegmark's Level IV (Ultimate Ensemble) multiverse classification are also ignored. Here too, Calle introduces science into philosophy by judging purpose versus purposelessness, mindfulness versus mindlessness. Calle's claim, that science eliminates need for God, is consistent only if God is a "god-of-the-gaps" type, but not if God is responsible for both the physics and the physical laws.

This book is worth reading for those interested in a well-written and entertaining review of developments in modern cosmology and today's cutting-edge research, but not caring about Calle's overall intent. I do not recommend it for anyone tired of simplistic antitheist "god-of-the-gaps" presentations.

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Letters

A Reply to "Seeking a Signature," an Essay Review by Dennis Venema

Venema's (*PSCF* 62, no. 4 [2010]: 276–83) "scientific critique" of Stephen Meyer's book, *Signature in the Cell*, fails to come to grips with Meyer's main thesis, which is that an unplanned nature is impotent in the generation of the information contained within the first cell. Certainly, random mutation linked to a selector such as natural selection can produce functional information, but is such information sufficient? Since God may superintend nature, the scientific question is this: Does an unplanned

nature have the potential to generate the information contained within the first cell?

Random mutation plus natural selection is not "a candidate for the origin of biological information from nonliving precursors."¹ Natural selection occurs between living cells. No comparable selective activity exists within the abiogenic world. While an RNA world might catalyze amino acid polymerization, it would not generate information any more than stringing letters together would produce prose. Such polymerization might include non-biological amino acids and R-isomers, which would further obstruct the generation of information. An RNA catalyst may preferentially select some amino acids over others, generating uniformity rather than complexity. A functional RNA molecule is not a template for a functional protein, and it does not explain any information contained within genetic RNA or DNA.

Fewer than 10^{46} carbon atoms exist in the upper 10 kilometers of Earth's crust, and fewer than 10^{44} polymers of 100 amino acids would exist at any moment in time. If each polymer reshuffled its amino acid residues once per second for 3 billion years, fewer than 10^{61} polymer variations would be available to explore sequence space.

Cytochrome *c*, an enzyme composed of 101 to 104 amino acid residues, has 27 necessary and specific amino acids, each located at a specific site along the protein chain. The probability of sequencing the appropriate codons for these amino acids is 1 chance in 10^{35} per try.² By extrapolation, an average-sized protein with about 400 amino acid residuals would contain somewhere between 81 and 108 specific amino acids located at specific sites. The probability of ordering the codons for such amino acids ranges between 1 chance in 10^{105} per try and 1 chance in 10^{140} per try.³ Fewer than 10^{61} protein variations exploring sequence space falls short in the generation of an average-sized protein-folding motif by a factor greater than 10^{44} to 10^{79} .⁴

An unplanned evolution has produced fewer than 1050 proteins to explore sequence space⁵ and is impotent in the generation of one average-sized protein-folding motif. Hundreds of such protein-folding motifs, and those larger,⁶ had to be present among the "immortal" genes. The probability of assembling the more than 810 specific amino acids in the generation of only 10 of these protein-folding motifs⁷ would be less than 1 chance in $10^{1,050}$ per try.⁸ A multiverse containing 10^{500} universes and producing fewer than 10^{586} proteins exploring sequence space⁹ is totally impotent to the task.

Sean Carroll wrote, "(I)t is probably 50 to 100 times 'easier' (i.e., more likely) to disrupt a gene than it is to make a precise specific single mutation."¹⁰ Assume that 50 of the 500 "immortal" genes are assembled. The 50 genes are identical to fossil genes. For every beneficial mutation in the building of the 51st gene, the intact genes, as a group, are disrupted at 50 to 100 sites. No evolutionary progress occurs when 50 functional genes are lost as one functional gene is assembled.

An unplanned nature is impotent in the generation of the information required by the first cell. This is not a scientific conclusion but a logical conclusion based on probability. No "... thorough search through all proposed

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mechanisms ...¹¹ need be made. The average layman is fully capable of arriving at this conclusion. Even though Stephen Meyer committed several rookie errors, his main thesis is correct. The generation of the information contained within the first cell requires intelligent oversight, superintendence, and/or design.

Finally, a planned evolution is fully compatible with common ancestry, descent with modification, orthogenic proteins, stratification, and the fossil evidence supporting evolution, for what could an unplanned evolution do that a planned evolution could not do?

Notes

¹Dennis R. Venema, "Seeking A Signature," *Perspectives on Science and Christian Faith* 62, no. 4 (2010): 280.

²Of the 27 specific amino acids in cytochrome c, Arg. occurs twice (2) and has six [6] codons; Asn (2), [2]; Cys (1), [2]; Gly (7), [4]; His (1), [2]; Leu (2), [6]; Lys (3), [2]; Met (1), [1]; Phe (2), [2]; Pro (3), [4]; Thr (1), [4]; Trp (1), [4]; Tyr (1), [2]. Calculate the probability of the natural assembly of these 27 specific amino acids: A probability of $(1/64)^2 \times (2/64)^{10} \times (4/64)^{11} \times (6/64)^4$ per try = $1/10^{35}$ per try or 1 chance in 10^{35} per try.

³ $27 \text{ a.a.} \times 3 = 81$ amino acids and $27 \text{ a.a.} \times 4 = 108$ amino acids; $(10^{35})^3 = 10^{105}$ and $(10^{35})^4 = 10^{140}$

⁴ $10^{105}/10^{61} = 10^{44}$ and $10^{140}/10^{61} = 10^{79}$

⁵Fredric Nelson, MD, "Tossing Darwin out of Science," as found at evolutionneedsanadjective.com.

⁶F. S. Collins and K. G. Jegalian, "Deciphering the Code of Life," as found in *Understanding the Genome* (New York: Warner Books, 2002), 29.

⁷ >81 specific amino acids located at specific sites/average-sized protein $\times 10$ average-sized proteins = >810 specific amino acids located at specific sites.

⁸ $810/27 = 30$; $(10^{35})^{30} = 10^{1,050}$

⁹ $<10^{61}$ proteins/planet $\times <10$ planets/star $\times <10^{24}$ stars/universe $\times 10^{500}$ universes = $<10^{586}$ proteins exploring sequence space.

¹⁰Sean B. Carroll, *The Making of the Fittest* (New York: W. W. Norton & Co., 2006), 159.

¹¹Venema, "Seeking A Signature," 281.

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A Reaction to "Seeking a Signature," an Essay Review by Dennis Venema

I was deeply disappointed in the review by Dennis R. Venema of Stephen C. Meyer's recent book, *Signature in the Cell: DNA and the Evidence for Intelligent Design* (PSCF vol. 62, no. 4 [2010]: 276-83). Venema does not need to be impressed by the lively endorsements the book has received, or the prominence the author of the book has attained, but he could have done what book reviewers ordinarily do—give a fair and balanced approach to the book before him.

His patronizing tone is annoying. Collegiality deserves better, especially when the colleagues are working for

a common cause. Does it not seem strange that what praise he has for the book he will leave unsaid, "not out of disrespect, but rather out of respect"?

Venema comes to the book with a mindset which assumes that in due time scientists will solve the origin-of-life problem—and will do so at a naturalistic level. With such a mindset, no study which advances intention, purpose, design, a miraculous bestowal on biological processes, will persuade him of alternatives. He says that "it is a reasonable expectation that further research will continue to pay dividends." With such a mindset one can predict the results. Venema ignores the forensic contribution to the discussion which Meyer's book makes. And then he finds what he regards as flaws in Meyer's argument that would militate against the notion that information can arise in the cell through natural causes. He skirts Meyer's observation that scientists have called off the debate about "What is science?" since there are at least thirty ways of doing science. Venema has bought into the model of philosophic naturalism—whatever his personal beliefs may be. Meyer has earned the right to say that "Intelligent design is an inference from scientific evidence, not a deduction from religious authority." And he has the backing of Philip Skell, who says about Meyer's book that "it demonstrates what I as a chemist have long suspected: undirected chemical processes cannot produce the exquisite complexity of the living cell."

Marilyn Robinson and others have recently observed that science for the last 150 years, for all the undeniable practical benefits and insights into nature which science has given us, has also left us with philosophies that lead to despair and nihilism. George Gaylord Simpson is one spokesman for this more recent approach: "Man is the result of a purposeless and materialistic process that did not have him in mind. He was not planned." Is Venema really comfortable with the implications of his naturalistic approach?

And have we really gone beyond Sir Isaac Newton, who asks,

How came the Bodies of Animals to be contrived with so much Art, and for what ends were their several parts? Was the Eye contrived without Skill in Opticks, and the Ear without Knowledge of Sounds? ... And these things being rightly dispatch'd, does it not appear from phenomena that there is a Being incorporeal, living, intelligent ...? (Meyer, p. 11)

One might add, does common sense not explain the existence of pyramids, the space shuttle, the Aswan Dam—rational minds intending to bring about a desired result? Or how explain the bacterial flagellar motor that inhabits the cell, with what resembles a thirty-part rotary engine, or the 500 bits of information present in a cell and necessary to synthesize protein? Or the tiny apparent "turbine" with nine tilted blades that inhabit a centriole? (Meyer's examples.)

Given his commitment and his position, shouldn't Venema be placing his shoulder behind a different wheel?

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