PERSPECTIVES on Science and Christian Faith

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

In this issue ...

Science-Fostering Belief—Then and Now

Early Humans, Adam, and Inspiration

Extended Humpty Dumpty Semantics and Genesis 1

Thinking Critically and Christianly About Technology

From Scientific Method to Methodological Naturalism: The Evolution of an Idea

The Origin of Eukaryotic Cells

Stewardship of an Aquatic Habitat on the Campus of Oral Roberts University, Tulsa, Oklahoma

Residual Radiocarbon in an Old-Earth Scenario

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

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Perspectives on Science and Christian Faith

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1. Submit all manuscripts (except Book Reviews) to: **Arie Leegwater, Editor, Calvin College, De Vries Hall, 1726 Knollcrest Cir. SE, Grand Rapids, MI 49546-4403. E-mail: leeg@calvin.edu.** Submissions are typically acknowledged within 10 days of their receipt.
2. Authors must submit **an electronic copy of the manuscript formatted in Word** either on a CD or as an email attachment. Typically 2–3 anonymous reviewers critique each manuscript submitted for publication.
3. Use endnotes for all references. Each note must have a unique number. Follow *The Chicago Style Manual* (14th ed., sections 15.1 to 15.426).
4. While figures and diagrams may be embedded within the Word text file of the manuscript, authors are required to also send them as individual electronic files (JPEG or TIFF format). Figure captions should be provided as a list at the end of the manuscript text. Authors are encouraged also to submit a sample of graphic art that can be used to illustrate their manuscript.

ARTICLES are major treatments of a particular subject relating science to a Christian position. Such papers should be at least 2,000 words but **not more than 6,000 words in length**, excluding endnotes. An abstract of 50–150 words is required. Publication for such papers normally takes 9–12 months from the time of acceptance.

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STUDENT AND EARLY CAREER SCIENTISTS CORNER contains varied autobiography submissions, science and faith articles, as well as notices of interest to undergraduate, graduate, and postdoctoral students and young science professionals at the beginning of their career. Submissions are encouraged and typically published 3–6 months from the time of acceptance.

BOOK REVIEWS serve to alert the readership to books of interest and provide a valuable source for reference. Readers are encouraged to review books in their scientific fields which have implications for the Christian faith. Guidelines for book reviewers and a list of books available for review are available from the Book Review Editor: **Richard Ruble, 212 Western Hills Dr., Siloam Springs, AR 72761** or **richardanne@cox.net** The viewpoints expressed in the books reviewed, and in the reviews themselves, are those of the authors and reviewers respectively, and do not reflect an official position of the ASA.

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ART EYES SCIENCE portrays original, unpublished items that integrate art, science, and faith. Submissions may be in any art form that can be depicted in a print journal and may include poetry, musical score, drawings, photography, short prose, or meditative thoughts. Submissions with text must be less then 300 words. Three paper copies and one electronic copy (Word document for text, JPG or TIFF for visual) of the item are to be sent to the editor for peer review prior to publication.

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The Elusive Virtue, *Gelassenheit,* and Feet Washing

Akin to grasping a slippery bar of soap is the Christian believer's attempt to possess humility. Humility is not to be confused with humiliation, which is the act of causing someone else to feel ashamed. Rather, to be humble means "*to give place to another.*" Any human relationship that values reciprocal attention is a humble relationship when one sentient individual gives place to another. While a character quality may be non-material, it may be meaningfully expressed in physical ways. Jesus clearly exemplified humility (Phil. 2:5–8) and called his followers to embrace humble servanthood as a way of life. Yet, we who desire to truly follow Jesus often find humility to be so elusive! Why?

The life of Jesus was an illustration of humility and service. Jesus came not only to serve created humanity (Matt. 20:28), but also to call human disciples into humble service that involves self-denial and a commitment "to take up his cross and follow [Christ]" (Matt. 16:24–25). Within my Anabaptist religious tradition, *gelassenheit* (literal German meaning: yieldedness or resignation) was taught as *the* way to follow Christ.[1] For example, the Moravian Anabaptist, Hans Haffner, wrote a tract in the 1530s entitled, *About the True Soldier of Jesus Christ,* where he described *gelassenheit* as true surrender, a letting loose of everything for Christ:

> True surrender (*gelassenheit*) is to put to death the flesh and to be born another time. The whole world wants to have Christ, but they pass him by. They do not find him because they want to have him only as a gift, only as a giver of grace and a mediator which he certainly is, but they do not want to have him in a suffering way.[2]

In listing character virtues in the Sermon on the Mount (Matt. 5:3–5), Jesus begins with poor in spirit, mourning, and meekness as the first three qualities of a Christ-like life.

In contrast to the way of Jesus, our society and culture call us to be proud, strong, and motivated to get ahead of others thereby demonstrating our superiority. Rather than giving place to another, we quickly claim our spot, and if possible try to add to our place by absorbing space from our competitors. We vie with each other to make the new discovery and to get it published first. We cultivate relationships with those in administrative power, rather than the janitorial staff, because we know promotions have much to do with perceptions. We consider ourselves as above the average, e.g., based on self-evaluations, most college professors rate their teaching effectiveness above average. Can a Christian be a nonconformist to the world in this area and still be a successful scientist? What would happen if instead of explaining to my colleague or mentor the unique and creative insight that I have, I would take that time to describe how another colleague demonstrates creativity and initiative?

In my local congregation, we periodically practice the congregational ritual of foot washing to commemorate the humble example and command of Jesus (John 13:14). As a ceremonial participant when I stoop over the basin with a draped towel washing a fellow congregant's feet, it is sobering to think that even the practice of this lowly symbolic act of humility can be conducted with a proud heart. What does it say about me, when I think more about how "I look with my bare feet in church" or the "efficient foot washing job that I am doing" rather than about the needs and feelings of my brother? Oops! Again, humility slips out of my grasp, like a slimy bar of soap!

Although I too frequently express the characteristic of pride, my intention by God's grace is to walk in Christ's path of humility and to truly "wash my brother's feet" by periodically giving up my place for another's needs and concerns. When that happens, humility boosts an intimate spousal bond, facilitates the close fellowship of congregational believers, and promotes harmony and productivity by scientific colleagues in the laboratory.

Let's walk together. I will provide the basin and the water. Can you bring a towel? ▣

Roman J. Miller, *Editor*

Notes

[1]Robert Friedmann, *The Theology of Anabaptism* (Scottdale, PA: Herald Press, 1973), 66, 124.

[2]Peter Hoover, *The Secret of the Strength: What Would the Anabaptists Tell This Generation* (Shippensburg, PA: Benchmark Press, 1998), 34–5.

In This Issue

Four Articles ...

Can science operate as an enterprise without being bolstered by faith? In our first regular article, Christopher Kaiser makes a strong case for the persistence of medieval faith in modern scientists like Einstein. Can you identify with this position? How does your faith affect your process of science? (pp. 171–81).

What is the reality of the biblical Adam? Peter Rüst brings his perspective on inspiration, anthropology, and biblical interpretation to present Adam as a global Holocene inhabitant. How do you explain the variances in Genesis and historical anthropology? What is the common ground? (pp. 182–93).

Continuing on the theme of the interaction of scripture and science, David Siemens, Jr. provides an insight on biblical interpretation with the "Humpty Dumpty" metaphor. His survey of various traditional interpretations provides the background for his favorite approach. Are there other options which Siemens missed? (pp. 194–200).

In the final regular article, Ken Funk considers the ethics of technology. Funk lays out three essential principles that should guide our use of technology. The deeper question is whether or not technology by its very existence tends toward evil or is amoral. Can Christians provide the "redemption" of technology? (pp. 201–11).

Four Communications ...

Co-authors Harry Poe and Chelsea Mytyk thoughtfully reflect on the development and evolution of the concept "methodological naturalism" (pp. 213–8). Then Michael Buratovich raises interesting speculations of the origin of complexity in eukaryote cells (pp. 219–23). Next John Korstad provides an illustrated testimonial how one university exercised stewardship of its aquatic resources (pp. 224–5). And finally, Robert Rogland considers and further reflects on the hypothesis of some young earth scientists that nuclear decay rates were accelerated some years ago (pp. 226–8).

Other Sections ...

The book review section contains contributions of numerous readers who thoughtfully analyze twenty-eight books. One art eyes science contribution and two letters conclude the pages of this issue.

Looking Ahead ...

The December 2007 issue of *PSCF* will feature the editorship passage from the old to the new by welcoming incoming editor, Dr. Arie Leegwater, who will assume responsibility for journal issues in 2008. The December 2007 issue will feature a discussion of global warming and contributions on origins, science education, and environmental ethics.

Happy Reading,
Roman J. Miller, *Editor*

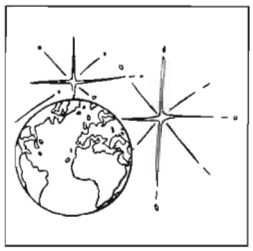
Looking Back: The Journal 50 Years Ago!

Fifty years ago in the September 1957 issue, the *Journal of the American Scientific Affiliation* published four major articles:

- "Dating with Radioactivity" by George Schweitzer
- "Illustrations of Spiritual Truths Using the Phenomena of Luminescence in Solids" by Richard Bube
- "Tranquilizing Drugs" by John McLennon
- "Revelation, History, and the Bible" by George Ladd

To hear these voices from the past, you can access these four articles online at the ASA website using the following link:

www.asa3.org/ASA/PSCF/1957/



Science-Fostering Belief—Then and Now

Christopher B. Kaiser

Some nineteenth-century historians and philosophers portrayed the relationship between science and religion as one of open warfare. By the end of the twentieth century, this warfare model was largely abandoned by historians of science. It is now generally recognized that early modern scientists were motivated by various religious beliefs. However, historians and philosophers still often assume that the beliefs of early scientists either were abandoned by later scientists or became peripheral to scientific work. Any beliefs that scientists rely on today are thought to be merely common-sensical and secular in spirit.

What seems to have escaped the notice of historians and philosophers alike is the fact that some of the beliefs of early modern scientists have persisted in surprisingly consistent forms. These beliefs are so basic to scientific endeavor that they it could not be sustained without them. Modern science actually turns out to be a faith-based enterprise.

In support of this revisionist position, I shall identify two distinct beliefs having to do with the comprehensibility of the natural world that occur in the writings of early modern scientists like Johannes Kepler. I shall discuss some of the forms those beliefs took in medieval Christianity and in Reformers like Philip Melanchthon in order to show their specifically theological character. Finally I shall illustrate the survival and vitality of these beliefs in modern scientists like Albert Einstein and Paul Davies.[1]

Christopher B. Kaiser

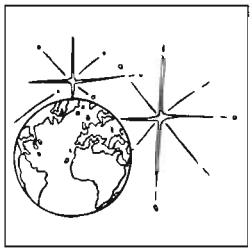
[The belief that some people] can discern anything beyond what is required for daily life [is what I call] Science-Fostering Belief ...

Natural science can be defined as the human endeavor to explore and understand all accessible features of the space-time world, even (and especially) those that are only accessible through the use of sophisticated technologies that probe the heights and depths of the universe. But this simple definition implies that some people have the audacity to believe they can discern anything beyond what is required for daily life. Such Science-Fostering Belief, as I shall call it, constitutes part of the software that motivates scientists and sustains them in their endeavors.[2]

But why? Why should anybody believe that they could use their brain to go beyond what is already known about the universe? Undoubtedly most modern scientists do not consciously articulate this belief as the starting point of their daily work. Science-Fostering Belief has become a fixture of the culture in which young scientists develop (as in my own experience) and in which their work is sustained. It may only be tacit for the majority of trained scientists on a daily basis—which is true of believers of all sorts.[3] The question is still why any culture or subculture that ever existed should have cultivated and sustained such an audacious belief.[4]

Exploring the cultural roots of Science-Fostering Belief will lead us to an examination of the historic "creationist tradition" and to rethink the relationship between scientific and theological endeavor. In spite of the fact that the interests of science and theology have at times conflicted, the two are much more closely related than we often assume, particularly when you probe the foundations on which the training and work of scientists rests. The tendency to treat them as two

Christopher B. Kaiser *is professor of historical and systematic theology at Western Theological Seminary in Holland, Michigan, where he has taught courses since 1976. He has a doctorate in astro-geophysics from the University of Colorado and a doctorate in theology from the University of Edinburgh. Kaiser has written two books:* The Doctrine of God *(1982, 2001), and* Creational Theology and the History of Physical Science *(1992, 1997). The second of these was awarded a Templeton Prize for Outstanding Books in Science and Religion in 1995. A new work on the* Foundations of Scientific Endeavour in Theological Perspective *is due to be published in 2007. Kaiser is active in the dialogue among Christian and Jewish traditions and is also a keen participant in the dialogue between science and theology. He and his wife Martha have three sons, two of whom are now happily married.*



In spite of the fact that the interests of science and theology have at times conflicted, the two are much more closely related than we often assume, particularly when you probe the foundations on which the training and work of scientists rests. The tendency to treat them as two separate phenomena ... is a peculiar result of modern secularization.

separate phenomena – associated with irreconcilable opposites like skepticism and faith, respectively – is a peculiar result of modern secularization. Here I take issue with Chet Raymo's characterization of good scientists as natural skeptics in contrast to "true believers."[5]

The Contingency of Belief: Four Clarifications

First we have to reckon with the fact that the founders of modern science were Europeans who were raised as Christians and who approached their work within an intellectual framework strongly influenced by biblical beliefs. The result is that one particular religious tradition is singled out for examination in this study. It is not exclusively a Christian tradition, because its roots go back to the cultures of the ancient Near East, Israel, and Greece. The "creationist tradition" that Christianity inherited was in the process of formation centuries before Christianity became a distinct religion.[6]

It may well be the case that, of all the historic cultures of the world, the vast majority would not have had the inclinations or beliefs needed to develop modern science on their own. It does not follow, however, that no other cultures have the belief structure needed to support scientific endeavor or even that progressive science might not have originated outside of Western Europe.

This is an immense area for investigation. In order to make the point, we need only cite a few examples. Ancient Chinese texts like *Master Lü's Springs and Autumns* (c. 240 BCE) clearly affirm the lawfulness of the complementary forces that emerge from the Supreme Oneness.[7] Such beliefs are very similar to those we shall discover at the foundation of modern Western science. The Holy Qur'an portrayed the sun, moon, and the heavens as subject to the legal ordinances of Allah.[8] In the Middle Ages, Islamic science developed mathematical and experimental techniques that did not appear until centuries later among early Western scientists.[9] So there are certainly other theological traditions to explore besides Christianity. But we are focusing on the cultural frame at the foundation of Western science, so we must concentrate on the Judeo-Christian background of modern science as a matter of historical contingency.

On the other hand, there are definite constraints on science-fostering cultures. While the kind of beliefs needed to foster scientific endeavor need not be uniquely Christian, they are neither universal nor arbitrary. A culture that can promote scientific research must inculcate the belief that the universe is intelligible in principle, and that humans are special in their ability gradually to learn all about it. Humans also need be made aware of their limitations, and most religious traditions do a good job at that. But forms of either skepticism or religion that undermine confidence in the lawfulness of the universe or the intelligence of humanity will not be able to sustain scientific endeavor over the long term.

The second preliminary point to be made is that no human culture was ever predetermined to cultivate the efforts of scientists.[10] Today we often take such support for the sciences for granted. We know that a career in science is possible for anyone with the ability and the inclination to pursue the subject. Universities and research institutes provide the resources to make such careers a possibility. Without such a belief and the institutions that sustain it, scientific endeavor as we know it would not be possible.

Cross-cultural travel (or reading) reveals that such institutions are not universal. They are becoming more prevalent as industrial society globalizes, but there are still many areas of the world where people have more pressing things to attend to. Sustainable research institutes have only originated within the last few hundred years in one small corner of the world.[11] Prior to that time, civic leaders were more likely to support the building of churches or the quest for the philosopher's stone than they were to support scientific endeavor as we know it. Historically speaking, therefore, the emergence of modern science was far from inevitable in Western Europe to say nothing of other parts of the world.

Third, there is no need to suppose that every individual will value or support the work of scientists even in a culture that takes the possibility of scientific endeavor for granted. Western Europe and America are highly scientific cultures, yet there has been and continues to be skepticism, if not downright opposition, with regard to the

pursuit and support of scientific research. Cultures of belief establish certain propensities, but they are far too conflicted to have exactly the same effect on all of their members.[12]

Cultures differ enormously in the kind of occupations they make possible. The culture of India has traditionally provided a way for many (if not most) individuals to break free from their inherited social ties and seek individual enlightenment once they have fulfilled their obligations to family and society. That life-trajectory is a distinct possibility in Indian life even though only a minority of people is inclined to pursue it, and modernist critics may even oppose it. The same is true of Western Europe in regard to the development of careers in science. So a science-sustaining culture need not be ideally suited for scientific endeavor any more than the cosmos in which we live is readily intelligible or the human brain is ideally suited for scientific research.

The fourth point is that I aim to reverse the common perception of the science-theology relationship as one of necessary conflict. There certainly have been instances in which religiously motivated authorities have opposed particular scientific ideas. The Congregation of the Holy Office's pressuring Galileo to renounce his Copernican convictions and the prosecution of John Thomas Scopes for teaching the evolution of humanity in an American public school are two of the best known examples.[13] The publicity that has grown up around isolated instances like these has sometimes been generalized into the dogma that religious faith is inherently opposed to scientific endeavor.

In order to counteract this impression, I shall give an example of a scientist who was sustained by the creational teachings of the Church—scientists as believers, then. I shall also give some examples of scientists who were not committed to a particular creed, but who recognized the importance of biblical teachings for their profession—scientists as believers, now.

Most historians of science have already corrected the record on this matter—they are not my concern.[14] But Church historians and historians of theology tend to ignore the role of religious beliefs in the history of science. I shall make a case for broadening and thickening our view of historical theology in order to trace its implications for secular disciplines like the natural sciences.

The Origin of Science-Fostering Belief

With these preliminary points in mind, we can now focus on the main question of this article: what was the cultural source of the conviction of early modern scientists that they could probe beneath the surface phenomena and discover the underlying laws of nature? What made them think that the enormous amount of time they spent investigating seemingly intractable problems would lead to improved understanding? Why did anyone ever dream that questions as abstruse as the balance of matter and anti-matter or the circulation of the mantle in the Earth's interior could actually be answered?

There are two topics that we need to address: the historical origin of Science-Fostering Belief, and what that belief looks like in the work of recent scientists—beliefs in science—then and now.

Early Modern Astronomy: The Case of Johannes Kepler

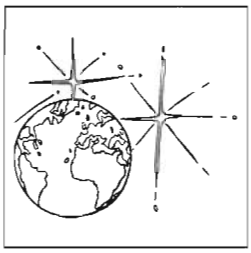
In the late sixteenth century, Johannes Kepler (1571–1630) studied theology and astronomy at the University of Tübingen. He became convinced that Copernicus was right—the ancient idea that the earth was the center of the universe was wrong; instead, the earth moved through space, revolving around a point very near the center of the sun. As Kepler's personal correspondence indicates, questioning the received wisdom of the ages took considerable intellectual courage.[15] This courage was based on his dissatisfaction with traditional (Ptolemaic) astronomy and his belief that a better understanding of things was possible.

Johannes Kepler[16]

Kepler was fascinated with the arrangement of the orbits of the six known planets (visible to the naked-eye). As stated in the "Greeting to the Reader," at the outset of Kepler's very first publication, *The Secret of the Cosmos* (1596), there had to be a good reason for this arrangement, but neither the treatises of ancient writers like Ptolemy nor Copernicus's own work gave an adequate answer.[17]

Kepler originally thought he could solve the problem in terms of solid geometry.[18] It so happens that there are just five regular polyhedrons—solids with faces that all have the same shape and size (tetrahedron, cube, etc.). That is exactly the same as the number of intervals between the orbits of the six known planets (Mercury, Venus, Earth, Mars, Jupiter, and Saturn). Could that be a mere coincidence? If not, it should be possible to construct a model for the orbits of all six planets by imagining them as circles on a set of giant spheres with the five regular solids nested between them (see figure 1).

The cognitive basis for this imaginative construction was Kepler's belief that there was a rational solution to the problem. An astronomer should be able to construct a mathematical model that would demonstrate the basic



Being a pious Lutheran who immersed his life and work in theological study and prayer, [Kepler] started with his inherited belief in God as a wise Creator and inferred that the planets God created must follow simple laws. Creational belief was the foundation of Kepler's endeavor as a scientist.

laws involved. Kepler expressed that belief at the outset of his 1596 treatise:

> It is my intention, reader, to show in this little book that the most great and good Creator, in the creation of this moving universe and the arrangement of the heavens, looked to those five regular bodies ... and that God fitted to the nature of those solids the number of the heavens, their proportions, and the law of their motions.[19]

In the beginning, God had constructed the planetary system according to the laws of solid geometry. Since the basics of solid geometry were known, a miniature model of the planetary system could be constructed. The idea of building a mathematical model for a natural system is standard procedure today. For Kepler the idea was based on belief in divine creation, which he inherited from a longstanding creationist tradition.[20]

We know today that Kepler's geometrical model does not work. It was based on incomplete data: there were at least two more planets to account for that could not be seen prior to the invention of the telescope. So there are aspects of Kepler's thinking that would be bypassed in the subsequent development of astronomical science. What was enduring was his belief. Kepler was convinced that there must be a discernible reason for the arrangement and motions of the planets. That conviction motivated his research throughout his career even though he never completely solved the problem that he started with.

I must emphasize the fact that Kepler's belief was not based on his (limited) success. Rather it preceded his work and motivated it. Being a pious Lutheran who immersed his life and work in theological study and prayer, he started with his inherited belief in God as a wise Creator and inferred that the planets God created must follow simple laws.[21] Creational belief was the foundation of Kepler's endeavor as a scientist.

The rest of the story is well known. Kepler eventually gained access to the latest, most detailed observations – those made by Tycho Brahe and his associates at his observatory in Denmark – for the changing position of Mars in the night sky. It was known that the orbit of Mars was not exactly circular. Kepler believed it possible to explain the data in terms of a simple pattern that could be expressed mathematically. But proving it was a long, laborious process. Today the entire problem could be easily solved using a simple computer algorithm. But Kepler relied on his creational beliefs to sustain his work for years using the rudimentary mathematical methods of his time.[22] His work is a good example of the Science-Fostering Belief that we are seeking to describe.

By the year 1605, Kepler finally demonstrated a solution to the data for Mars. The changing position of Mars could be explained by assuming that its orbit was an ellipse rather than a circle.[23] With the advantage of later scientific knowledge this may seem like a trivial step. However, the shift from circles to ellipses was more radical than just trying a new formula – Kepler was assigning a fundamental role in nature to a shape that had previously played no practical role in everyday life.[24] In fact, most astronomers stayed with the simpler idea of circular orbits until Isaac Newton published his demonstration of elliptical orbits from the inverse square law of gravitation in 1687.[25]

Kepler also discovered the principle that governed the motion of each planet along its elliptical orbit (later known as the law of "equal areas in equal times") and ten years later he devised a formula that related the period of revolution to the size of the orbit for each of the planets.[26]

Kepler synthesized his hard-earned results in a treatise entitled, *Harmonics of the*

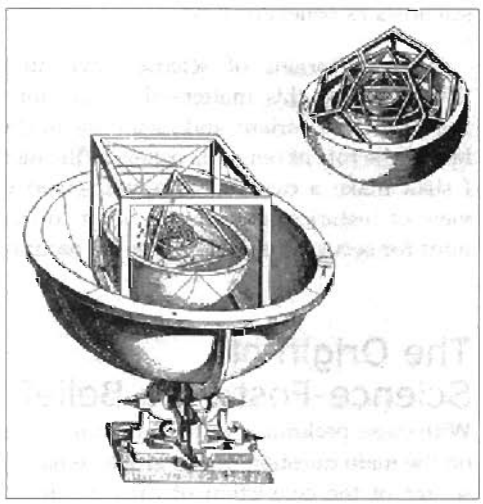


Fig. 1. Kepler's Early Model for the Planetary Orbits[28]

Universe,[27] published twenty-three years after his first publication. As always, he was forthright about the basic convictions that had sustained him in his efforts:

> Geometry, which before the origin of things was coeternal with the divine mind ... supplied God with patterns for the creation of the world and passed over to human nature along with the image of God ...[29]

Kepler's Science-Fostering Belief had at least two distinct components. The belief that the universe is ordered by mathematical laws [and] the belief that mortal beings like humans have the intelligence needed to discover these cosmological laws ...

Here Kepler restated his long-standing conviction that God had created the heavens according to the principles of basic geometry. But the quotation adds a second belief—the biblical idea that God had created humanity in the divine image (based on Gen. 1:26–27). Kepler also cited Plato and Proclus to show that geometry was not derived from human experience. It was present in the mind of each human from birth and only needed to be elicited by a good teacher.[30] Since geometry was an innate form of knowledge of the patterns that God used in creation, Kepler reasoned that it must have been part of the divine image in humanity. In fact, he described the human capacity for geometry as a ray of that divine image that was infused into the human soul at birth.[31] In this way, Kepler sustained his own belief not only that there was an answer to the puzzle of the planetary orbits, but that human beings had the ability (and the obligation) to discover it.

From this passage in *Harmonics of the Universe*, it appears that Kepler's Science-Fostering Belief had at least two distinct components. The belief that the universe is ordered by mathematical laws is one of them—Kepler thought of it largely in terms of geometry as the pattern of creation. The second component is the belief that mortal beings like humans have the intelligence needed to discover these cosmological laws—again Kepler thought in terms of geometry implanted in the human mind. In other words, there is a striking correspondence between the depths of the human psyche and the deep structures of the universe, between mind and matter—not a perfect correspondence, perhaps, but more than one might expect from a pragmatic assessment of human nature.

Kepler frequently noted the importance of this subject-object correspondence for scientific endeavor. This conviction was what one recent historian has called the "mainspring of his life's work."[32] It was clearly stated, for example, in his correspondence of the late 1590s, years before his major breakthrough. In a letter addressed to his astronomy teacher, Michael Mästlin, Kepler (1597) explained that

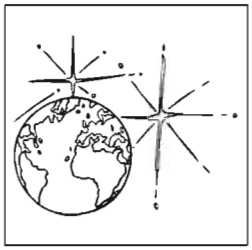
> ... God, who founded everything in the world according to the norm of quantity, also has endowed humanity with a mind which can comprehend these norms. For, as the eye for color, the ear for musical sounds, so is the human mind created for the perception not of any arbitrary entities, but rather of quantities ...[33]

Kepler's letter portrays the human mind as being adapted to discern the mathematical structures of creation in the same way that the eye is adapted to perceive color.[34] Although Kepler does not refer in this passage to the idea of the divine image in humanity, he does base his belief on the idea that humans are God's special creatures. God ensured that humans would have the innate ability to discover the norms according to which the world and everything in it were created.[35]

The role of the divine image in humanity is more clearly stated in another of Kepler's letters, written just two years later (1599):

> Those [laws which govern the material world] are within the grasp of the human mind. God wanted us to recognize them by creating us after his own image so that we could share in his own thoughts ... and, if piety allows us to say so, our understanding is in this respect of the same kind as the divine, at least as far as we are able to grasp something of it in our mortal life.[36]

As the context of the passage indicates, Kepler felt himself compelled to justify his efforts to improve on the science of the ancients. Some of Kepler's critics apparently thought that enhanced knowledge of such recondite subjects was forever beyond the understanding of beings like humans who were confined to live on earth. So Kepler's reference to a well-known biblical idea (Gen. 1:26–27) provided needed theological support. But it also came from the heart of his own conviction formed through his theological training at the University of Tübingen. The willingness to question received knowledge and to strive for deeper understanding was generated by religiously founded beliefs. For some of Kepler's contemporaries, scientific understanding and religious belief apparently seemed contradictory, but for Kepler himself they were not only consistent, but mutually affirming. The theological background for his conviction is to be found in the writings of Martin Luther and Philip Melanchthon.



For Davies, the double-foundation of rational order and human understanding is a "tantalizing mystery," really a double-mystery. But there is a third mystery implied in Davies' statement about the "miracle" of science ... the mystery of why scientists believe the universe to be intelligible.

Kepler's Background in Lutheran Creational Theology

The example of Kepler shows that we are dealing with a culture of belief that was deeply informed by biblical teachings. It is worthwhile citing the founders of Kepler's immediate theological tradition, Luther and Melanchthon.[37] Two of the most widely available treatises on the creation of humanity were Luther's "Lectures on Genesis" (published in 1544) and Melanchthon's treatise "On Christian Doctrine" (*Loci communes*, 1555). The two treatises may be treated together because they were written and revised over the same period of time and because Luther's lectures were strongly influenced (if not partly written) by Melanchthon.

Luther's *Lectures on Genesis* make it clear that the creation of the first humans in the divine image entailed "the most dependable knowledge of the stars and of the whole of astronomy."[38] This original knowledge was largely lost due to human rebellion against God, but a spark of that original life is still evidenced in human efforts to "understand the motion of the heaven or measure the heavenly bodies."[39] Melanchthon's *Loci communes* was more specific and listed "understanding about number and order" among the gifts of God that may still be observed in humans.[40] So Kepler's beliefs were not at all idiosyncratic or arbitrary. They were rooted in the teachings of his church, particularly as they were mediated by the writings of Luther and Melanchthon and the teachings of mentors like Michael Mästlin and Jakob Heerbrand.[41]

Kepler's beliefs about creation were not unique to Lutheran circles. They were quite typical of Western European culture in the sixteenth and seventeenth centuries. Other figures could be examined with basically the same result. Some prominent examples of natural philosophers expressing the identical beliefs to Kepler's are Lefèvre d'Étaples, Paracelsus, Giordano Bruno, Francis Bacon, Isaac Beeckman, René Descartes, and Walter Charleton.[42] Our extended examination of Kepler suffices to establish the role of such beliefs in early modern science and to outline the nature of creational beliefs particularly as they were passed on to founders of modern physics.

Science-Fostering Belief in Modern Physics

What does Science-Fostering Belief actually look like in the work of representative modern scientists? As I stated earlier, the beliefs of most modern scientists are mostly tacit in everyday practice. The best examples for our purposes are scientists who reflect on the epistemology of their discipline. The ones we shall look at are Albert Einstein, Henry Margenau, and Paul Davies. Even though these writers differ in many ways, their beliefs are quite characteristic of their scientific culture and will give a good sense of the Science-Fostering Belief that they inherited from early figures like Kepler.

We shall review these three scientists in reverse chronological order, beginning with Davies in order to illustrate the role of belief in present-day physics. Then we shall turn to Margenau and Einstein in order to illustrate the role of belief at the foundations of modern physics (relativity and quantum theory). Einstein's historical insight about the cultural foundation of early modern science will point us back to Johannes Kepler and the historic creationist tradition.

A Present-Day Cosmologist: Paul Davies

My first example is the 1995 Templeton laureate, Paul Davies.[43] In several important articles and most eloquently in his 1992 book, *The Mind of God: The Scientific Basis for a Rational World*, Davies drew attention to what he calls the "great miracle of science":

Paul Davies

> The success of the scientific method at unlocking the secrets of nature is so dazzling [that] it can blind us to the greatest scientific miracle of all: *science works*. Scientists themselves normally take it for granted that we live in a rational, ordered cosmos subject to precise laws that can be uncovered by human reasoning. Yet why this is so remains a tantalizing mystery.[44]

Davies clearly articulates the basic point of this article—that the pursuit of science is based on belief. In fact, he is quite specific in stating that there is a dual-belief at the foundation of scientific endeavor: First, scientists believe that the cosmos is rationally ordered—that it is governed by precise (mathematical) laws of some sort. This is an article of faith since science does not tell us where that rational order or those mathematical laws come from. Second, scientists believe that human minds are actually capable of understanding that rational order—they have the scientific intelligence needed to develop mathematical models and rational formalisms that will test positively against data gathered in the laboratory and even against data gathered from the farthest reaches of space-time. These two beliefs correspond to the dual-belief that Kepler inherited from his theological tradition.[45]

The burden of Davies' quotation is not just that this dual-belief—rational order and human understanding—exists, but that modern scientists "normally take it for granted." It has become almost self-evident to working scientists today despite the fact that neither the existence of a rational order nor the possibility of human understanding is at all obvious in itself.

For Davies, the double-foundation of rational order and human understanding is a "tantalizing mystery," really a double-mystery. But there is a third mystery implied in Davies' statement about the "miracle" of science. In addition to the mysteries of rational order and human understanding, there is the mystery of why scientists believe the universe to be intelligible. This belief is the cultural foundation of scientific endeavor that we have found in the creationist tradition leading up to Kepler.

A Philosophical Physicist: Henry Margenau

The fact that scientific endeavor is motivated and sustained by faith was not realized for the first time by Paul Davies. Any number of writers could be cited on this topic. One of the clearest of the previous generation was Henry Margenau (1901–1997), a professor of physics and natural philosophy at Yale University (1950–1969). In a philosophical study, published in 1961, Margenau explored what he called "the new faith of science," by which he meant the set of beliefs to which all working scientists are personally committed even though they are "not subject to logical and empirical proof" and are often even contradicted by the difficulties encountered in scientific research.[46] As we have seen, this faith was not quite as new as Margenau believed: it is the same Science-Fostering Belief we have seen in the writings of Kepler and Melanchthon.

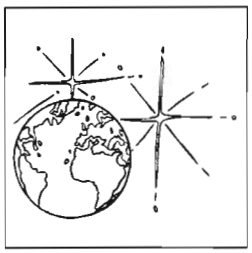
Margenau was haunted by the fact that scientists might well regard their efforts as futile. He described the difficulties that nuclear physicists were experiencing in constructing a field theory for nuclear forces. In the 1950s, new "elementary particles" were being discovered in high-energy experiments, and there were seemingly intractable mathematical problems in the theoretical calculations. Any scientist who had to work on such problems for years and who saw "little but chaos" might well become pessimistic about the long-term prospects of their discipline. What prevented scientists from giving up under such conditions, Margenau observed, was an "over-arching faith":

> [The scientist] holds with the fervor of a religious conviction that his task is meaningful, that the history of science does converge in the limit upon a set of knowledge, laws and principles that are unique, categorical, and all inclusive.[47]

Margenau's point here corresponds to the first article of faith we found in Davies' writings: "that we live in a rational, ordered cosmos subject to precise laws." But Margenau saw this belief as something more than what scientists take for granted. It was a personal commitment made with the "fervor of religious conviction."

Margenau's analysis of the "faith of science" focuses on the belief that the cosmos is rationally ordered. ... According to [Margenau's] catechism, no one may ever completely understand the laws of the cosmos, yet those laws do exist and there is no insurmountable obstacle that can prevent scientists from getting successively closer approximations.

Margenau's analysis of the "faith of science" focuses on the belief that the cosmos is rationally ordered. Even though, he is not so specific about the complementary belief that humans are capable of discerning that order, this second belief is implied in his optimism about the prospects of eventually reaching a final theory. It is also implicit in the "catechism" Margenau developed to express the faith that sustained scientific research. This catechism had a total of six articles. If Margenau wrote today, he might call these, "Six Impossible Things Scien-



Like Davies and Margenau, Einstein clearly identified the twin beliefs that underlie scientific endeavor ... But Einstein was more explicit ... about the history of the beliefs he had inherited. Even though he was strongly critical of organized religions, Einstein traced his intellectual heritage back to the "sphere of religion."

tists Believe before Breakfast."[48] Here I shall list just three of them, which read as follows:

(1) I believe that the search for truth is a never-ending quest, yet I pledge myself to seek it.

(3) I recognize no subjects and no facts which are alleged to be forever closed to inquiry or understanding; a mystery is but a challenge.

(5) I believe in the convergence of the scientific laws upon principles that are all embracive, though they may never be completely within our reach.[49]

According to this catechism, no one may ever completely understand the laws of the cosmos, yet those laws do exist and there is no insurmountable obstacle that can prevent scientists from getting successively closer approximations. Scientific endeavor is thus a process of "continual self-correction toward an ideal limit of understanding which is forever approached and yet never fully attained."[50] As Margenau stated, every mystery should be viewed as a new challenge.

Henry Margenau was a physicist and a philosopher. We might even call him a "theologian of scientific endeavor" in that he consciously articulated the beliefs that motivate scientists and showed the religious dimensions of science as a human endeavor.

At the Foundation of Modern Physics: Albert Einstein

Going back one hundred years, to the time when the foundations of relativity and quantum theory were being developed, Albert Einstein also recognized that faith lay at the foundation of his own work and that it had a religious character. The basic points we have seen in Davies and Margenau recur throughout Einstein's epistemological writings.[51] For example, he stated the importance of assuming the rationality (or intelligibility) of nature itself:

> Certain it is that a conviction, akin to religious feeling, of the rationality or intelligibility of the world lies behind all scientific work of a higher order.[52]

The creative scientist must be entirely convinced of intelligibility in the depths of the natural world, the object of scientific work.[53] But the scientist must also assume some connection between subject and object in order for the natural world to be intelligible to humans. As Einstein reflected on his own scientific work, particularly in relativity theory, he observed that he had always approached his work assuming a primordial connection of some sort between the human scientist and nature. For Einstein there was no logical bridge between the phenomena and the principles that explain them that could ever take the place of disciplined human intuition. Therefore, the only way to explain how applicable concepts could arise in the scientist's mind was to assume a "pre-established harmony" between the two.[54]

Using this well-known phrase from Leibniz, Einstein argued for a "pre-established harmony" between the human mind and nature that could not be explained in terms of any mechanism, whether logical or natural.[55] He also borrowed a striking phrase from Kant to formulate one of his most cogent statements of the problem: "the eternal mystery of the world is its comprehensibility." As Einstein explained Kant's point in his own words: "... the world of our sense experiences is comprehensible. The fact that it is comprehensible is a miracle."[56]

Einstein described this philosophical idea of "pre-established harmony" or "comprehensibility" in theological terms as a matter of "belief" or "faith."[57] He confessed his own firm belief in "a superior mind" that revealed itself in the laws of nature,[58] and he stated the importance of intellectual humility in the face of "reason incarnate" in the world – incarnate yet inaccessible to the human mind in its profoundest depths.[59]

Like Davies and Margenau, Einstein clearly identified the twin beliefs that underlie scientific endeavor: (1) that the world is governed by mathematical laws; and (2) that human reason is capable of grasping those laws. But Einstein was more explicit than our previous two examples about the history of the beliefs he had inherited. Even though he was strongly critical of organized religions, Einstein traced his intellectual heritage back to the "sphere of religion." Here is the way he put it in a 1941 essay entitled, "Science and Religion":

> Science can only be created by those who are thoroughly imbued with the

> aspiration toward truth and understanding. This source of feeling, however, springs from the sphere of religion. To this [sphere of religion] there also belongs the faith in the possibility that the regulations valid for the world of existence are rational, that is, comprehensible to [human] reason.[60]

Einstein repeatedly pointed to this larger "sphere of religion" in order to explain the scientist's belief in the comprehensibility of the natural world. In the context of the quote just above, he referred back to the ideas of Christian natural philosophers like James Clerk Maxwell (1831–1879), who had an immense influence on Einstein's own teachers.[61]

Einstein also pointed out that founders of modern science were people of profound religious faith.

> What a deep conviction of the rationality of the universe and what a yearning to understand, were it but a feeble reflection of the Mind revealed in this world, Kepler and Newton must have had to enable them to spend years of solitary labor in disentangling the principles of celestial mechanics! ... Only one who has devoted his life to similar ends can have a vivid realization of what has inspired these men and given them the strength to remain true to their purpose in spite of countless failures.[62]

Belief in the intelligibility of the cosmos made the solution of scientific problems seem possible to natural philosophers like Kepler and Newton long before it was an everyday occurrence as it is commonly thought to be today. Even though Einstein rejected any notion of a personal God who answers individual prayers and who judges people according to their individual choices,[63] he recognized deeper roots for this faith in the Psalms and the Prophets that had inspired early European scientists.[64]

If Einstein, Margenau and Davies are correct in their observations, scientific endeavor still depends on the twin beliefs in universal laws of nature and in human intelligence to match those laws. And if Einstein was correct in his understanding of history, the emergence of modern science itself was dependent on a religious heritage that engendered those very beliefs.

Scientists are believers. This simple idea has implications for our views of both science and theology. A suitably thick description of scientific endeavor must therefore include a theological dimension.[65] It must portray the embedding of modern science in the cultural history that has provided the necessary motivation (Kepler), conviction (Einstein), and persistence (Margenau) needed for sustained endeavor.

Conversely, a suitably thick description of historical theology must include a scientific dimension. It must include the thinking of scientists like Kepler, Einstein, Margenau, and Davies who articulate beliefs that ultimately derive from the biblical tradition. It should also make room for the hundreds of scientists (and other lay professionals) who live out those beliefs even if they do not consciously articulate them. ▣

Notes

[1]This paper was presented at the 61st Annual Meeting of the ASA, at Calvin College, 31 July 2006. It is based on the third chapter of Kaiser, *Foundations of Science in Theological Perspective: Toward a Theology of Scientific Endeavor* (London: Ashgate), scheduled for publication in 2007.

[2]I use the terms "belief" and "human psyche" in order not to limit our investigation by the strictly cognitive associations of the comparable terms "ideas," "mind" and "intellect." Belief in the possibility of science is only part of the software needed. It must be supplemented and reinforced by years of training in mathematics and other disciplines. Here we are concerned with the beliefs that motivate some people to undergo such training and devote their lives to the practice and propagation of what they have learned. Science-Fostering Beliefs is the cultural foundation of scientific endeavor viewed upward and forward in history. The cultural foundation of scientific endeavor is Science-Fostering Beliefs viewed looking downward and backward in history.

[3]Tacit knowledge (or awareness) is knowledge upon which people rely without necessarily thinking about it; see Michael Polanyi, *The Tacit Dimension* (New York: Doubleday-Anchor, 1966), 9–10, passim.

[4]Our analysis is restricted to finding conditions for the *possibility* of scientific endeavor. We are not trying to determine historical conditions that may have caused or impelled certain individuals to pursue science within the context of those conditions. The answer to that question is likely to vary from individual to individual. Here we focus on the common cultural frame that made scientific endeavor possible—a necessary though not sufficient condition for such endeavor.

[5]Chet Raymo, *Skeptics and True Believers: The Exhilarating Connection Between Science and Religion* (New York: MJF Books, 1998), 2–4.

[6]I have borrowed the term, "creationist tradition," from Richard C. Dales, "A Twelfth-Century Concept of the Natural Order," *Viator* 9 (1978): 191–2. This historic "creationist tradition" is a composite of beliefs that supports scientific endeavor and is not to be confused with "creation science."

[7]Lü Shi Chun Qiu V.2; *The Annals of Lü Buwei*, trans. John Knoblock and Jeffrey Riegel (Stanford: Stanford University Press, 2000), 136–9; cf. Derk Bodde, *Chinese Thought, Society, and Science: The Intellectual and Social Background of Science and Technology in Pre-Modern China* (Honolulu: University of Hawaii Press, 1991), 335–6. Bodde's essay (first published in 1979) describes this and a number of similar texts from ancient China. Other ancient Chinese texts like the famous Chuang Tzu (Zhuang zi, chaps 2, 5) emphasize the other side of the dialectic—the difference between conventional human understanding and the laws of Heaven.

[8]Qur'an Sûrah 13:2 ("each running to an appointed term"); 36:37–8 ("each in an orbit"); 41:12 ("in each heaven its mandate"); English translation (ET) in *The Meaning of the Glorious Koran*, trans. Mohammed Marmaduke Pickthall (New York: New American Library, 1953), 182, 316, 341.

[9]The thirteenth-century Syrian physician, Ibn al-Nafîs developed a theory of the circulation of blood very similar to the later ideas of William Harvey. His treatise was preserved by a Cairo hospital, but was forgotten and remained unknown until its modern rediscovery. In the sixteenth century, Taqî al Dîn wrote books on astronomy, optics, and mechanical clocks. As court astronomer to the Sultan, he was able to build an observatory in Istanbul (1577) comparable to that of Tycho Brahe in Denmark. Al Dîn's observatory was later destroyed on the recommendation of the chief Mufti and was never rebuilt; Bernard Lewis, *What Went Wrong? The Clash*

Between Islam and Modernity in the Middle East (New York: Oxford University Press, 2002), 79–81.

[10]The word "scientist" did not come into use until the nineteenth century when various sciences became specialized and professionalized. Before that time, most scientists thought of themselves as philosophers or "natural philosophers." Using the term "scientist" for earlier centuries is technically anachronistic, but necessary in order to convey a sense of continuity of scientific endeavor over time.

[11]It is difficult to adjudicate competing claims for the earliest sustainable research institutes, but the idea was first advocated by seventeenth-century Europeans like Francis Bacon, Jan Comenius, and Samuel Hartlib.

[12]See Kaiser, *Creational Theology and the History of Physical Science: The Creationist Tradition from Basil to Bohr* (Leiden: E. J. Brill, 1997), 47–59, on the development of conflict in the creationist tradition of Western Europe.

[13]See the excellent studies by David Lindberg and Edward Larsen in *When Science and Christianity Meet*, ed. David C. Lindberg and Ronald L. Numbers (Chicago: University of Chicago Press, 2003).

[14]E.g., David C. Lindberg and Ronald L. Numbers, "Beyond War and Peace: A Reappraisal of the Encounter between Christianity and Science," *Perspectives on Science and Christian Faith* 39 (Sept. 1987): 140–9.

[15]E.g., Kepler's letter to Galileo, Aug. 1597; Carola Baumgardt, *Johannes Kepler: Life and Letters* (New York: Philosophical Library, 1951), 40–2.

[16]Baumgardt, *Johannes Kepler: Life and Letters*, frontpiece.

[17]Latin and English texts are found in Johannes Kepler, *Mysterium Cosmographicum: The Secret of the Universe*, trans. A. M. Duncan (New York: Abaris Books, 1981), 48–9. The full Latin title was *Prodromus Dissertationum Cosmographicarum Continens Mysterium Cosmographicum* ("A Preview of Cosmographical Dissertations Containing the Mystery of the Cosmos"). A second, annotated edition was published in 1621.

[18]For Kepler's other attempts to explain the arrangement of the planets, see Fernand Hallyn, *The Poetic Structure of the World: Copernicus and Kepler*, trans. from French by D. M. Leslie (New York: Zone Books, 1990), 187–9.

[19]Kepler, *Mysterium Cosmographicum*, Preface to the Reader, 63.

[20]Christopher B. Kaiser, *Creation and the History of Science* (Grand Rapids: Eerdmans, 1991); Kaiser, *Creational Theology and the History of Physical Science*.

[21]Kepler did express the hope that his discoveries would convince some philosophers that the world was created and ordered by God, but his own belief was rooted in his religious heritage; cf. Kepler's letter to Baron von Herberstein, 15 May 1596; in Baumgardt, *Johannes Kepler: Life and Letters*, 33–5.

[22]Calculus was not invented until the time of Newton and Leibniz. Kepler did his calculations with logarithms.

[23]Kepler's *Astronomia Nova* was written in 1605–1606 and published in 1609. For a good, brief description of Kepler's long process of discovery, see. A. C. Crombie, *Augustine to Galileo: The History of Science AD 400–1650*, 2 vols., 2d ed. (Oxford: Heinemann, 1959), 2:188–90.

[24]Howard Margolis coins the term "around-the-corner inquiry" for insights like Kepler's in order to differentiate it from direct inference; Margolis, *It Started with Copernicus: How Turning the World Inside Out Led to the Scientific Revolution* (New York: McGraw-Hill, 2002), 126–7, 160–1.

[25]Isaac Newton, *Philosophiae Naturalis Principia Mathematica* ("Mathematical Principles of Natural Philosophy").

[26]For details, see Crombie, *Augustine to Galileo*, and Arthur Koestler, *The Sleepwalkers: A History of Man's Changing Vision of the Universe* (New York: Macmillan, 1959), 213–22.

[27]The Latin title is *Harmonice Mundi* (1619), which is sometimes translated "Harmony of the World."

[28]Drawn by Christopher Leibfried, Tübingen, 1597; Kepler, *Mysterium Cosmographicum*, Plate 3; see p. 228 for a listing of the planets and regular solids.

[29]Kepler, *Harmonice Mundi* IV.1; Johannes Kepler, *Gesammelte Werke*, 20 vols., ed. Walther von Dyck, Max Caspar, et al. (Munich: Becksche Verlagsbuchhandlung, 1937–1988), 6:223, lines 32–4; ET from Johannes Kepler, *The Harmony of the World*, trans. E. J. Aiton, A. M. Duncan, and J. V. Field (Philadelphia: American Philosophical Society, 1997), 304 (slightly modified). The same idea is found in Kepler's defense of Galileo, *Dissertatio cum Nuncio Sidereo*; *Gesammelte Werke*, 4:308. In the context of the passage cited from *Harmonice Mundi* IV.1, Kepler identified geometry as one of the attributes of the divine being (*quid enim in Deo quod not sit Ipse Deus*, "for what is in God that was not God himself?"). This idea was already found in *Augustine* (e.g., *On Genesis Literally* IV.3.7), but Kepler was commenting here on the (recently read) Neoplatonic ideas of *Proclus*, which he had interpreted in accordance with what is "known to Christians" like Augustine concerning the doctrine of creation; cf. Kepler, *Harmony of the World*, 299, 303, 493. See the marginal note in *Harmonice Mundi* I, Proposition 45, and the discussion of Axiom 7 in Book III; *Gesammelte Werke*, 6:47–9; ET in Kepler, *Harmony of the World*, 74, 146–7.

[30]Proclus was a sixth-century Neoplatonist who taught that geometrical structures like the sphere were inscribed on the human soul by the cosmological Mind or Intellect (Nous); Proclus, *A Commentary on the First Book of Euclid's Elements*, trans. Glenn R. Morrow (Princeton: Princeton University Press, 1970), 14. The Platonic explanation for the adaptation of the human psyche to the deep structures of the universe is rather different from the evolutionary explanation given in Chapter 2. Our concern in this chapter is with the culture of belief rather than with the anthropological question of origins.

[31]As Kepler explained in a Letter to Johann Georg Brengger, 5 April 1608, the human soul (or spirit) was formed out of celestial (spiritual) substance and then "illuminated and instructed by a ray out of God's image"; Baumgardt, *Johannes Kepler: Life and Letters*, 79; cf. Philo, *De Opificio Mund*, 146 ("a copy or fragment or ray of that blessed nature"). The interpretation of the "heavens" in Genesis 1:1 as unformed spiritual substance goes back as far as Augustine, *Confessions*, XII.17.25; XIII.2.2–3.

[32]Gerald Holton, *Thematic Origins of Scientific Thought: Kepler to Einstein* (Cambridge, MA: Harvard University Press, 1973), 84; rev. ed. (1988), 68.

[33]Letter to Michael Mästlin, 9 April 1597; *Gesammelte Werke*, 13:27; ET from Holton, *Thematic Origins of Scientific Thought*, 84; rev. ed., 68 (modified). Mästlin had helped to arrange the publication of Kepler's *Mysterium Cosmographicum* (1596), for which he also provided a preface and an appendix.

[34]In Chapter 2, I argued for an evolutionary explanation for both of these adaptations.

[35]Gerald Holton suggests that Kepler had two different gods: one biblical and the other Pythagorean; Holton, *Thematic Origins of Scientific Thought*, 86; rev. ed., 70. However, the idea that God had created everything "according to the norm of quantity" was already in Kepler's Bible in texts like Wisdom 11:20 and will be discussed below.

[36]Letter to Johannes Georg Herwart von Hohenburg, 9/10 April 1599; *Gesammelte Werke*, 13:309, letter no. 117, lines 174–9; ET in Baumgardt, *Johannes Kepler: Life and Letters*, 50. As Chancellor of Bavaria, von Hohenburg was able to help Kepler establish connections at the Imperial Court in Prague. He was also a mathematician and, though a Catholic, had studied under Mästlin; Baumgardt, *Johannes Kepler: Life and Letters*, 57–9. Kepler shares his ideas about God and creation with Herwart as if the two of them remembered them from their teacher.

[37]For a detailed treatment of Kepler's Lutheran background, see Peter Barker and Bernard R. Goldstein, "Theological Foundations of Kepler's Astronomy," in John Hedley Brooke, Margaret J. Osler, and Jitse Van der Meer, eds, *Science in Theistic Contexts: Cognitive Dimensions* (*Osiris* 16, Chicago: University of Chicago Press, 2001), 88–113.

[38]Martin Luther, *Lectures on Genesis, Chapters 1–5*, in Jaroslav Pelikan and Helmut T. Lehmann, eds., *Luther's Works: American Edition*,

55 vols. (St. Louis and Philadelphia: Concordia and Fortress Press, 1955–1976), 1:66.

[39]*Luther's Works*, 1:45–6.

[40]Melanchthon, *On Christian Doctrine: Loci Communes 1555*, ed. Clyde L. Manschrek (New York: Oxford University Press, 1965), 71.

[41]Robert S. Westman, "The Melanchthon Circle, Rheticus, and the Wittenberg Interpretation of the Copernican Theory," *Isis* 66 (June 1975): 165–93; E. J. Aiton, Introduction to *Johannes Kepler, Mysterium Cosmographicum: The Secret of the Universe*, trans. A. M. Duncan (New York: Abaris Books, 1981), 23.

[42]For specifics, see Kaiser, *Creational Theology and the History of Physical Science*.

[43]Paul Davies is currently Visiting Professor of Physics at Imperial College London, Adjunct Professor of Physics at the University of Queensland and Adjunct Professor of Natural Philosophy in the Australian Centre for Astrobiology at Macquarie University, Sydney; www.abc.net.au/science/morebigquestions/davies.htm.

[44]Paul Davies, *The Mind of God: The Scientific Basis for a Rational World* (New York: Simon & Schuster, 1992), 20.

[45]In another of his writings, Paul Davies states that the general quest of modern science has historical roots in a theological worldview, but he does not specify creational beliefs; Davies, *Are We Alone? Philosophical Implications of the Discovery of Extraterrestrial Life* (Harmondsworth: Penguin, 1995), 138.

[46]Henry Margenau, *Open Vistas: Philosophical Perspectives of Modern Science* (New Haven: Yale University Press, 1961), 73, 75. For Margenau, the "newness" of this faith was relative to the prior ideology of logical positivism, which held that science was independent of metaphysics and dealt only with the empirically verifiable. As we shall argue, the "new faith" of which Margenau spoke had deep historical roots.

[47]Margenau, *Open Vistas*, 75. William G. Pollard was another physicist-philosopher who wrote in 1961 to point out the importance of "a firm and unshakable faith in the ultimate intelligibility of the chaotic torrent of phenomena in terms of underlying laws and universal principles"; Pollard, *Physicist and Christian: A Dialogue between Two Communities* (New York: Seabury Press, 1961), 14–16. Pollard and Margenau were the two science-writers who most influenced me in my studies as a student of science.

[48]Lewis Wolpert, *Six Impossible Things Before Breakfast: The Evolutionary Origins of Belief* (London: Faber & Faber, 2006), based on Lewis Carroll, *Through the Looking-Glass and What Alice Found There* (C. L. Dodgson, 1871).

[49]Margenau, *Open Vistas*, 76.

[50]Margenau, *Open Vistas*, 74.

[51]The following discussion is based on my essay, "Humanity in an Intelligible Cosmos" (2001).

[52]Einstein, "Scientific Truth" (1929), in Einstein, *The World As I See It* (London: John Lane, 1935), 131; also in Einstein, *Ideas and Opinions* (London: Alvin Redman, 1954), 262.

[53]Interestingly, Einstein did not view the new science of quantum theory as "rational" in this sense due to the seemingly contradictory properties of photons; see Marcus Chown, "Einstein's *Rio Requiem*," *New Scientist* 181 (6 March 2004), 50–1.

[54]Einstein, "Principles of Scientific Research" (1918); "Inaugural Address to the Prussian Academy of Sciences" (1914); "The Method of Theoretical Physics" (1933), in Einstein, *World As I See*, 125–6, 128, 136; also in Einstein, *Ideas and Opinions*, 221, 226–7, 274.

[55]Einstein, "Principles of Scientific Research" (1918), in Einstein, *The World As I See It*, 125–6; also in Einstein, *Ideas and Opinions*, 226–7.

[56]Einstein, "Physics and Reality" (1936), in Einstein, *Out of My Later Years* (New York: Philosophical Library, 1950), 61; also in Einstein, *Ideas and Opinions*, 292. By "world of our sense experiences," Einstein meant primarily the world of empirical scientific discovery; cf. "The Method of Theoretical Physics" (1933), in Einstein, *The World As I See It*, 133; also in Einstein, *Ideas and Opinions*, 271.

[57]E.g., Einstein, "The Fundaments of Theoretical Physics" (1940); "Message to the Italian Society for the Advancement of Science" (1950), in Einstein, *Ideas and Opinions*, 324, 357; Einstein, "Autobiographical Notes," in Paul Arthur Schilpp, ed., *Albert Einstein: Philosopher-Scientist* (LaSalle, IL: Open Court, 1949), 63.

[58]Einstein, "The Religiousness of Science" (1934 or earlier); "Scientific Truth" (1929), in Einstein, *The World As I See It*, 28, 131; Einstein, *Ideas and Opinions*, 40, 262.

[59]Einstein, "Science and Religion II" (1941), in Einstein, *Out of My Later Years*, 29; also in Einstein, *Ideas and Opinions*, 49. Cf. Einstein's 1952 letter to Beatrice F. of San Francisco:

> I am imbued with the consciousness of the insufficiency of the human mind to understand deeply the harmony of the universe which we try to formulate as "laws of nature." It is this consciousness and humility I miss in the Freethinker mentality (Letter from Einstein Archive, quoted in Max Jammer, *Einstein and Religion: Physics and Theology* [Princeton: Princeton University Press, 1999], 121–2).

Einstein did not explain exactly what he meant here by the limitations of the human mind. Elsewhere he does state that physics deals with only a small part of nature, excluding all its more subtle and complex aspects; Einstein's Preface to Max Planck, *Where Is Science Going?* trans. James Murphy (London: Allen & Unwin, 1933), 11. Presumably he meant those aspects of nature that emerge in human history, which would include the emergence of the very intelligence that physicists rely on in their work. That same year he spoke of "the theorist's hope of grasping the real in all its depth"; Einstein, "The Method of Theoretical Physics" (1933), in Einstein, *The World As I See It*, 138; also in Einstein, *Ideas and Opinions*, 275.

[60]Einstein, "Science and Religion II" (1941), in Einstein, *Out of My Later Years*, 26; also in Einstein, *Ideas and Opinions*, 46. Cf. Einstein's reference to "the truly *religions conviction* that this universe of ours is something perfect and *susceptible to the rational striving for knowledge*"; "Religion and Science: Irreconcilable?" in Einstein, *Ideas and Opinions*, 52.

[61]On Maxwell's faith and its impact on Einstein, see my *Creational Theology and the History of Physical* Science, 379–99.

[62]Einstein, "Religion and Science" (1930), in Einstein, *The World As I See It*, 27; also in Einstein, *Ideas and Opinions*, 39–40.

[63]E.g., Einstein, *World As I See It*, 25, 28; cf. Jammer, *Einstein and Religion*, 47–50, 74–5.

[64]Einstein, "Religion and Science" (1930); "Johannes Kepler"; "Religion and Science: Irreconcilable?" (1948), in Einstein, *The World As I See It*, 25–27, 141–2; also in Einstein, *Ideas and Opinions*, 38–40, 52. Here Einstein also cited Spinoza and Schopenhauer's descriptions of Buddhism.

[65]The phrase, "thick description," is borrowed from the work of Clifford Geertz, *The Interpretation of Cultures: Selected Essays* (New York: Basic Books, 1973), 9–13, 17.

Article

Early Humans, Adam, and Inspiration

Peter Rüst

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Two views of Genesis 1–11 are common. Young-earth creationism claims to take this text literally as inspired by God and interprets it as the history of the first few thousand years of the existence of the universe. Source criticism, on the other hand, takes it as an account of how ancient Hebrews viewed this history, God accommodating to their mythological beliefs derived from contemporary Near Eastern cultures, yet "breaking" these myths by framing them into monotheism. The former view is contradicted by science while the latter produces arbitrary hermeneutics and modifies biblical theology.

But if Adam was not the first human created in the image of God, he can be taken as a real person who lived at a Holocene time in Sumer, but who, called to prepare the way for the Messiah to come, became a type representative of fallen humans living both before and after his time.

Views of "plenary inspiration" are often misconstrued as proposing some kind of mechanical dictation by God.

Inspired by God

What do we mean by considering the Bible to be inspired by God? Views of "plenary inspiration" are often misconstrued as proposing some kind of mechanical dictation by God. This certainly would not be a biblical concept. There is no doubt *that* God wants to reveal himself. But *how* might he be doing it? He can reveal himself directly to the consciousness of any human being whenever he chooses to do so. Normally, such a revelation would hardly be authoritative for others being told about it. God can also commission a prophet to tell his hearers or readers: "Thus says the LORD ..." But are later generations addressed, as well? And there may be false prophets.

The central belief of Christians is that God revealed himself most fundamentally through the incarnation, death, and resurrection of his "only begotten" Son, Jesus Christ, as presented in the collection of the canonical biblical texts called "the Scriptures." How did these sixty-six books in our Bible (excluding the Apocrypha) become "canonical" or authoritative? Each one of them was consistently recognized by communities of believers as reflecting divine authority. One crucial aspect of such canonical recognition has always been noncontradiction between a newly received book and the part of the canon already accepted. Thus, as the collection of biblical texts grew over the centuries, the canon grew concomitantly, in practice usually with hardly any delay, although "official" pronouncements of recognition might have appeared later, depending on who these "officials" were.

Paul refers to "the foundation of the apostles and prophets."[1] With "apostles" he may have designated the whole future canon of the New Testament (NT) and with "prophets" that of the Old Testament (OT). Alternatively, both apostles and prophets may refer to the proclamation of the gospel, with the OT canon included indirectly, as all NT authors presuppose it as canonical. In some cases, the writer of a book, e.g., Hebrews, did not identify himself explicitly. Other authors, like Luke, indicated that some of what they wrote was derived from diverse sources. Some OT books, such as Psalms, obviously represent collections from various authors. Others, like Chronicles

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and Genesis, are summaries of anonymous historical records. Such historical sources may not immediately have been considered divinely inspired as a whole when they were written, although they might contain proclamations explicitly attributed to the Lord and accepted as such. But as dealing with the people of God, they certainly were considered very important, requiring utmost respect.

No matter how a biblical text is to be interpreted, any concept of genuine divine inspiration must imply that we have to keep the entire text in the form indicated by the most reliable manuscripts available. We even may assume that God not only inspired the text in its original form—which we do not have at our disposition—but also kept watch over its transmission. It certainly is his intention to give his word not only to the first recipients of a text, but to all humans reached by it throughout his *Heilsgeschichte* (redemptive history).

An inspired text ... must be understandable by people of all times and cultures. [One] must both accept the full extent of the canonical texts as representing God's revelatory will and ... avoid any contradiction to reality ...

An inspired text, therefore, must be understandable by people of all times and cultures. A reasonable interpretation must both accept the full extent of the canonical texts as representing God's revelatory will and, at the same time, avoid any contradiction to reality, which of course includes what modern science knows about it. This is no claim of the Bible "teaching science," because interpretations of both scientific findings and the biblical texts may be deficient or ambiguous. Our knowledge of both science and Scripture will always be less than complete.[2] Nevertheless, reasonable interpretations of the text will be compatible with reality.

There are biblical texts which not only allow for but require more than a single interpretation. This is most obvious with prophecies having both contemporary and future fulfillments. This ambiguity of prophecies eliminates the possibility of "proving" divine inspiration by revealing facts of modern science—and therefore of "proving God." Genuine prophecy and typological foreshadowing about future events certainly make up an important part of the Bible, as evidenced by many NT quotations of OT texts.[3] Such a prophecy would have conveyed a message to its first hearers, while its full implications at the time of its final fulfillment may not yet have been obvious to them—or even to the apostles.

Literary Genre

Different types, or *genres*, of texts have to be read in different ways. If the sun "comes out like a bridegroom leaving his chamber, and, like a strong man, runs its course with joy,"[4] it is clear that this poetical text does not "teach" that the sun has a bride, a chamber, and joy. Nor did Asaf necessarily think that the earth rests on literal pillars, when he reported God as saying, "When the earth totters, and all its inhabitants, it is I who keep steady its pillars."[5] Poetical texts neither give us any reliable information about modern science *nor* about the worldview or cosmogony of the ancients. To understand their meaning, we have to recognize their figurative aspects.

Hebrew poetry is often framed in couplets giving similar or contrary pronouncements in the two parts. It may also use obvious metaphors. By its characteristics, poetical text may even be recognized when contained in otherwise nonpoetical text like narrative. The context has to be taken into account to decide whether a given word or statement is meant to be understood figuratively or literally.

A text which is given in narrative form may be either a historical account or a parable not meant to tell us something that "really happened." Again, the context would indicate the genre. Jesus said, "A man was going down from Jerusalem to Jericho ...,"[6] but we can recognize it as a story invented as an illustration, although it was not explicitly called a parable.

In many biblical texts which unmistakably are historical narratives, some expressions cannot be taken literally. When "Jerusalem and all Judea and all the region about the Jordan were going out to" John the Baptist and "were baptized by him in the river Jordan, confessing their sins,"[7] the word "all" is a superlative exaggeration designating emphasis, understood as such by its context. It would be naive to call this an "error" in the text.

There are cases which are more controversial. Is the book of Jonah historical narrative or a made-up story or some hybrid? Any one of these may conceivably be the interpretation intended by divine inspiration, but it must have been understood correctly by the original recipients. Later readers have to find the correct genre from the internal and external context of the book.

When Jesus said, "For just as Jonah was three days and three nights in the belly of the great fish, so will the Son of Man be three days and three nights in the heart of the earth,"[8] and, "For as Jonah became a sign to the people of Nineveh, so will the Son of Man be to this generation ... The men of Nineveh ... repented at the preaching of Jonah,"[9] he apparently referred to the story as a historical

If God's redemptive history revealed in the Bible focuses on the incarnation, death, and resurrection of the Son of God, NT quotations of OT texts make it clear that many prophecies have more than one fulfillment, and therefore more than one interpretation may be "correct" with respect to God's revelatory will.

narrative. He might have talked in this way even if the whole story is a metaphor, but only if his audience recognized it as such. But did they? And if not, did Jesus accommodate himself to their erroneous beliefs? Such accommodation appears unlikely.[10]

Similar considerations apply to the book of Job, with James talking of Job as a real historical person.[11] And if such accommodationism is applied to the Torah and later historical books, the consequences are very serious.

Can Different Interpretations Be Correct?

Some assume that a given biblical text can only have one correct interpretation, namely what the human writer could know and wanted to say. But if God's redemptive history revealed in the Bible focuses on the incarnation, death, and resurrection of the Son of God, NT quotations of OT texts make it clear that many prophecies have more than one fulfillment, and therefore more than one interpretation may be "correct" with respect to God's revelatory will.[12] But does the fact that clearly messianic prophecies may have more than one correct interpretation extend to other statements or text details, as well?

A prophecy is a message, inspired by God, about something unknown or even unknowable by humans at the time it is given. It may relate to the near or far future. Or it may point backwards in time. There are many biblical references to the creation of the universe, the earth, the first humans, etc. As most knowledge about such topics by means of human investigation has surfaced in modern times only, such references would be prophecies, divine messages about things unknowable at the time they were given.

This does not imply that a biblical text can inform us about facts that only became known by modern science. Some references to creation may just express the fact *that* God created, but not *how* he did it. Aspects of the text looking like operational details may be metaphorical ornaments, which the original readers did not take literally. Such metaphorical details, taken literally, need not be compatible with reality, knowable then or today.

Or the same details of a text can legitimately be interpreted *both* as an anthropomorphic description[13] of what the ancients could observe and understand, *and* as compatible with—as distinct from "teaching"—what we know from modern science.[14] God could achieve this by accommodating himself to a prophet who did not understand the second possible interpretation, gently guiding him in selecting a formulation conforming to the prophet's own limited knowledge and vocabulary, yet compatible with reality.

Such a "modern" interpretation would be sufficiently ambiguous to prevent its misuse as a logical proof of God. To safeguard human personality, secondary interpretations compatible with facts unknowable at the time of writing must always be ambiguous. This restraint in divine revelation is necessary because it will leave humans the freedom not to believe[15]—which they clearly must have, as God does not treat the humans he wants to commune with as puppets or robots.

Early Genesis and Abraham

Now, what is the genre of Genesis 1–11? Is it basically the history it looks like, or is it a collection of "broken" myths of the Ancient Near East, God accommodating himself to the mistaken beliefs the Israelites encountered in Egypt, Canaan, or Babylonia?

From internal and external evidence, much of Exodus through Deuteronomy apparently was written by Moses.[16] But these books presuppose the contents of most of Genesis, the history of the founding fathers. Thus, Genesis certainly looks like the preface to the Torah, the Law. And as far as we can tell, throughout the history of the people of Israel, the Torah was regarded as sacred, as divine revelation, off-limits to any tampering, deleting, or adding. This implies that Genesis was so regarded, as soon as Moses included this collection of older records as the first of the five books constituting the Pentateuch.

Unfortunately, the source-critical hypothesis of the Pentateuch has gained wide acceptance in many theological circles, even evangelical ones. Beginning more than two hundred years ago, the text was split up into many fragments attributed to speculative

"Jahweh" (Yahweh), "Elohim," "Deuteronomy," and "Priestly" sources (JEDP), supposedly written much later than the time of Moses. This hypothesis derives Genesis 1-11 from myths current in Babylonia in the sixth century BC. Apparently narrative details are considered to be remnants of a mistaken ancient mythology, in which the writers believed and to which God accommodated himself. In this minimalist understanding of divine inspiration, the only real content of the text would be the replacement of polytheism with monotheism.[17]

The JEDP hypothesis lacks internal consistency, has never reached a consensus among a majority of the fragmenters, arbitrarily manipulates the text, is contradicted by archeology, changes Israel's history, and deletes much of traditional Jewish and Christian theology, including any concept of inspiration.[18] It certainly is no help in understanding the biblical texts.

Information about Israel's founding fathers must have been transmitted through Abraham and his descendants, as far as Genesis 12–50 is concerned ... At least the backbone, if not all, of [Genesis 1–11] must have been handed down by Abraham.

Information about Israel's founding fathers must have been transmitted through Abraham and his descendants, as far as Genesis 12-50 is concerned. Archeological evidence squarely places these narratives in the first half of the second millennium BC.[19] Similarly, Genesis 1-11 is a literary composition typical of times not later than the early second millennium BC.[20] At least the backbone, if not all, of this earlier history must have been handed down by Abraham.

Therefore, real similarities between early Genesis and Babylonian myths must go back to times before God called Abraham from Babylonia, almost 2000 BC. Who borrowed from whom? Genesis is obviously much more realistic, uncontaminated by polytheistic fantasy and corruption, and therefore closer to any possible common sources or events. Using first millennium BC myths as the main key for interpreting Genesis is untenable.

Abraham grew up in Ur in Sumer,[21] or Southern Mesopotamia. He would have been conversant with cuneiform writing on clay tablets,[22] and we may reasonably assume that he kept the information important to him in such a durable form. In fact, the text of Genesis 1-36 contains remarkable tell-tale indications of having originated as cuneiform records: the concept *toledot* ("generations" or "history") marks colophons at the ends of Sumerian and Akkadian clay tablets.[23] A colophon contained the name of the owner, the title of the tablet or series of tablets, and sometimes the date of writing. Keywords linking the tablets of a series were placed at the beginning or end.

An Individual Adam

Even among those who admit that Genesis 2-11 contains some biblical prehistory, the question as to the individuality of Adam remains controversial. Now, a mythological or even merely metaphorical understanding of the Adam story requires Genesis 2-4 to be taken as devoid of any historical reality. This also makes the transition from non-history to history anywhere between chapters 4 and 12 quite arbitrary and unconvincing. A weak understanding of inspiration would then risk being extended to all of Israel's history, or even effectively to the whole Bible, robbing much of redemptive history of its documentation.

Furthermore, later in the OT and in the NT, there are various quotes from Genesis 2-11. Did the ancient writers and their readers always understand such quotes as metaphorical, or worse as reflecting divine accommodation to error prevalent in Babylonia? Only metaphor could avoid a fully reductionistic interpretation. But as most of Genesis 2-11 looks like historical narrative, it hardly makes sense to take it as metaphorical throughout.

Paul mentioned Adam several times.[24] At least in some cases, he specifically quoted, or alluded to, the story of Genesis 2-3.[25] The text seems to indicate that he took Adam as a historical person, although it is conceivable that he just referred to the received Torah text for making a theological point. In other cases, Paul contrasted Adam with Christ, taking both as representatives of humanity.[26] Like the chronicler, Luke and Jude just referenced the name Adam in the received genealogies.[27]

If Adam was a historical person, we have to deal with the record of human evolution already very reliably documented in paleontology and molecular biology. Of course, it may be claimed that God created the first humans independently of any animal precursors, as Fazale Rana and Hugh Ross do.[28] They carefully discuss the highly significant molecular and morphological similarities between modern humans and their evolutionary relatives or precursors, but then they indicate that these similarities reflect the repeated use of functional modules, as is done in computer programming. In very many cases, this judgment is correct. Yet it seems that Rana and Ross just assume that those other highly significant similarities which are *extremely unlikely* to be due to common require-

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ments[29] will ultimately be shown to perform some presently unknown functions, and this opinion is very questionable. If there were no common descent, God would have used animal modules, even unnecessary ones,[30] when creating human DNA. Does this not look suspiciously like deliberately misleading those whom he enjoined to subdue the earth[31]—a task which requires scientific investigation?

To frame creation and evolution as incompatible effectively sanctions the tragic myth of warfare between science and theology, which tends to make its adepts discard either Christianity or reason. An approach which is both theologically and scientifically sound must take natural processes like evolution to be creative tools in God's hand.[32] God does not just occasionally "intervene" in his creation. All that happens is done by God, whether or not science can investigate it. In this sense, all "natural" processes are God's doing.[33]

Furthermore, all "natural" processes are composed of elementary quantum events, and on this level God can select any outcome he chooses, thus invisibly guiding processes composed of any number of elementary events. The outcome of a quantum event is indeterminate. Science can only describe it by a random probability distribution. But God has the freedom to imprint his own special probability distribution on this default,[34] even actively producing extremely improbable designed outcomes. By overriding quantum indeterminacy, his guiding of natural processes remains hidden, undetectable by science.[35] In this way, he preserves the freedom humans need to realize their personality and a genuine love relationship to God.

Was Adam the first human, as traditionally believed? Theoretically, as Rana and Ross show, such a belief can be harmonized with the scientific dating of fossils and artifacts, even if human evolution is rejected.[36] But it has also been shown that God's creative activity can be harmonized both with the personal development of individual humans and similarly with evolutionary origins of humanity.[37] In both cases, "supernatural" processes can go hand in hand with "natural" ones.[38] Thus, we may and we must deal with the evolution of modern humanity. But when did Adam live?

An Early Adam

A biblical definition of the first humans is given in Gen. 1:26–31, particularly in the concept of being created in God's image—which, as such, is of course invisible to science. The image of God, distinguishing humans from animals, however, not only provides us with the possibility of dialog with God, but also with personality, explicitness, conscience, freedom of choice and responsibility, spiritual goals and behavior.[39] Would any of these characteristics show up in the paleontological record? We may look for indicators of behavior presumably presupposing them, such as sacrifices, burials, paintings, figurines, body ornaments, clothing, compound tools and weapons, etc. However, interpreting a possibly spiritual dimension of such archeological finds is notoriously difficult.

Rana and Ross[40] recognize that typically human characteristics go back at least about 50,000 years[41]—which is much earlier than what has traditionally been taken as Adam's time. One also has to verify that all living and historical humans could have descended from first humans as biblically defined. This, as well, probably indicates that these humans lived much earlier than in the Holocene. But Rana and Ross reject human evolution and insist that a first human, Adam, was created *de novo* about 60,000 years ago.

Glenn Morton, on the other hand, accepts evolution of what we call modern humans from earlier forms.[42] He emphasizes that much older archeological finds must be interpreted as indicative of humanity.[43] But believing that the catastrophic filling of the Mediterranean basin five million years ago[44] corresponded to Noah's flood,[45] he places Adam even much earlier than any *Homo* species.

A Late Adam

A different approach was taken by Dick Fischer. Like Rana and Ross and Morton, he accepts the dates given by science. He interprets the "days" of Genesis 1 as long epochs.[46] But he places Adam squarely into the Holocene, at a few thousand years BC.[47] He emphasizes that, "except in obvious instances," the Bible can be taken literally, but translations and traditional interpreta-

tions are sometimes wrong. Some errors can be detected by comparing the text with modern findings.

One obvious example is Noah's flood, which clearly was restricted to Mesopotamia, as shown by plausible correspondences between the Hebrew text and scientific findings.[48] Eden can be localized at the confluence of the four rivers: Euphrates, Hiddekel (Tigris), Pishon (from Saudi Arabia into Kuwait, now blocked by sand dunes), and Gihon (from Iran).[49] It lies on top of 10 kilometers of sedimentary rock, which therefore cannot have been deposited by Noah's flood. The traditional belief in a global flood is mistaken.[50]

The list of the patriarchs from Adam to Noah displays certain parallels to that of the ten pre-flood Sumerian kings found in Mesopotamian cuneiform texts, which points to a partially common historical basis.[51] There are more or less close parallels between the first two kings or patriarchs, as well as between the last four men on both lists, whereas the third to sixth kings bear Sumeric names and show no relationship to the third to sixth Adamite patriarchs. Apparently, Adam lived less than about 7,000 years ago in southern Mesopotamia, together with the Sumerians. Many archeological and biblical hints fit into this pattern of correspondence. So, there were pre-Adamites.

Nevertheless, Fischer wants to keep Adam as the first genuine human. He equates the Adam of Genesis 2–3 with the first humans of Genesis 1. This is the traditional assumption, shared also by Rana and Ross and Morton, as well as most other interpreters. But for Fischer, it has the consequence of having to claim a fundamental distinction between the descendants of Adam and all other humans. He assumes that only Adam and Eve were created "in God's image," and only Adamites were "capable of achieving God's kingdom," whereas non-Adamites only obtain this accountability through hearing the biblical message, and their participation in God's image depends on faith in the Messiah.

But what exactly does it imply to be created in God's image? Here it is important to distinguish between two different meanings of "spiritual" life: (1) in the sense of the spiritual dimension differentiating humans from animals, i.e. God's image,—German *geistig*, and (2) in the sense of eternal life obtained through faith in the Messiah—German *geistlich*.[52] All humans have dimension (1), God's image, but only believers in the Messiah have dimension (2), eternal life, in addition. James apparently attributes God's image to all humans, not just believers.[53] This would contradict Fischer's definition.

John McIntyre, like Morton, accepts both the evolution of humans, defined as being created in God's image, from earlier forms of *Homo sapiens* and the fact that these are much older than the traditional dating of Adam at about 5000 BC.[54] Yet, he also wants to retain Adam as the first human created in God's image. But because Adam's environment depicted in Genesis 2–4 is a Holocene one, he still places him after 9000 BC.[55] According to McIntyre, Adam and Eve became sinners when they acquired the "knowledge of good and evil" by eating of the forbidden tree. This moral knowledge made them responsible, and therefore guilty. All other humans also are sinners, "but sin is not counted where there is no law."[56] He is right in pointing out, as Calvin and others did, that sin cannot be inherited. McIntyre claims that this moral law made possible the organization required for building cities, and that therefore cities are a marker for the propagation of moral knowledge, and therefore of sin, into all continents.

A main motivation for equating Adam and Eve with the first humans of Genesis 1 seems to be the belief in "original sin" (understood in the sense of Erbsünde, *"inherited sin").*

Robert Schneider accepts all archeological indications for early humans and their dating, and that these evolved from earlier forms.[57] Yet, like Rana and Ross, he proposes that God may have "intervened" in a scientifically undetectable way by creating humans in God's image. For Schneider, these were a single pair, Adam and Eve. But like McIntyre, and unlike Rana and Ross, he places them at the beginning of the Holocene, at around 10,000 BC. He claims that those Adamites would have replaced all non-Adamites. He speculates that the Adamites constituted a new species, so that hybrid incompatibility prevented them from having mixed progeny with any non-Adamites.

Both McIntyre and Schneider indicate that Adamites may have reached all continents before the corresponding aboriginals were first contacted by missionaries, eliminating the problem of humans who may not know God's law and would therefore be neither accountable nor in need of a Savior. Unlike Rana and Ross and Morton, McIntyre and Schneider apparently do not judge the archeological indications for self-consciousness and for (possibly degenerated) religion going back to at least 50,000 years ago to be sufficiently relevant for the image of God.

A main motivation for equating Adam and Eve with the first humans of Genesis 1 seems to be the belief in "original sin" (understood in the sense of *Erbsünde*, "inherited sin"). Romans 5:12, "... sin came into the world through one man, and death through sin, and so death spread to all men ...," is interpreted as teaching the

Apparently each proposal, Adam early and Adam late, solves some problems, but each runs into others. ... I shall now propose a fully harmonious interpretation. Three requirements have to be met: (1) Unique focus on God's redemptive plan ...; (2) Plenary inspiration ...; (3) Reliable scientific results ...

doctrine that sin and death came into the (human) world by Adam and that all his descendants inherited sin and death from him. Fischer claims that both Adamites and non-Adamites inherited death from their animal ancestors, but Adam's descendants inherited accountability, and therefore sin, from him.

Full Harmonization

Apparently each proposal, Adam early and Adam late, solves some problems, but each runs into others. Placing Adam early either ignores the biblical environment and Sumerian allusions of the Adam story or assumes unreasonably large genealogical gaps. Placing Adam (taken as the "first man") late ignores the specifically human characteristics of many earlier humans. Even more seriously, the humanity of living humans who did not descend from Adam (also according to Genesis 4–10) is called into question.[58]

I shall now propose a fully harmonious interpretation. Three requirements have to be met:

(1) *Unique focus on God's redemptive plan:* The Bible represents God's revelatory will. Redemption was not an afterthought prompted by someone's fall, but designed from eternity. All of Scripture points to the incarnation of the Son of God, his substitutionary sacrifice on the cross, and his bodily resurrection.[59] All of the OT, from creation to the last prophet, has to be interpreted as God preparing the way for his becoming man. As George Murphy rightly emphasizes,[60] there never were any pre-Fall, sinless and immortal humans, no *Erbsünde* in the sense of inheritance of sin and death from Adam. No created human can have the freedom required for a personal relationship with God and remain sinless. Therefore, the necessity for the Creator himself becoming man to accomplish redemption has been clear from eternity, "before the foundation of the world."[61] Thus, redemption history cannot have two poles, like fall and restoration, but can only have a single focus, the redemption wrought once for all by the Messiah.[62] Adam cannot have any fundamental importance, and there can be no further canonical revelation after the NT.[63]

(2) *Plenary inspiration:* The text has to be interpreted in its full canonical context,[64] assuming a divine inspiration which respects both God's and the prophet's freedom, and excluding mythologizing presuppositions rooted in reductionism. All Scripture, in every detail of the originals, has to be taken as inspired by God. Of course, this does not imply any kind of mechanical dictation view, nor can the fact be ignored that we do not dispose of any of the originals. Therefore, sound text and genre criticism is essential. Details in the original are there because God wants them to be there. He used fallible prophets who may have entertained erroneous views of reality. He did not force them, but gently guided their thinking to formulate, despite their limitations, text which is compatible with his design for revelation. It would be a "literal mistake"[65] for hermeneutics to just consider what the writer himself would have thought, whether the result is young-earth creationism or accommodation to mythology.[66] Placing Adam earlier than a few thousand years BC leads to forced interpretations in early Genesis, and therefore violates Scripture.

(3) *Reliable scientific results:* God's revelation is given not only for the original recipients, but also for humans of all other cultures and all later times, so he is expected to have directed the prophets to use language compatible with reality, avoiding unnecessary offense of later readers. There is sufficient unavoidable offense in the cross of Christ.[67] The biblical concept of genuine prophecy regarding past or future events beyond the ken of the prophet makes it possible that an ancient biblical text is compatible with a reality unknown before the advent of modern science. Language is sufficiently flexible to allow for such compatibility providentially designed by God. Placing the first humans at just a few thousand years BC is incompatible with very reliable scientific results. It violates biblical theology by presenting either God's revelation or his creative maintenance as deceptive.

Thus, (2) requires a late Adam, whereas (3) requires early first humans. These two requirements cannot be brought together—as long as the unbiblical tradition of original sin inherited from Adam is held. Therefore the way out of the seeming deadlock between (2) and (3) is clear: the first humans were early, and Adam has to be placed late. Adam was not the first human created in

God's image. Genesis 1:26–31 does *not* refer to the same events as Gen. 2:5–25.[68]

Humans are three-dimensional, body-soul-spirit beings. As to their bodies and souls (in the sense of sentiency), the first humans arose by "natural" evolution from ancestral primate forms. Then, at a specific point in time, God created them in his image, as far as the (human) spirit is concerned.[69] Much later, one of them, Adam, was chosen by God and given the challenge of proclaiming the kingdom to come, just as Abraham was chosen later. Adam failed, and God changed his covenant with him, in accordance with his eternal preknowledge and predetermined redemptive plan of incarnation and cross.

The first humans were early, and Adam has to be placed late. Adam was not the first human created in God's image. Genesis 1:26–31 does not *refer to the same events as Gen. 2:5–25.*

Various objections have been raised against the idea of pre-Adamites. If there were other humans around, from whom Adam arose, why could he not find a suitable wife? Why did he have to name the animals to search for a suitable partner? Why did God have to "build" one for him out of his rib or side? Why did he call Eve the "mother of all living"?[70]

All this depends on the question of what happened to Adam in Gen. 2:7. He was "formed," not "created." Whereas "forming" implies a preexisting entity, "creating" implies the origin of something out of nothing. Even if the "breath of life" given Adam would imply that he was miraculously created without having parents, it would not necessarily follow that he was the first biblically genuine human created in the image of God. On the other hand, Adam may have had parents and was now given spiritual life in the sense of John 3:16 and 8:56.[71]

Now, if Adam lived among other people when God placed him into the garden and filled him with the "spirit of life," he would quite naturally yearn for a wife who would share this new spiritual life, and when he finally was given one (whether we interpret this event literally or metaphorically), he would joyfully recognize her as a suitable mate. After their fall, God told Satan (the snake) that the "seed" of the "woman" would "crush his head." Adam and Eve appear to have appreciated by faith some of this wonderful messianic prophecy, formulated in quite an unusual way—intimating even Jesus' birth from a virgin. So Adam recognized that Eve would be the typical mother of all who would be spiritually alive, namely "in Christ." When she gave birth to Cain, she may have thought God's promise would already be fulfilled.

Adam's naming the animals has to do with God's charge of having "dominion" over the other creatures, a charge given much earlier to the first humans. But now, Adam is to be able to "take care" of the creation, which implies much more than dominating it and presumably requires, in practice, his intimate spiritual relationship with God. Yet, at the same time, he has to learn that his very personal spiritual yearning for a believing wife cannot be replaced even by his mission of loving the creation and caring for it.

Adam in the New Testament

There is a hermeneutical difficulty with biblical texts about Adam.[72] The designation *'adam* occurs almost six hundred times in the OT. The Greek translation[73] of the OT usually renders it as *anthrôpos* ("human"), and only about forty times as *Adam*, referring to the particular man of this name, a distinction based on the respective contexts. There are a few ambiguous occurrences. In its OT quotations, the NT deals in a similar manner with this word. Are the choices made by the NT authors reliable? The canonicity of the NT would argue at least for a greater reliability than that of our non-inspired judgments regarding the OT text. Furthermore, a prophetic ambiguity may, in particular cases, have been intended by God.

It may be that the NT authors believed Adam to be the first man. Yet none of the NT references to *Adam* requires it. These may be cases of providential compatibility with reality unknown to the writers.

Genealogies containing Adam's name need not concern us, as they just represent quotations of received texts. They do not argue that Adam was the first human. Luke 3:23–38 gives a genealogy, going backwards from Jesus to Adam, who is then linked to God. In Jude 14, Enoch is "the seventh from Adam," referring to the genealogy in Genesis 5. Some genealogies are demonstrably incomplete. Their purpose was to show a significant derivation, but not necessarily a complete line of descent. Even biological descent may not be given, as in the first and the last links in Luke 3: "Jesus ..., being the son (as was supposed) of Joseph, of Heli ..., of Seth, of Adam, of God." Nor does the use of the term "fathered" guarantee biological fatherhood, as shown in 1 Chron. 4:8: "Koz fathered ... the clans of Aharhel, the son of Harum." There is a striking analogy between some biblical genealogies and phylogenetic trees in biology.

In 1 Tim. 2:8–15, Paul deals with the proper behavior of men and women in worship services. He refers to the story

Sin became possible when humans were created in God's image and therefore God-conscious, self-conscious, and correspondingly responsible to God. So "sin came into the world through one man," namely the first one of those created in God's image who sinned, long before Adam.

of Adam and Eve,[74] writing: "I do not permit a woman to teach or to exercise authority over a man; rather, she is to remain quiet. For Adam was formed first, then Eve; and Adam was not deceived, but the woman was deceived and became a transgressor." Apparently, his argument here is typological, Adam and Eve standing for men and women. Although Paul seems to have taken them as historical persons,[75] the text does not imply that Adam was the first human, just that he was formed before Eve, and that Eve was deceived and transgressed before Adam did. Creation is not in view: according to both Gen. 2:7 and 1 Tim. 2:13, Adam was "formed," not "created."[76] Of course, by whatever means Adam was formed, his origin, like that of any other individual human, implies God's creative activity.[77] But in any case, if Paul thought Adam was the first human, God kept him from saying so.

Apart from Luke, Jude, and 1 Timothy, the only NT mentions of Adam (at least in an explicit way) are the ones in Romans and 1 Corinthians, which we now shall consider in detail.

In Adam—In Christ

Romans 5 is not about human origins. Paul dealt with the origin of sin in chapters 1–3. In chapter 5, the focus is on the eternal security of the believer in Christ.[78] Romans 5:12–21 compares the old, fallen humanity with the new, redeemed humanity. Adam, the head of fallen humanity, is a contrasting "type," foreshadowing Christ, the head of redeemed humanity. Adam, the one whose history is given in Genesis 2–3, is a representative of all fallen humans. Similarly, Christ is the real typical man, the representative of all those redeemed by him. Christ represents the redeemed before God's throne in heaven, making intercession for them.[79] God sees all redeemed humans "in Christ," all the unredeemed "in Adam." Just as the redeemed humanity includes all OT and NT saints, so all humans before and after Adam are included in the fallen humanity.

Paul may or may not have thought Adam was the historically first man, but if he did so, God kept him from putting such an opinion down in writing. Eight times in verses 12–21, Paul wrote of the first man through whom sin and death came to all humans:

> ... sin came into the world through one man, and death through sin, and so death spread to all men ... many died through one man's trespass ... the free gift is not like the result of that one man's sin ... the judgment following one trespass ... because of one man's trespass, death reigned through that one man ... as one trespass led to condemnation for all men ... as by the one man's disobedience the many were made sinners ...

There was first a (possibly rather small) population of humans created in God's image, and of course one of these was the first to sin. This was the "one man," through whom "sin came into the world." And all other humans after him trespassed, as well. In none of the eight times Paul here referred to this first man did he explicitly identify him with Adam.

Only verse 14 mentions Adam: "... death reigned from Adam to Moses, even over those whose sinning was not like the transgression of Adam." This can be applied to pre-Adamites, as well. Sin became possible when humans were created in God's image and therefore God-conscious, self-conscious, and correspondingly responsible to God. So "sin came into the world through one man," namely the first one of those created in God's image who sinned, long before Adam. "Sin indeed was in the world before the law was given"—and similarly before God gave Adam the particular law of the Garden of Eden. But "... sin is not counted where there is no law."

Humans varied and increased in their knowledge of God during the course of time, and so did their responsibility. This increase in God-consciousness, of course, is not just "natural" psychological evolution. It is a part of God's revelatory and redemptive history in the "supernatural" spiritual realm. God deals intimately and creatively with each human individual's personal development and opportunities.[80]

Adam received a special calling and law, so his fall was special. He had already been mortal; the death he reaped was spiritual.[81]

And the spiritual death which the first sinner reaped, long before Adam, "spread to all men," not because of Adam, but emphatically "because all sinned" (Rom. 5:12).

Man of Dust—Man of Heaven

Paul's great resurrection chapter, 1 Corinthians 15, is a pointed defense of a real, bodily resurrection[82] against all opponents: "... how can some of you say that there is no resurrection of the dead? ... If in this life only we have hoped in Christ, we are of all people most to be pitied." Adam is named in verse 22: "... as by a man came death, by a man has come also the resurrection of the dead. For as in Adam all die, so also in Christ shall all be made alive." The first sinner is not called "Adam," but "a man."[83] Then Paul contrasts the old, fallen humanity, the representative of which is Adam ("in Adam"), with the new, redeemed humanity "in Christ," as he did in Romans 5. Again, if Paul thought Adam was the first man, God kept him from saying so.

Verses 35–53 explain what a bodily resurrection means, quite practically: "How are the dead raised? With what kind of body do they come?" Again, the human origin is not in view here, but the contrast between the old, "natural" humanity, represented by Adam, and the new, spiritual humanity represented by Christ. Verses 44–49 read, in part:

> It is sown a natural body; it is raised a spiritual body. If there is a natural body, there is also a spiritual body. Thus it is written, "The first man Adam became a living being"; the last Adam became a life-giving spirit ... The first man was from the earth, a man of dust; the second man is from heaven. As was the man of dust, so also are those who are of the dust, and as is the man of heaven, so also are those who are of heaven. Just as we have borne the image of the man of dust, we shall also bear the image of the man of heaven.

Paul quotes Gen. 2:7, "the man became a living creature" (literally "a living soul"[84]), and correctly identifies this man with Adam (the passage quoted does not talk about "creating" Adam, but about "forming" him). Paul contrasts him with the "last Adam," who obviously is Christ. Christ is the typical "man," as God meant man to be. The qualification "last" clearly indicates that no historical consideration is in view here at all, but a theological, typological comparison of the two human collectives represented by Adam, the "man of dust," and by Christ, the "man of heaven." Similarly, Christ being called "the second man" shows that Adam is not called the "first man" in a historical sense. If there is a temporal sequence, it is only in the sense that the collective of fallen humanity logically precedes the collective of redeemed humanity, just as redemption presupposes fallenness. But obviously, the two collectives overlap in time.

Evolved—Then Created

In conclusion, this article demonstrates a possibility of harmonizing a plenary inspiration of the Bible with the findings of science, including the evolution of Adam from earlier humans, as follows:

Inspired by God: God's central revelation is the incarnation, death, and resurrection of his Son. This is the basis of biblical Christianity. A corollary is the plenary inspiration of the sixty-six canonical biblical books (excluding the Apocrypha), as shown by the NT use of the OT.

Literary Genre: Every text has to be interpreted in its full biblical and extrabiblical context, requiring nondestructive text criticism, seeking the original divine revelatory intent in the available text, and respecting the principle that the original and later readers must understand the genre.

Can Different Interpretations be Correct? Genuine, divinely inspired prophecy, as seen in the NT use of the OT, demonstrates that a text can have more than one correct interpretation, including, in principle, compatibility with modern science.

Early Genesis and Abraham: The source-critical hypothesis of the Pentateuch destroys biblical revelation, but is contradicted by its own inconsistency and by more recent archeology. Genesis consists of basically historical traditions transmitted through Abraham and his descendants.

An Individual Adam: Any transition from mythology to history in Genesis is arbitrary. The NT use indicates an individual Adam. This has to harmonize with paleontology and genetics which virtually prove early humans. To forego this requirement of harmony means to question even the theology of Genesis and its sequel.

An Early Adam: The creation of the first humans in the biblical sense is defined by the image of God. Indirect indicators of spiritual, self-conscious behavior, and therefore of humans created in God's image, date back at least 50,000 years.

A Late Adam: Genesis 2–4 places Adam firmly into the Holocene in Sumer. Genesis 6–9 is compatible with a flood restricted to Sumer-Akkad. But the unbiblical doctrine of inherited original sin causes problems for a Holocene Adam as a progenitor of all humans living in historical times.

Full Harmonization: Required conditions are: (1) God's redemptive plan, (2) plenary inspiration, (3) reliable science. Genuinely human pre-Adamites are the solution. God created the spiritual dimension in *Homo sapiens* who inherited the psychological and corporeal dimensions from evolutionary precursors.

Adam in the New Testament: Adam also means "human," but the NT judiciously distinguishes the two meanings. The writers may have believed Adam was the first human, but God kept them from explicitly saying so, even where

they refer to Adam and the first humans in the same context.

In Adam – in Christ: Romans 5:12–21 has been improperly used to fashion the inherited-sin dogma. But neither inheritance of sin and death nor a time sequence is in view, but rather the contrast between two humanities in the context of the security of the believer in Jesus.

Man of Dust – Man of Heaven: 1 Corinthians 15 deals with the glorious resurrection hope of the believers in Christ, not with sin or time sequence. Christ being the "last Adam" and the "second man" would be nonsensical in a context of genetic inheritance or genealogies.

Evolved – Then Created: Biological evolution of humans and historicity of Adam and Eve may be compatible. God's creating humans in his image is placed at whatever time most plausibly fits the paleontological and genetic data, but Adam and Eve lived only a few thousand years BC in Sumer.

This is not claimed to be the only possible interpretation of early Genesis, but a reasonable one if both the Bible and the creation ("nature") are taken to be reliable revelations – different in type and scope, but coming from the hand of the same absolutely truthful Author. He has charged us to take care of the planet on which he has placed us and given us the possibility and ability to do the science required to fulfill this charge. He will therefore not deceive us with apparent properties of his creation which do not correspond with reality. Harmony between his word and his work is not only reasonably to be expected, but it is a theological requirement. ▣

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Notes

[1]Eph. 2:20.
[2]1 Cor. 13:9, 12.
[3]There are about 260 explicit quotations and several times as many allusions.
[4]Ps. 19:6.
[5]Ps. 75:3.
[6]Luke 10:30.
[7]Matt. 3:5–6.
[8]Matt. 12:40; by the way, in biblical languages, a fish was not distinguished from a whale.
[9]Luke 11:30, 32.
[10]P. Rüst, "Accommodationism's Illusion of Solving Biblical Problems," *Perspectives on Science and Christian Faith* [*PSCF* hereafter] 56 (2004): 235–6; www.asa3.org/ASA/PSCF/2004/PSCF9-04Ruest.pdf.
[11]James 5:11.
[12]An outstanding example is Isa. 7:14, as quoted in Matt. 1:23; a sign given to King Ahaz is one correct interpretation, but the incarnation of the "God with us" is a second correct interpretation. The charge that some NT quotations of the OT misinterpret what the original author "intended," has been convincingly refuted by G. K. Beale, "Did Jesus and His Followers Preach the Right Doctrine from the Wrong Texts?" *Themelios* 14 (1998): 89–96; ——, "Right Doctrine from Wrong Texts?" *Themelios* 32 (2006): 18–43.
[13]P. Rüst, "Phenomenological Language in Ancient Revealed Narrative," *PSCF* 58 (2006): 164–5; www.asa3.org/ASA/PSCF/2006/PSCF6-06Ruest.pdf.
[14]A. Held and P. Rüst, "Genesis Reconsidered," *PSCF* 51 (1999): 231–43; www.asa3.org/ASA/PSCF/1999/PSCF12-99Held.html; ——, "Taking Genesis as Inspired," *PSCF* 52 (2000): 212–4, www.asa3.org/ASA/PSCF/2000/PSCF9-00Held.html; P. Rüst and A. Held, "Der Genesisbericht und die Evolution," *Texte aus dem VBG-Institut* 1/03 (2003): 28 S.; www.vbginstitut.ch/uploads/media/INS_TE_03_1_Evolution_und_Genesis.pdf.
[15]P. Rüst, "How Has Life and Its Diversity Been Produced," *PSCF* 44 (1992): 80–94, www.asa3.org/ASA/PSCF/1992/PSCF6-92Rust.html; J. Polkinghorne, "Where Is Natural Theology Today?" *Science and Christian Belief* 18 (2006): 169–79.
[16]O. T. Allis, *The Five Books of Moses* (Phillipsburg, NJ: Presbyterian and Reformed Publishing Company, 1949); E. J. Young, *An Introduction to the Old Testament* (Grand Rapids, MI: Eerdmans, 1989); A. A. MacRae, *JEDP: Lectures on the Higher Criticism of the Pentateuch* (Hatfield, PA: Interdisciplinary Biblical Research Institute, 1994); K. A. Kitchen, *On the Reliability of the Old Testament* (Grand Rapids, MI: Eerdmans, 2003), 241–312.
[17]Or even just the supposedly more "primitive" henotheism, addressing the highest among other gods.
[18]Allis, *The Five Books of Moses*; G. L. Archer, *A Survey of Old Testament Introduction* (Chicago, IL: Moody Press, 1964); G. Maier, *Das Ende der historisch-kritischen Methode* (Wuppertal, Germany: Brockhaus, 1975); R. C. Newman, *Evolution-Religion and the Genesis Account*, Res. Report No. 23 (Hatfield, PA: Interdisciplinary Biblical Research Institute, 1984); E. J. Young, *An Introduction to the Old Testament* (Grand Rapids, MI: Eerdmans, 1989); MacRae, *JEDP: Lectures on the Higher Criticism of the Pentateuch*; R. C. Newman, "Scientific and Religious Aspects of the Origins Debate," *PSCF* 47 (1995): 164–75; A. Rofé, *Introduction to the Composition of the Pentateuch* (Sheffield Academy Press, 1999); Kitchen, *On the Reliability of the Old Testament*.
[19]Kitchen, *On the Reliability of the Old Testament*, 313–72.
[20]Ibid., 421–47: "Later generations might recopy such works ..., but nobody composed them afresh anymore after about 1500" (p. 447).
[21]Ibid., 316.
[22]To claim that Abraham would not have been literate is implausible, as he apparently was highly regarded as a "prince of God" by his contemporaries, Gen. 23:6, even in adjacent countries, cf. Gen. 14:17–21; 21:22–23.
[23]P. J. Wiseman, *New Discoveries in Babylonia About Genesis* (London: 1936); ——, *Clues to Creation in Genesis* (London: Marshall, Morgan & Scott, 1977); ——, *Ancient Records and the Structure of Genesis: A Case for Literary Unity* (Nashville, TN: Nelson, 1985). The eleven occurrences of *toledot* are in Gen. 2:4; 5:1; 6:9; 10:1; 11:10; 11:27; 25:12; 25:19; 36:1; 36:9; and 37:2. There is no twelfth *toledot* for Joseph's history, as he would have written it in the manner customary in Egypt, on papyrus.
[24]All his references are Rom. 5:14; 1 Cor. 15:22, 45; 1 Tim. 2:14, 15.
[25]First mention in Rom. 5:14; first mention in 1 Cor. 15:45; 1 Tim. 2:14, 15.
[26]Second mention in Rom. 5:14; 1 Cor. 15:22; second mention in 1 Cor. 15:45.
[27]1 Chron. 1:1; Luke 3:38; Jude 14.
[28]F. Rana and H. Ross, *Who was Adam? A Creation Model Approach to the Origin of Man* (Colorado Springs, CO: NavPress, 2005).
[29]E. E. Max, "Plagiarized Errors and Molecular Genetics: Another Argument in the Evolution-Creation Controversy," (2002), www.talkorigins.org/faqs/molgen/, updating of an article in *Creation/Evolution* XIX (1986): 34; P. Rüst, "Dimensions of the Human Being and of Divine Action," *PSCF* 57 (2005): 191–201; www.asa3.org/

ASA/PSCF/2005/PSCF9-05Ruest.pdf; ——, "*Dimensionen der menschlichen Natur und des göttlichen Wirkens*" (2006): 16 S.; www.vbginstitut.ch/uploads/media/INS_TE_06_1_Dimensionen.k.pdf.

[30]As our knowledge of complex biological systems is still very far from complete, it is often difficult to be sure a given feature is unnecessary. But an increasingly sophisticated analysis of large numbers of similar cases decreases the importance of this caveat.

[31]Gen. 1:28.

[32]Held and Rüst, "Genesis Reconsidered"; K. B. Miller, ed., *Perspectives on an Evolving Creation* (Grand Rapids, MI: Eerdmans, 2003).

[33]Isa. 45:7.

[34]P. Rüst, "Dimensions of the Human Being and of Divine Action," *PSCF* 57 (2005): 191–201.

[35]P. Rüst, "Creative Providence in Biology," *PSCF* 53 (2001): 179–83; www.asa3.org/ASA/PSCF/2001/PSCF9-01Ruest.pdf; ——, "God's Sovereignty in Creation—A Reply to Howard Van Till," *PSCF* 54 (2002): 216–17; www.asa3.org/ASA/PSCF/2002/PSCF9-02Ruest.pdf.

[36]E.g., Rana and Ross, *Who was Adam?*

[37]P. Rüst, "Dimensions of the Human Being and of Divine Action," *PSCF* 57 (2005): 191–201.

[38]R. J. Russell, "Special Providence and Genetic Mutation: A New Defense of Theistic Evolution," in Miller, ed., *Perspectives on an Evolving Creation*, 335–69.

[39]Rüst, "Dimensions of the Human Being and of Divine Action."

[40]Rana and Ross, *Who was Adam?*

[41]H. Bächler, *Die ersten Bewohner der Schweiz* (Bern, Switzerland: Francke Verlag, 1947), 75–6, 141–54; H. Müller-Beck, "Das Altpaläolithikum," in *Ur- und frühgeschichtliche Archäologie der Schweiz* Vol. I (Verlag Schweiz.Ges.Ur-u.Frühgesch., 1968), 89–106; G. R. Morton, *Adam, Apes and Anthropology: Finding the Soul of Fossil Man* (Dallas, TX: DMD Publishing Company, 1997); P. Yoder, "Will the Real Adam Please Stand Up!" *PSCF* 58 (2006): 99–101; J. P. Hurd, "Reply to the Real Adam and Original Sin," *PSCF* 58 (2006): 102–3; D. Wilcox, "The Original Adam and the Reality of Sin," *PSCF* 58 (2006): 104–5.

[42]Morton, *Adam, Apes and Anthropology.*

[43]G. R. Morton, "Dating Adam," *PSCF* 51 (1999): 87–97; ——, "Language at the Dawn of Humanity," *PSCF* 54 (2002): 193–4.

[44]K. Hsü, *The Mediterranean Was a Desert* (Princeton, NJ: Princeton University Press, 1983).

[45]G. R. Morton, "The Mediterranean Flood," *PSCF* 49 (1997): 238–51; ——, "Noah, From Whence Art Thou?" *PSCF* 53 (2001): 137.

[46]D. Fischer, "The Days of Creation: Hours or Eons?" *PSCF* 42 (1990): 15–22; ——, "Young-Earth Creationism: A Literal Mistake," *PSCF* 55 (2003): 222–31.

[47]D. Fischer, "In Search of the Historical Adam: Part 1," *PSCF* 45 (1993): 241–51; ——, "In Search of the Historical Adam: Part 2," *PSCF* 46 (1994): 47–57; ——, *The Origins Solution: An Answer in the Creation-Evolution Debate* (Lima, OH: Fairway Press, 1996); J. A. McIntyre, "The Real Adam and Original Sin," *PSCF* 58 (2006): 90–8.

[48]Fischer, *The Origins Solution*; C. A. Hill, "The Garden of Eden: A Modern Landscape," *PSCF* 52 (2000): 31–46; ——, "A Time and a Place for Noah," *PSCF* 53 (2001): 24–41; ——, "The Noachian Flood: Universal or Local?" *PSCF* 54 (2002): 170–183; ——, "Qualitative Hydrology of Noah's Flood," *PSCF* 58 (2006): 120–9; A. E. Hill, "Quantitative Hydrology of Noah's Flood," *PSCF* 58 (2006): 130–41.

[49]Gen. 2:10–14; Hill, "The Garden of Eden."

[50]Hill, "The Garden of Eden."

[51]Fischer, *The Origins Solution.*

[52]Rüst, "Dimensions of the Human Being and of Divine Action."

[53]James 3:9.

[54]J. A. McIntyre, "The Historical Adam," *PSCF* 54 (2002): 150–7; ——, "The Real Adam," *PSCF* 56 (2004): 162–70; ——, "The Real Adam and Original Sin."

[55]The Younger Dryas stadial, after the last glaciation, was a brief, cold climate period at the end of the Pleistocene between about 10,700 and 9,500 BC (http://en.wikipedia.org/wiki/Younger_Dryas).

[56]Rom. 5:13.

[57]R. C. Schneider, "Seeking the Emergence of Created Man and Woman," *PSCF* 58 (2006): 196–215.

[58]However, if inheriting just some of Adam's genes would be sufficient, the possibility of a recent Adam being the ancestor of all living humans cannot be excluded, cf. D. L. T. Rohde, S. Olson, J. T. Chang, "Modelling the Recent Common Ancestry of All Living Humans," *Nature* 431 (2004): 562–6.

[59]R. Liebi, *Der Messias im Tempel* (Bielefeld, Germany: Christliche Literatur-Verbreitung, 2003); G. L. Murphy, "Christology, Evolution, and the Cross," in Miller, ed., *Perspectives on an Evolving Creation*, 370–89.

[60]G. L. Murphy, "Roads to Paradise and Perdition: Christ, Evolution, and Original Sin," *PSCF* 58 (2006): 109–18.

[61]1 Pet. 1:18–21.

[62]E.g., Heb. 9:12.

[63]Both would compromise the unique focus on the cross, which was preplanned from eternity and which ushered in the "last days" (Acts 2.17; James 5:3).

[64]G. K. Beale, "Right Doctrine from Wrong Texts?" *Themelios* 32 (2006): 18–43.

[65]D. Fischer, "Young-Earth Creationism: A Literal Mistake," *PSCF* 55 (2003): 222–31.

[66]P. Rüst, "Accommodationism's Illusion of Solving Biblical Problems," *PSCF* 56 (2004): 235–6.

[67]Isa. 8:14; Rom. 9:33; Gal. 5:11; 1 Pet. 2:8; Rüst, "Accommodationism's Illusion of Solving Biblical Problems."

[68]Held and Rüst, "Genesis Reconsidered."

[69]P. Rüst, "Dimensions of the Human Being and of Divine Action."

[70]Gen. 2:18–23; 3:15, 20; 4:1.

[71]Held and Rüst, "Genesis Reconsidered."

[72]The Hebrew *'adam* means "man," in the sense of "human."

[73]The Septuaginta, or LXX, the Greek version of the OT translated between the third and first centuries BC in Alexandria, Egypt, by about seventy Jewish scholars, often used in NT quotations of the OT.

[74]Genesis 2–3, the source Paul quotes, by the way, makes it clear that it would be wrong to accuse him of discriminating against women. The woman's submission under her husband is linked with the fall of both. It may be a remedial help for both. No intrinsic superiority of man is even hinted at. It may even be argued that Paul appears to attribute to Adam a greater misuse of what had been given him (and therefore a greater guilt) than to Eve. At least Adam's was a conscious transgression.

[75]It might be argued that Paul was just referring to Genesis 2–3 as a story written in the Torah, without committing himself as to its historicity, just as the parable of the Good Samaritan was a story invented by Jesus to make a theological point.

[76]Held and Rüst, "Genesis Reconsidered"; Rüst, "Dimensions of the Human Being and of Divine Action."

[77]Rüst, "Dimensions of the Human Being and of Divine Action."

[78]Cf. J. G. Fijnvandraat, *Wiedergeboren in Ewigkeit?* (Schwelm: Heijkoop-Verlag, 1980).

[79]Make intercession, approach, appeal, plead (*entygchanô*), cf. Rom. 8:27, 34; 11:2; Heb. 7:25.

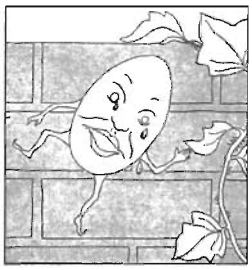
[80]Rüst, "Dimensions of the Human Being and of Divine Action."

[81]He is reported to have lived for a long time after the "day" in which he "shall surely die" (Gen. 2:17).

[82]N. T. Wright, *The Resurrection of the Son of God* (Minneapolis, MN: Fortress Press, 2003).

[83]"For" in verse 22 does not introduce an argument equating Adam of verse 22 with the man of verse 21. It translates the Greek *ôsper gar*, literally "namely [*gar*] exactly like [*ôsper*]," indicating that the comparison being made between verses 22 and 21 is centered on "death" and "resurrection," not on "Adam."

[84]Both Gen. 2:7 and 1 Cor. 15:45 have "living soul."



Article

Extended Humpty Dumpty Semantics and Genesis 1

David F. Siemens, Jr.

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The Bible is often interpreted by making the language say what has been decided on subjective grounds, that is, by going beyond Humpty Dumpty's view of language. The more popular interpretations of the opening passage of Scripture that are currently encountered are described and analyzed. Some, less likely because they are obsolete or uncommon, are also mentioned. Most are incompatible with the Hebrew text.

Humpty Dumpty claimed, "When I *use a word, it means just what I choose it to mean – neither more nor less." The extended version [is]: "When I* encounter *a word, it means just what I choose it to mean."*

The interpretation of Scripture often falls under extended Humpty Dumpty semantics. Humpty Dumpty claimed, "When *I* use a word, it means just what I choose it to mean – neither more nor less."[1] The extended version changes one word: "When I *encounter* a word, it means just what I choose it to mean." Unfortunately, adherents to this stronger claim seem generally unaware of their commitment. Still, it is evident in three common interpretations of Genesis 1,[2] and in others less common.

Genesis 1 presents the story of creation. Five major interpretations are found among American Protestants.[3] The most popular one among current American evangelicals understands events taking place in six normal days, 6–10,000 years ago. Indeed, some insist on the more recent date. This is young earth creationism (YEC).[4]

A second view has the list presenting the order of events that extend back billions of years: days represent sequential ages. This requires that the sequence agree with the history of the universe and, especially, the earth. This view, concordism or old earth creationism (OEC), commonly allows the ages to overlap.[5] Two variants published in *PSCF* cannot be discussed for lack of space.[6]

A third view, once popular, combines elements of the two main approaches. It holds that the universe is ancient, like OEC. However, there was a cataclysmic destruction, so that life had to be re-created a few thousand years ago, like YEC. This gap theory was popularized in the Scofield Bible.[7]

A fourth view representing the six days of Genesis 1 as visions, is compatible with a series of creative acts, like OEC but without the constraints of sequence, and with theistic evolution, a divinely directed evolutionary development of creation, with perhaps a few creative interactions.[8]

The fifth view makes the passage strictly a literary product, a Hymn of Creation, a rewriting of ancient myths to reject polytheism and promote monotheism,[9] specifically the God of the Hebrews.[10] This approach is almost certainly connected to acceptance of organic evolution.

The question I raise is: How compatible is the explicit language of the text with each of these views? I am, in most cases, not discussing the claims of science[11] or technical matters relating to the derivation of the Hebrew terms and their meanings in the light of other ancient languages, though mention of some of these will necessarily be made. My question primarily concerns the language of the biblical texts.

Verses 1 to 5

The first words in Genesis raise a question. Which are we to understand: "In the beginning God created ..." or "When God began to create ..."? Students of Hebrew say that the language is ambiguous. The notion of an absolute beginning, though generally adopted, cannot be proved from this passage. Ancients could have read it as no more

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than the shaping of something available. A phrase from a later period, held by Greek and Roman philosophers, is *ex nihilo nihil fit*, from nothing is nothing made, a flat denial of the very possibility of creation *ex nihilo*. The Hebrew verb, *bara'*,[12] does not necessarily refer to an absolute origin.[13] The former of the two translations is essentially required by both YEC and OEC. Either view fits gap theory, the visions view, or literary construction.

What God created or began to create were "the heavens and the earth." Is this a statement of origin or an introduction to the entire passage?

What God created or began to create were "the heavens[14] and the earth." Is this a statement of origin or an introduction to the entire passage? The common OEC view holds that this refers to the entire universe, including the solar system. As a consequence, the darkness (verse 2) was a local phenomenon. That is, dense clouds surrounding the primordial earth prevented the light of the sun, moon, and stars from reaching its surface. Consequently, the light that appeared on the first day (verse 3) was already there, merely becoming visible at the surface as the earth cooled and the heavy cloud cover thinned. Thus God did not have to establish a boundary (verse 4), for the sun was already lighting just one hemisphere of the rotating earth.[15] This does not fit the text. On the other hand, any of the other four views allow this verse either to be introductory, referring to all that follows, or to indicate the origin of the primordial earth without the extra baggage. However, Scofield takes the OEC view.

Gap theory tends to hold that the first verse presents the creation of all things in perfect form, not formless, void and dark, citing Isa. 45:18 (margin): "He created it not a waste."[16] However, some adherents believe that the earth developed to this excellent state. All hold that this primordial period represents most of the earth's existence. A consequence of either alternative is that "was" in verse 2 must be translated "became." The majority of scholars hold that the specific form of the verb refers to a condition that once existed, but no longer does, making "was" appropriate. Indeed, among thirty-five translations, from the Septuagint and Vulgate to more recent ones in various languages, only one suggests, in a footnote, "or possibly *became*."[17] So the required translation is marginal, but not excluded.[18] I believe that the interpretation was devised to reconcile the geological evidence for an ancient earth with the brief period allowed by the biblical genealogies. However, there is no geological evidence for a break in the sequence of strata that would require such a total re-creation.

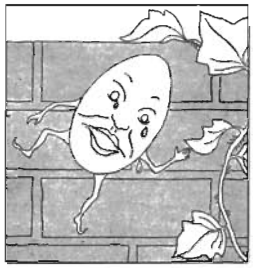
The YEC interpretation, that light was miraculously introduced into dark chaos, does not have the problem that concordism has with a sun before the fourth day. An empty earth was covered with water blown by the divine wind,[19] ruffling the surface. An omnipotent God certainly can produce light without the introduction of a sun. Such a miracle is compatible with the text, though not with anything derived from science.[20] Both the vision view and the literary view, since they do not involve direct causation, meet with no problems on this point.

The phrase, literally "and it was evening and it was morning, day first," (verse 5) is unusual, though a similar phrase is repeated with each of the days except the seventh.[21] The reverse of this evening-morning order is more common.[22] Is this evening-morning sequence used because it is the pattern of the Jewish day, which begins at sundown?[23] This common explanation runs counter to the common usage. A special contrasting hint comes in Dan. 8:14, 26, when it is the time of a vision. This supports the view that we have six visions of God's work rather than either a purely literary arrangement or the actual developmental sequence.

The Firmament

An item noted by some and denied by others in the introductory verses is a connection between the Babylonian mythical monster, Tiamat, and the Hebrew term for "deep," *tehom* (8415). The words are said to be cognate. According to the Babylonian legend, the water monster, Tiamat, terrified all the deities until the hero, Marduk, disabled and killed her and then split her in two. Half became the seas and half became the vault of heaven.[24] This apparently parallels God's act in placing a firmament between the lower waters and the higher waters.[25] But Genesis lacks monsters, fleeing deities, and battles. One deity is in total control, may be the source of all that is, and certainly provides its order. This strongly suggests that the passage is apologetic.

What is the nature of this firmament? Can it be the atmosphere, with the upper waters being clouds? Can it refer to space? The original term for "firmament," *raqia'* (7549) is related to *raqa'* (7554), beaten out. The verb apparently came to be used for anything spread out[26] or stepped on,[27] but at all times it was used for something beaten out.[28] It apparently would not have occurred to the ancient Hebrews to have a spread out gas, let alone space. Every time the word is used, something fairly solid is involved. Almost certainly the only thing of a tenuous sort these ancient Semites recognized was air in motion, that is, the wind or breath. The less common term, *neshamah* (5397 and related words), indicates a puff of wind or breath.



Article

Extended Humpty Dumpty Semantics and Genesis 1

[God placed] a firmament between the lower waters and the higher waters ... What is the nature of this firmament? Can it be the atmosphere, with the upper waters being clouds? Can it refer to space? ... The firmament cannot be either the atmosphere or space, and so cannot be understood in contemporary terms.

The common one, most often translated "spirit," is *ruach* (7307), "wind" or "breath." It has a related verb, "to blow," "breathe," or "smell." It is no wonder that the most ancient translators used *stereõma,* primarily "a solid body," then "foundation" or "basis." The Latin translation is *firmamentum*, "support" or "prop," with the related *firmum* sometimes meaning "immovable."[29]

According to the text, the upper waters were above the firmament. The Hebrew text (v. 7) uses *ma'al,* a preposition, *mi* (4480), "from";[30] plus *'al* (5921), "on," followed by the preposition *le*, "to," "for," or "of," attached to the following word, "firmament" (7549). This is the same construction as Ezek. 1:25: "And *above the firmament* that was over their heads ..." (Italics are mine. Strong here gives a number only to "firmament.") The upper waters are mentioned in Gen. 7:11 and 8:2, as well as in Ps. 148:4. These waters cannot be clouds, which clearly look to be in front of the blue dome, not above it.

Moving ahead, the heavenly bodies were placed "in," "by," "with," or "against" (*be*, the same preposition which begins the chapter, see note 29)[31] the firmament of the sky, *beraqia' hashamayim* (verses 14, 15, 17). To understand this, consider that one can occasionally see Venus during the day, when the blue sky is visible. During part of its monthly cycle, the moon is similarly visible. One cannot look directly at the sun and see it relative to the blue dome, but, as close as one can look, it, along with the moon and stars, appears to be in front of the blue dome. At night, the rising moon appears to be in front of the velvety black dome. The bodies clearly do not look to be farther away than the cerulean bowl. Clouds, of course, are in front of the sun, moon, stars, and blue sky, so they cannot possibly be the waters above the firmament.

Let me underscore this. Anything that looks sky blue, like turquoise, will be opaque or, at the extreme, translucent. Further, something like a transparent pale cobalt glass will make a white object behind it look blue. But the moon and most stars look white, except near the horizon, when they redden. Some, like Mars and Betelgeuse, are always red, a color absorbed by a blue filter. Any simple explanation based on the text therefore has the celestial bodies in front of the dome, not seen through it.

Another mention of the firmament occurs in verse 20. Of that J. Barton Payne wrote:

> The Mosaic account of creation uses *rāqia'* interchangeably for the "open expanse of the heavens" in which birds fly (Gen. 1:20 NASB), i.e. the atmosphere ... and that farther expanse of sky in which God placed "the lights ..."[32]

But, as noted above, the more plausible notion is that the sun, moon, and stars were placed against or by the solid firmament.

The ancients had no notion of indefinite space in which the heavenly bodies could exist. The Hebrew text says birds fly *'al he'erets 'al paniye raqia' hashamayim* (5921, 776, 5921, 6440, 7549, 8064, plus two definite articles) "above the earth and in face of firmament of the heavens," that is, in front of or below the firmament. To understand this, we can look at the use in Genesis of *panim* (6440) with the prepositions. Only three prepositions and two combinations thereof are found with this noun. The first, *le* (basically "to," "for," or "of"), may mean "in front of" a person,[33] or "before" in either time or place.[34] With the name of a place, it means "east of,"[35] though it is not usually alone. The second, *mi*, generally indicates removal from someone's presence.[36] It may also indicate cause.[37] The third, *'al*, normally indicates that something is on a surface,[38] but may indicate presence,[39] direction toward[40] or, like the first, east of.[41] The second plus the first indicates destination toward[42] or away from,[43] as well as "east of."[44] The second plus the third may be translated "in front of,"[45] or "downward," or "away from,"[46] or removal.[47] Faced with these choices, it should be obvious that birds do not fly on the surface of the firmament. "In the presence of" or "east of" make no better sense. But they do fly toward the firmament. There is in the language no "open expanse," but there is the clear indication that birds fly between the earth and sky. Since birds fly below the *raqia'*, it cannot be the atmosphere as Payne claims and the NASB indicates implicitly.

Looking further, fish usually are "of the water (river, sea)"[48] and birds (fowl) are "of the heavens,"[49] never of the firmament.

The phrases use the distinctive Hebrew pattern.[50] Only twice are fish "in the river"[51] and birds "in the heavens."[52] The preposition in these four instances is *be*.

When all these uses are put together,[53] the firmament cannot be either the atmosphere or space, and so cannot be understood in contemporary terms. This eliminates YEC, OEC, and gap theory interpretations. The firmament, which the ancients clearly saw, was not half the body of a monster which had terrified the gods, as the myths of nations to the east claimed. It was rather something that Elohim made with a command to separate two great masses of water.

The lower waters also needed to be controlled. Hence God gathered them together (verse 9) so that the dry land appeared. However, the deep continued to exist.[54] It was considered the source of springs.[55] The ancient view had the disk of land floating on the deep,[56] with the dome of the firmament above and the sea around it. All of this is totally incompatible with the earth orbiting the sun in a solar system located in an arm of the Milky Way, with space extending billions of light years in every direction.[57]

The Sun: Time and Tense

As noted earlier, a characteristic interpretation by the day-age contingent has the sun becoming visible as the primordial dense clouds thinned. Verses 16–18 report that God made two great lights and the stars. The verb in Hebrew is *'asah* (6213), "to make,"[58] in the Qal imperfect tense, the form used throughout the chapter.[59] This is the common narrative tense used to describe past action. However, the OEC interpretation requires the heavenly bodies to be in existence since verse 1. How can we get around this? The OEC answer lies in manipulating the few tenses available in Hebrew. These contrast to the many in English and the modern languages of Europe.[60] The Hebrew imperfect may be translated as the past tense or, if the occasion demands, as the past perfect (pluperfect). So they translate: "God had made two great lights," and so on. Unfortunately, this does not meet the requirement imposed by the meaning of "firmament." Still, it is a possible translation. But does it fit?

One of the characteristics of Hebrew narrative is vav-consecutive (also waw-consecutive), the syllable *va* attached to the first word of a sentence. It is the "and" that starts most sentences in Genesis 1 in the King James version. Modern versions commonly omit it, though occasionally, apparently arbitrarily, they insert it as "then." *Va* occurs elsewhere, as in "formless *and* empty," "*and* darkness" and "*and* spirit of," all in verse 2, for it is the common coordinating conjunction as well. But its occurrence as the first word in every narrative sentence is special. An introduction to Hebrew says:

> It is a stylistic device of biblical Hebrew when narrating a series of past events to begin the narration with an affix form of the verb and to continue it with a series of verbs in the prefix form with vav conversive.[61]

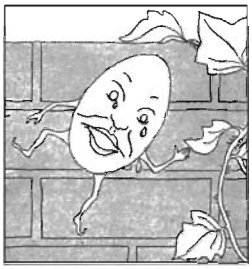
Va and a Qal imperfect, a prefix form, do not begin Genesis 1:1, 2, 15, 22; 2:1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14, 16, 17, 21, 24; 3:1, 3, 5, 7, 15, 16, 17, 18, 19, 23, 24, either because the verse begins a new story or marks a shift from narrative to comment, or because a thought is split between the verse and its predecessor, or a different tense is used.[62] The usage is so consistent that one can almost put "next" where an initial *va* occurs. Since it occurs at the start of every verse from 14 through 19 except where a different form of a verb is used, and since it continues the pattern of both preceding and succeeding verses, there are no reasonable grounds for changing the tense of the verbs in the verses about celestial bodies from past to past perfect. Conformity to contemporary views about the universe is not a reasonable basis for revising the ancient text. The text clearly says that the making and placing of the sun, moon, and stars followed the growth of fruiting trees. Since verse 11 specifies that the seed is in the fruit, these cannot be mosses and ferns.

The Patterns

This sequence fits a clear pattern that supports the notion that we have a literary arrangement in this passage. The two halves of the week are parallel. On the first day, there was light and darkness. On the fourth day, there were lights. On the second day, there was the separation of waters. On the fifth day, God created fish for the sea and birds for the space between the waters. On the third day, there was dry land and seed-bearing plants. On the sixth day, land animals and humankind were created, and fruit from the seed-bearing plants was assigned as their food.

In addition to the literary view, this pattern is compatible with YEC, for God can produce things in any order he pleases. However, the question then arises, why did an almighty God take six days to produce what he could produce instantaneously? This matches the view that Augustine of Hippo, the greatest of the Latin fathers, held, along with numerous others:[63] instantaneous creation of all things, with developmental unfolding of their potential over time.[64] It also fits in with a view he and other church fathers espoused, that the days cannot be literal because the markers were not there until they were made on the fourth day. But one must note that these interpretations are not implicit in the text.

The pattern is also compatible with the view that the six days represent six visions during which God gave the message that he is the source of all things and the one whose word is to be unconditionally obeyed. It is certain that God can arrange his message in a pattern that is satisfying as literature. Additionally, God can present his message within the cosmology of the time, one that has



The view that Genesis 1 is a record of six visions ... matches every positive point of the ... literary view. But it has one added advantage. It gives a clear reason for the evening-morning sequence.

waters under the earth and above the dome of the sky. The one view which does not reasonably fit the pattern of the text is the concordism advocated by OEC.

What about the two minority views? Morton looks for meanings to make the biblical text as close as possible to being literally or historically true. Placing Eden in the dry Mediterranean Basin makes finding supportive or negative evidence difficult. However, this is not affected by the meaning of "firmament." This latter also holds for Fischer, since he attempts to give a "literal" reading of Genesis 1. There are, of course, additional problems.[65]

Conclusions

What does all this mean for each of the five major views? First, YEC requires that the first words be understood as strictly meaning that "in the beginning God created ...," which is not necessarily the way the ancients would have understood them. It has no reason for the evening-morning sequence. It commonly requires a canopy to provide water for the Flood, but does not match the requirements of the text concerning the firmament. It may have a deep under the earth, but only until the chaos of the Flood demolishes it.[66] While it can be consistent with the production of light on the first day and can fit the order of the days, it produces a question about why an almighty God should have taken so long to produce a universe.[67] So there seem to be more problems than solutions, even without considering the scientific evidence that the universe is billions of years old.

Second, like the YEC view, OEC requires the same specific interpretation of the first words of the chapter. It demands that the universe contain a sun and stars at the time of the earth's creation, which runs counter to the need for light to be produced on the first day and the making and placement of lights on the fourth. It gives no proper reason for the less common evening-morning sequence for each of the six days, especially since there is hardly such a daily sequence applicable to ages, where one may speak of the dawn of a new age. The evening of an age is its ending, not its beginning. OEC cannot be made to agree with the biblical description of the firmament and the placement of the heavenly bodies. It does not have a deep under the earth. In its normal interpretation, it does not fit the notion that fruiting plants existed before the celestial lights. But it requires stretching the translation, switching tenses, for the order of the days to come out right. If anything, there are more problems here than with YEC.

Third, gap theory has about half of the problems listed for OEC, plus the requirement that "was" be understood as "became" in verse 2. Beyond the biblical problems, there is the lack of a gap in the geologic record to match the posited destruction of all life on the earth. Indeed, events of the fourth day suggest that the destruction was universal, indicating that there was no earth to refurbish. Since this view adopts the timing of YEC for the re-creation, and the late fossils match current species, gap theory produces more problems than either view just noted.

Fourth, the view that Genesis 1 is a record of six visions allows either translation to the first words. Since it is not a causal description, there is no problem with the original production of light, with the making of the heavenly lights, or with the nature of the firmament. It counters the pagan mythology. It provides a basis for matching the half weeks, for the sequence of events, for the source of springs as viewed in antiquity. In sum, it matches every positive point of the fifth, literary, view. But it has one added advantage. It gives a clear reason for the evening-morning sequence. Neither view has any of the other problems noted in connection with YEC, OEC, or gap theory.

Will this analysis change any minds? Probably not, for the adoption of extended Humpty Dumpty semantics has deep roots. Notions absorbed in childhood and understood as determining one's eternal destiny are altered only with such extreme difficulty that change is unlikely. Only one holding the literary interpretation, which does not have threatening consequences, may easily accept the notion that it seems to be a series of visions. But the six visions may be viewed as part of the literary device. ▣

Acknowledgment

Comments from two reviewers and the editors improved the original version, for which I am grateful.

Notes

[1]Lewis Carroll, "Humpty Dumpty," in *Through the Looking Glass* (Waterville, ME: Thorndike Press, n.d.), 108.

[2]Actually, this must be Gen. 1:1–2:3 or 2:4. Whether the first narrative (1) ends with verse 3, or (2) verse 4 is split, so that 4a goes with the earlier passage and 4b with what follows, or (3) all of verse 4 goes with the earlier passage, does not affect the discussion here.

[3]I refer to recent times. If one goes back several centuries, the most popular view was that God created chaos which, after a longer or shorter period, he formed as described in this chapter. By the eighteenth century most realized that the time frame required more than 6,000 years.

[4]While the several books by Henry Morris are probably best known, the notion goes back to George MacCready Price, who got the view from the Seventh Day Adventist founder, Ellen G. White. Two current sources are www.icr.org and www.answersingenesis.com. Closely connected to this view is the insistence that there was a worldwide Flood a few millennia back, which produced most of the geological strata. This "flood geology" is associated with "creation science." The other views noted in this study hold that any flood had to be localized.

[5]There are a couple of major variants within this general view. One holds that all the individual species, genera or families were divinely created, thus varying the amount of evolution required. See www.reasons.org for an example. Another holds that new genetic material was introduced from time to time, with greater dependence on evolution. What is known as ID (intelligent design) is usually a variant of this general view.

[6]Glenn Morton, "The Mediterranean Flood," *Perspectives on Science and Christian Faith* (*PSCF* hereafter) 49 (June 2001): 238–51; Dick Fischer, "In Search of the Historical Adam," *PSCF* 45 (December 1993): 241–51; 46 (March 1994): 47–57. John A. McIntyre, "The Historical Adam," *PSCF* 54 (September 2002):150–7.

[7]*The Scofield Reference Bible* (1909) was the *de facto* standard in fundamentalist circles for decades. Its view is not a return to the earlier view (see note 3), which began in chaos. This chaos follows ages of development.

[8]On this see David F. Siemens, Jr., "Life: An Analogy Between Views of its Creation and Eternal Life," *PSCF* 55 (2003): 232–8.

[9]Some scholars argue that henotheism rather than monotheism is supported. Arguments for and against this view are beyond the scope of this study. Some also discount the Babylonian connection.

[10]Depending on the date assigned to the composition of the text, some will change "Hebrews" to "Israelites" or "Jews." This does not affect the argument of this study.

[11]Analysis of ID falls mainly in this area, apart from some theological and philosophical problems that have been advanced.

[12]Transliteration of Hebrew words is simplified. Formal usage adds nothing for most of us, and scholars already know the precise spelling.

[13]See, for example, Gen. 1:21; Exod. 34:10; Num. 16:30; Pss. 51:10; 89:12, 47; 102:18; 104:30; Isa. 4:5; 41:20; 43:1, 7, 15; 45:7; 48:7; 54:16; 57:19; 65:17f; Jer. 32:22; Ezek. 21:30; 28:13, 15; Amos 4:13; Mal. 2:10.

[14]*Shamayim*, 8064, is dual in form, though often translated as "heaven" rather than "heavens." Dual forms are used specifically to refer to two objects. For some reason, there are two heavens in both ancient Hebrew and the later Aramaic. It does not fit the notion of the third heaven (2 Cor. 12:2). The numbers given with the Hebrew words are from Strong's *Exhaustive Concordance of the Bible*, convenient for identification even without a grounding in Hebrew. However, Strong's unusual transliterations, which he intended to guide pronunciation, are not followed here, nor are the scholars' distinctions between the several vowels, which may alter with context.

[15]To be precise, dawning and twilight provide light before sunrise and after sunset. Thus there is some light beyond the edges of the hemisphere.

[16]Scofield also notes Jer. 4:23–26 and Isa. 24:1.

[17]New International Version. However, the Spanish equivalent, *Nueva Versión Internacional*, omits this note. It is not in the Authorized Version, to which Scofield's note was appended.

[18]The common claim is that *hayah* (1961) does not mean "became" unless the complement is prefixed with the particle *l-*. However, Paul Seely (personal communication) notes five passages where the obvious translation is "became" without the particle: Gen. 19:26; Exod. 8:17 (Hebrew, v. 13); 1 Sam. 16:21; 22:2; 2 Sam. 8:14 (contrasted with vv. 2 and 6 which have the prefix).

[19]*Ruach* (7307), the Hebrew term, is used for wind, for breath, and for spirit. In all of these usages, there is activity or effect. There appears to be no notion of air or gas except in motion.

[20]This involves a question about how "creation *science*" and "flood *geology*," normal parts of YEC thought, can mesh with the invocation of miracles.

[21]See Gen. 1:8, 13, 19, 23, 31. That some have attempted to translate *'echad.* (259) as "one" rather than "first" is irrelevant. The word is used as both ordinal and cardinal. However, I have encountered some (not Hebrew scholars) who have made a point of this, apparently on the grounds that there could be no time before "day one."

[22]Gen. 49:27; Exod. 18:13f; 29:39; Lev. 6:20; Num. 28:4; Deut. 28:67; 1 Kings 17:6; 2 Kings 16:15; 1 Chron. 16:40; 23:30; 2 Chron. 2:4; 13:11; 31:3; Ezra 33:3; Job 4:20; Pss. 65:8; 90:6; Eccles. 11:6.

[23]See Exod. 27:21; 29:41; Lev. 24:3; Ps. 55:17; Dan. 8:14, 26. Other passages with this order, but probably not bearing on the resolution of this problem, are: Exod. 16:8, 12f; Num. 9:15, 21; 28:8; Deut. 16:4; Esther 2:14; Ps. 30:5; Isa. 17:14; Ezek. 24:18; 33:22; Zeph. 3:3. Note the common usage of "day and night," which runs counter to the notion that the start of the 24-hour period determines usage: Gen. 1:5, 14, 16, 18; 7:4, 12; 8:22; 31:39f; Exod. 10:13; 24:18; 34:28; Num. 11:32; Deut. 9:9, 11, 18, 25; 10:10; 1 Sam. 19:24; 28:20; 30:12; 1 Kings 19:18; Neh. 1:6; Job 2:13; 3:3; Ps. 19:2; 74:16; 77:2; 88:1; Prov. 7:9; Eccles. 8:16; Isa. 28:19; 38:12f; 62:6; Jer. 33:20; 36:30; Hosea 4:5; Jonah 1:17. The reverse order is found in 1 Sam. 25:16; 1 Kings 8:29; Neh. 4:22; Esther 4:16; Isa. 27:3. Morning, *boqer* (1242), is joined to night, *layil* (3915), in Exod. 10:13; Lev. 6:9; Judges 16:2; 19:25; Ruth 3:13; 1 Sam. 14:36; 1 Kings 19:35 Ps. 92:2; Isa. 21:12; Hosea 7:6.

[24]George A. Barton, *Archeology and the Bible*, 7th ed. (Philadelphia: American Sunday School Union, 1937), 287–9. This is from tablet IV of the Babylonian Creation Epic.

[25]Gen. 1:6f. A thorough discussion of the firmament is Paul H. Seely, "The Firmament and the Water Above," *Westminster Theological Journal* 53 (1991): 227–40; 54 (1992): 31–46 .

[26]See Isa. 42:5; 44:24; Ps. 136:6.

[27]See Ezek. 6:11; 25:6; 2 Sam. 22:43.

[28]See Exod. 39:3; Num. 16:19; Isa. 46:19; Jer. 10:9.

[29]*Raqia'* occurs seventeen times in fifteen verses (Gen. 1:6, 7, 8, 14, 15, 17, 20; Pss. 19:1; 150:1; Ezek. 1:22, 23, 25, 26; 10:1; Dan. 12:3). Each occurrence is translated *stereōma* in LXX and *firmamentum* in the Vulgate except that LXX omits the word in Ezek. 1:26. There verses 25 and 26 read loosely, "And lo! A voice from above the firmament that was over their heads, which looked like a sapphire. On it was what looked like a throne, and above the throne was what looked like a man."

[30]One must note that Strong does not normally assign numbers to common prepositions. These two have other functions, which accounts for their numbers. Genesis begins with *bereshit*, where *be* is a preposition, but the number 7225 is only for *reshit*, "beginning." The term *mi* sometimes means "then."

[31]The rest of the phrase is 7549, then the definite article plus 8064.

[32]*Theological Wordbook of the Old Testament* (Chicago: Moody Press, 1980), 862.

[33]Gen. 6:11, 13 (first instance); 7:1; 13:9; 17:1, 18; 18:8, 22; 20:15; 23:12; 24:33, 51; 27:7; 30:33; 47:2, 7; 50:18.

[34]Gen. 10:9; 13:10; 24:7; 24:40; 27:7, 10; 29:26; 30:30; 32:4, 17, 18, 10, 21; 33:3, 14; 34:10; 35:31; 40:9, 43, 46; 43:9, 14, 15, 33; 44:14; 45:5, 7; 46:28; 47:6, 18; 48:15, 20.

[35]Gen. 23:17.

[36]Gen. 3:8; 4:14 (second instance); 16:6, 8; 31:35; 32:31; 35:1, 7; 36:6, 7; 43:34; 45:3.

[37]Gen. 27:46; 41:31; 47:13.

[38]Gen. 1:2, 29; 6:1; 7:3, 18, 23; 8:9; 11:4, 8, 9; 41:56.

[39]Gen. 11:28; 16:12; 17:3, 17.

[40]Gen. 18:16; 19:28.

[41]Gen. 23:19; 25:9, 18.

[42]Gen. 23:4, 8; 50:1, 13.

[43]Gen. 47:10.

[44]Gen. 49:30.

[45]Gen. 23:13.

[46]Gen. 4:14; 44:29.

[47]Gen. 6:7; 7:4; 8:8.

[48]Gen. 1:26, 28; Num. 11:22; Ps. 8:8; Ezek. 47:10.

[49]Gen. 1:26,28, 30; 2:19, 20; 6:7; 7:3; 9:2; Deut. 28:26; 1 Sam. 17:44, 46; 2 Sam. 21:10; 1 Kings 14:11; 16:4; 21:24; Job 12:7; 28:21; Ps. 8:8; Eccles. 10:20.

[50]Western European languages have special forms to indicate possession or use prepositions (the seas' fish or the fish of the sea). Hebrew joins parts together something like the-fish-of-the-sea. The first term in the chain is a pregenetive or construct.

[51]Exod. 7:18, 21.

[52]Deut. 4:17; Prov. 30:19.

[53]Isa. 40:22 may be added. It likens the heavens to a veil or curtain (1852), which could have been thin or gauzy, and to a tent (168), which would have been made from a dark, heavy cloth woven from goat hair. The usual translations of Job 37:18 likens the skies to a cast mirror, which would have been made of bronze. However, the term used, *shechaqim* (7834), usually refers to dust or clouds.

[54]Gen. 7:11; 8:2; 49:29; Pss. 71:20; 135:6.

[55]Ps. 78:15.

[56]Exod. 20:4; Deut. 5:8; Ps. 136:6. See also Deut. 33:13.

[57]There are some who, in biblical grounds, reject Copernicus. See www.fixedearth.com.

[58]This is a common verb of action, more often translated "do." It occurs 2,633 times. For a few of the various senses (not always well translated), note Gen. 1:7, God made the firmament; vv. 11f, trees make fruit; v. 31; 2:2–4, God made all his work; 12:5, Abraham made souls; 18:7f, a young man and Abraham made a calf.

[59]Exceptions are descriptive verbs, like "moved" (v. 2) and the several translated as imperatives.

[60]Ancient Greek had two simple past tenses (plus perfect tenses), imperfect and aorist, corresponding to the modern Spanish imperfect and preterite, or the French *imperfait* and *passé simple.* The former indicates action viewed as continuous; the second, punctiliar. English has only one simple past tense. All these modern languages have several perfect tenses as well as other compound tenses to express temporal relations. English, for example, includes it went, it has gone, it had gone, it was going, it would go, it would have gone, it has been going, it had been going, it would have been going.

[61]Bonnie Pedrotti Kittel, Vicki Hoffer and Rebecca Abts Wright, *Biblical Hebrew: A Text and Workbook* (New Haven: Yale University Press, 1989), 387. "Vav conversive" is their synonym for "vav consecutive."

[62]Obviously, some of the verses listed have a similar indication of the continuity of the narrative.

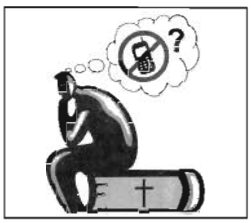
[63]John H. Stek, "What Says the Scripture?" in Howard J. Van Till, et al., *Portraits of Creation: Biblical and Scientific Perspectives on the World's Formation* (Grand Rapids: William B. Eerdmans Publishing Company, 1990), 239, n. 51.

[64]He apparently had not adopted this view in his earliest interpretation of Genesis, *De Genesi contra Manicheos libri II*, written before his ordination. He had adopted it a few years later. See Roland J. Teske, trans., *St. Augustine on Genesis*, vol. 84 of *The Fathers of the Church: A New Translation* (Washington, DC: The Catholic University of America Press, 1991), 164f, 168, 170f, 173.

[65]See, for example, David F. Siemens, Jr., "Is Fisher's Search Misdirected?" *PSCF* 46 (March 1994): 69.

[66]See Gen. 7:11.

[67]Augustine had already suggested that Genesis presented what human beings could understand, not the way God worked. See Teske, *St. Augustine on Genesis*, 175.



Thinking Critically and Christianly About Technology

Ken Funk

To think critically and Christianly about technology is to engage in a process of careful judgment and evaluation of it using Christian principles. The principles proposed here are that technology ought to facilitate (1) communion with God, (2) preservation of human life and improvement of human welfare, and (3) preservation and protection of the natural world. Application of these principles easily yields obvious approbation and disapprobation for technology. Closer examination, however, reveals that technology is ambivalent, it promotes subsidiary goods to primary importance, it contributes to the illusion of human sovereignty, and it is a source of moral distraction. From these and other considerations, it may be concluded that while technology may be intrinsically value-neutral, instrumentally speaking it tends toward evil in the hands of fallible humans. Christians therefore ought to be more prudent in the development, choice, and use of technology.

Ken Funk

Most contemporary thinking is characterized by uncritical approval of technology. Technology is seen as the chief means to the good life, so almost every new, fast, small, cool thing is enthusiastically welcomed and used—until a newer, faster, smaller, cooler thing comes along. One aspect of modernity that is far from dead is the belief that the human condition is humanly correctable and human beings are humanly perfectible, and technology is seen as the key to correction and perfection. Every problem has, it would seem, a technological solution. Even when a problem is associated with technology, that problem can be traced to human incompetence or malice, or just plain bad luck, but in any case, clever innovation will yield a technological solution. When any reflection is given to technology at all, it is judged as value-neutral, critical thought stops there, and the quest for technological progress continues.

Judging by outward behavior, Christian thinking about technology is in complete agreement. In terms of the technologies that Christians choose and use and the patterns of use that they manifest, the daily lives of Christians are largely indistinguishable from those of non-Christians. Even Christian worship is permeated by technology. Although distinct in its substance, the form of contemporary worship, owing to the technologies used and the ways they are used, closely approximates those of secular business, education, and entertainment.

This ought to trouble us, for Paul the Apostle wrote to the new Roman Christians, "... do not be conformed to this world, but be transformed by the renewing of your mind, that you may *prove* what the will of God is, that which is good and acceptable and perfect"[1] He wrote to the church at Thessalonica, "... *examine* everything carefully, hold onto that which is good; abstain from every form of evil."[2] The key verbs in those passages, *prove* and *examine*, are from the Greek *dokimazein*, which means to prove, test, or examine; to hold as good or pure after trial;[3] to accredit,[4] which means to certify as meeting a prescribed standard. In short, it means to be critical. If Christians are to be responsive to Paul's admonitions, they must learn to think critically and Christianly about everything, and not least about technology.

The purpose of this article is to explain what thinking critically and Christianly

In terms of the technologies that Christians choose and use and the patterns of use that they manifest, the daily lives of Christians are largely indistinguishable from those of non-Christians.

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Article

Thinking Critically and Christianly About Technology

Thinking critically and Christianly about technology means careful evaluation and judgment of technology with respect to Christian principles. It means making value judgments about technology from a Christian worldview, and it yields a Christian critique of technology.

about technology would mean, to suggest how it might be done, and to provide some examples of doing it.[6] Thus this article is both a primer on thinking critically and Christianly about technology and a Christian critique of technology. With respect to the latter, it is not the first. Although the critiques of Jacques Ellul[7] and E. F. Schumacher[8] are not distinctively Christian, they reflect Christian principles. Albert Borgman[9] more directly addresses the impact of technology on the sacred, but it is from a mainstream or liberal Christian perspective. On the other hand, Stephen Monsma and the Fellows of the Calvin Center for Christian Scholarship critique technology from a more evangelical or reformed perspective.[10] Their thinking parallels my own in many respects. But my approach is significantly different in a number of ways.[11]

Below, I explain what I mean by thinking critically and Christianly about technology and define technology in several senses. I present three biblical principles and apply them to arrive at some fairly obvious judgments about technology as well as some not-so-obvious observations about how it changes the way we value things in manners inconsistent with those principles. I close with a broad conclusion about technology and some recommendations.

Definitions

By thinking critically about something, I mean engaging in a process of careful, principled judgment and evaluation.[12] It is principled in its articulation and application of a set of axiological principles,[13] and careful in its thorough and systematic use of them and in its precise language. It makes judgments and evaluations of the thing with respect to the principles to produce approbation and disapprobation and, perhaps, intentions and recommendations for behavior consistent with its findings. To think Christianly as well as critically about something means to judge and evaluate it with respect to principles that are distinctly Christian.

Thus, thinking critically and Christianly about technology means careful evaluation and judgment of technology with respect to Christian principles. It means making value judgments about technology from a Christian worldview, and it yields a Christian critique of technology. Put simply, it asks and attempts to answer the question, "From a Christian perspective, is technology good or evil?" That may seem naively simplistic, but it is not. The fact that technology so thoroughly permeates contemporary life requires a thoughtful answer to this very question.

To think critically and Christianly about technology requires a definition of the term. While there are many of them,[14] the essence of technology is, I believe, best captured by a definition based on the term's etymology. The English word is derived from two Greek words, *techne* and *logos*. *Techne* means *art, skill, craft, the way, manner or means by which a thing is gained*.[15] This emphasizes practice or process, especially process in which physical states of the world—configurations of matter, energy, and information—are transformed to ones of greater value: goodness, utility, or beauty. With this emphasis on process involving the artist or craftsman, *techne* is inseparable from the practitioner,[16] and any tools of *techne* are instruments of the practitioner, overcoming his limitations and extending his capabilities to impart value to the world. *Logos* means *word, expressed thought, or reason*, the last sense equivalent to the Latin *ratio*.

From its roots, *technology* may thus be defined as the application of rational methods to extend human capabilities to realize valued states of the material world. It is a means of overcoming human limitations[17] and a practice or process in which its users are intimately involved. An instrument of value creation, technology is therefore an extension of human moral agency. Its application of rational methods distinguishes technology from other human endeavors, such as music and the visual arts, literature and poetry, and sports and entertainment. Although these may utilize technology, they are distinct from it in that they rely on mainly arational methods.[18] Technology's direct effect on the material world also distinguishes it from those processes aimed at achieving emotional or spiritual ends, like art or religion.

The word is commonly used in at least four senses, so to speak more precisely, I will use the following terms. *Technological objects* are the physical and conceptual things (tools, devices, systems, materials, methods, procedures) used as means to realize valued states of the material world. The process of devel-

oping technological objects is *technological innovation*. A *technology*, for example, computer technology, is a subset of technological objects. *Technological practice* is the process of choosing and using technological objects, and involves a reciprocal relationship in which the users of the technological objects affect the objects and the objects affect their users. By use of the unqualified term, *technology*, I mean technology in its broadest sense, encompassing all of these dimensions.

Principles

The Bible contains many references to technology, but they are, of course, to ancient technological objects and practice, and few of them offer any direct approbation or disapprobation. The Bible does, however, speak extensively about value, that is, goodness and morality. Indeed, it proclaims a hierarchy of good and sets forth certain corollary moral responsibilities corresponding to each level in that hierarchy. As technology exists for the realization of valued states of the world and is an extension of human moral agency, the Bible thus provides principles for thinking critically and Christianly about contemporary technology.[19]

There exist very few intrinsic goods,[20] perhaps only three.[21] The supreme good is individual and corporate communion with God. Jesus preached the kingdom of God[22] and told us to seek it first above all else,[23] thus declaring it the highest good, the *summum bonum*. Augustine named eternal life the supreme good,[24] which is consistent with Christ's teaching, for Jesus equates it with being in God's kingdom in the account of the rich young man.[25] Elsewhere in the gospels, eternal life is equated with salvation,[26] knowledge of God,[27] and unity with God through Christ.[28] We usually think of salvation or eternal life as being an individual fellowship with God, but Christ's teachings, especially in the Gospel of John, place such individual fellowship with God in the context of the fellowship of believers. I use the phrase, individual and corporate communion with God, to refer to these equivalent terms. As part of this special relationship we are privileged to have with God, we are to love God with all of our hearts, souls, minds, and strengths[29] and to place nothing before God in importance.[30] We are to acknowledge his sovereignty,[31] to ascribe glory to him,[32] to trust him,[33] to obey his commandments,[34] and to be humble before him.[35]

Below communion with God in the hierarchy of the good are human beings and their welfare.[36] God created man in his own image,[37] thereby giving human beings intrinsic value of great magnitude.[38] Indeed, God valued humans enough to lower himself to redeem them.[39] We are thus to love our neighbor as we love ourselves[40] and to treat others as we wish to be treated.[41] We are to live in righteousness,[42] humility,[43] peace and tranquility,[44] free from anxiety.[45] We are not to live in isolation, but in community.[46]

The natural world and its order and integrity, although lowest in the hierarchy of the good,[47] are nevertheless of great value. God repeatedly declared the lower creation very good[48] and associated with his valuing are certain responsibilities for humans as moral agents. We have been given the cultural mandate to "[b]e fruitful and multiply, and fill the earth, and subdue it."[49] We have also been given dominion over the earth,[50] but that dominion should be one of responsible stewardship[51] and not one of tyranny.

From these three intrinsic goods and their corollary moral responsibilities, John Calvin's admonitions as to "how we must use the present life and its helps,"[52] suggest three principles for thinking critically and Christianly about technology that address its instrumental value[53] in the realization of the intrinsic goods.

Principle 1:
Technology ought to facilitate and not hinder our communion with God and the fulfillment of our moral obligations to him.[54]

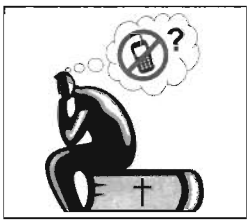
Principle 2:
Technology ought to facilitate and not hinder the preservation of human life and improvement of human welfare[55] *and the fulfillment of our moral obligations to people.*

Principle 3:
Technology ought to facilitate and not hinder the preservation of the natural world and its order and integrity and the fulfillment of our moral obligations to God's lower creation.

When technological practice yields states of the material world manifesting or conducive to these intrinsic goods and helps us in fulfilling these moral responsibilities, the technology involved has positive instrumental value (is good). When the opposite is true, technology has negative instrumental value (is evil). In ascribing value to technology in general, to a certain technology, or to a specific technological practice involving a particular technological object, the greatest weight must be assigned to its contribution to communion with God, lesser weight to its contribution to human life and welfare, and least weight to its effects on the natural world.

Application

Application of these principles easily yields approbation of technology. Sustainable technologies, like biofuels and recycling technologies, reduce our consumption of nonrenewable natural resources (consistent with the third principle). We enjoy longer, healthier, more comfortable lives than did our ancestors, thanks to agricultural, construction, and medical technologies (second principle). From the middle of the first century to today, technological objects, including roads, boats, printing presses, and the internet, have facilitated the spread of the gospel (first principle).



Thinking more critically and Christianly about technology, however, reveals evils of technology more subtle and therefore potentially more dangerous. I will discuss four: (1) the ambivalence of technology, (2) the promotion of subsidiary goods, (3) the illusion of human sovereignty, and (4) technological distraction.

On the other hand, the byproducts of mining, agricultural, materials processing, and manufacturing technologies spoil the earth's land, air, and water, and render many of our remaining natural resources unfit for use (contrary to the third principle). Adverse drug reactions and human errors in the use of medical devices and procedures kill tens of thousands of Americans annually, and agricultural chemicals in soil, air, and water and those remaining on the foods we eat cause environmental illnesses which are sometimes fatal (second principle). Transportation and communication technologies carry messengers and messages contrary, even hostile, to the gospel (first principle).

Approbation and disapprobation like this could go on, and indeed they fill volumes. But even short lists of the obvious good and evil of technology are tedious: obvious good needs no correction and obvious evil is easy to see, if not to avoid. Thinking more critically and Christianly about technology, however, reveals evils of technology more subtle and therefore potentially more dangerous. I will discuss four.

The Ambivalence of Technology

First is the ambivalence of technology, a term coined by Jacques Ellul.[56] Whenever we create a new technology to realize some good, we must expect that it will bring evil too, both intended and unintended.

For example, airliners provide a valuable service to humanity by transporting millions of people quickly, safely, and in relative comfort to their destinations daily. Yet airliners harm the natural environment by producing noise and air pollution. Moreover, every year, around twenty large commercial transport aircraft accidents kill hundreds or thousands of passengers and people on the ground. More frighteningly, airliners were used as weapons in the September 11 terrorist attacks that took thousands of lives.

Another example is found in chemical fertilizers. They make it possible to grow crops in the quantities necessary to feed the world's burgeoning population, yet excessive and indiscriminate use can poison the environment. And in April 1995, Timothy McVeigh mixed chemical fertilizer with racing fuel to make the bomb with which he murdered 168 people in the Federal Building in Oklahoma City.

This pattern is universal: every technology created for good brings evil as well. In most cases, that evil is an unintended consequence of technological practice, but in others, technological objects originally intended for good are used for evil purposes. I can think of no technology that is exceptional in this regard and, therefore, not in violation of at least one of the principles.

The Promotion of Subsidiary Goods

Second, technology promotes subsidiary goods to primary importance, a phenomenon which follows a common pattern. First, the capacity to realize an intrinsic or instrumental primary good is established by a new technology (e.g., cars, computers, or cell phones). Then, gradually, subsidiary goods come to our attention. Subsidiary goods may be valued attributes of the technological objects themselves (e.g., compactness, light weight, versatility, economy, or physical or functional capacity) or valued attributes of the technological practice that yields the primary good (e.g., speed, convenience, efficiency, or economy).

As a result we begin devoting more and more time and resources to increasing the subsidiary goods. We call this "making the technology better" or "finding a better technology": smaller, faster, more powerful, cheaper, more convenient, more efficient, and so on. A point is reached at which we are devoting a disproportionate share of time and resources to increasing the subsidiary goods rather than realizing the primary good. While it is true that making the technology better has at least the potential to increase the primary good indirectly, there is a point of diminishing returns, at which additional time and resources would be more properly spent on realizing the primary good: "better is the enemy of good enough." But by this time it may be too late: the pattern has been set and the quest for the better has become an obsession.

Eventually the subsidiary goods achieve a kind of prominence over the primary good, even though they have no intrinsic or

instrumental value themselves. By virtue of the fact that it manifests them, the technology itself is exaggerated in importance and even takes on a kind of intrinsic value. Technological innovation and practice thus change the way we value away from a manner that is consistent with the three principles. In letting this happen, we may be like the foolish rich man who tore down his barns to build bigger ones and in so doing, forfeited his soul.[57]

The Illusion of Human Sovereignty

Third, technology contributes to the illusion of human sovereignty. God gave us dominion over the earth and we have accepted the role with enthusiasm. With agricultural technologies, we bend the natural world to our will to produce the food and fiber that we consume and wear and with which we shelter ourselves. Drilling and mining machines plumb the depths of the earth and sea for once inaccessible resources. With excavation equipment and explosives, we shape the landscape to make way for buildings and highways. Dams, dikes, and levees channel and control the natural flow of water, and construction and architectural technologies permit us to build houses, communities, and even large cities on sites once subject to frequent flooding.

Technology gives us power over our own bodies. With medical technologies, we have overcome many of the diseases and afflictions that plagued our ancestors. Hair colorings, cosmetics, medicines, and surgical procedures extend at least the appearance of youth. Medicines and surgeries prevent or counteract the undesired consequences of bodily passions, like unbridled sex and overeating. Some of our contemporaries even believe that genetic engineering, nanotechnology, robotics, and other technologies will make us immortal.[58]

Technology also gives us power over others. Locks, security systems, and firearms constrain the behaviors of those who would rob or otherwise harm us. Marketing, advertising, and propagandizing technologies shape economic and other social behavior. Stronger nations impose their wills on weaker nations with information and weapons systems.

It is true that people continue to die of afflictions associated with old age, that cures for certain diseases remain elusive, that insurgents not only survive high-tech weapons attacks but return from them to fight with renewed vigor, and that tsunamis and hurricanes still destroy villages, towns, and even cities. But the tremendous technological progress we have made in the last centuries naturally gives hope that even persistent nuisances like these will be overcome by technology. That, I believe, is not only a false hope, but an impious one.

It is not that these technologies are inherently evil, but that collectively, technology indulges our natural inclinations to put our confidence in ourselves as its creators rather than in God, the Creator of all. When we become ill, do we first turn to prayer or to medicine, or do we even routinely accompany medicine with prayer? Can we be surprised at the depravity around us when we no longer see fit to acknowledge God's sovereignty?[59] Technological practice not only alters the world in obvious ways, it changes us, bringing us to a state of confidence in human sovereignty that is in clear violation of the first principle.

Technological Distraction

Fourth, technology is a source of moral distraction, drawing our attention and effort from higher goods to lower goods. Luke tells of the visit of Jesus and his disciples to the home of Martha and Mary.[60] While Mary sat at the Lord's feet listening to him, Martha became distracted with all the preparations for her guests. She complained about Mary to Jesus, who responded, "Martha, Martha, you are worried and bothered about so many things; but only a few things are necessary, really only one, for Mary has chosen the good part, which shall not be taken away from her." It was not that Martha was doing something inherently evil, for hospitality is obedience to the second greatest commandment[61]; it was that Mary was doing something far better.

We all recognize the alternative described by the commonplace, "the lesser of two evils," as a kind of good. But in the conversation with Martha, Jesus implied what Leibniz later more explicitly declared, that the pursuit of the lesser of two goods, at the expense of the greater, is a kind of evil.[62] And that is often precisely the case with technology: Technological objects distract us from the higher good—especially the *summum bonum* of communion with God—by persistently drawing our attention to lower goods.

Technological objects enable or at least facilitate the realization of many, many goods: food, clothing, shelter, health, knowledge, entertainment, beauty, community—the list could go on forever. But there is a cost of acquiring and maintaining these goods, and that not only monetary. To realize them, we must allocate time and attention to the operation of the technological objects that provide them: cooking utensils, sewing machines, table saws, medical devices, computers, televisions, lawn mowers, and e-mail. Often, owing to their complexity (e.g., computers) or the physical danger they pose (e.g., lawn mowers), the use of technological objects to realize mundane goods requires our undivided attention: when we use them, that use occupies our minds to the extent that our thoughts are not free to rise to higher things.

Article

Thinking Critically and Christianly About Technology

From a Christian perspective, is technology good or evil? ... The inescapable conclusion is that, instrumentally, technology is good, technology is evil, and the tendency of technology, like that of the human heart, mind, and body of which it is an extension, is toward evil.

Using technological objects requires that time and attention also be given to learning about them, acquiring them, learning how to use them, cleaning and maintaining them, and dealing with the undesirable consequences of their use. When we are done with them or tired of them we go to some trouble to dispose of them or give or sell them to someone else. A good deal of time is also spent in teaching others to do these things.

So technological objects both create many opportunities for the good and occupy our time and attention in their use and in their care. This situation is further compounded by the ubiquity of technological objects and their salience: technological objects are all about us and they are often conspicuous in their physical presence, virtually demanding our attention by their sights and sounds. The fact that goods can often be realized more quickly with technological objects than without them (if they can be realized at all without them) induces us to undertake more activities to realize those goods, for we naturally desire the good. The growing list of activities to pursue accelerates the pace of life in general and, in turn, increases the urgency of each individual activity. Unfortunately, even technologies designed to help us manage time more effectively, like electronic calendars, only make matters worse by encouraging us to pack more into each day, thereby increasing the number and urgency of mundane activities even more.

By definition, technological objects directly affect only the material world, so the goods that they provide are predominantly the lower goods, those addressed in principles two and three. Although the use of technological objects can indirectly contribute to the *summum bonum*, communion with God, the vast majority of the activities they support do not. The ubiquity and salience of technological objects and the pervasiveness and urgency of technologically supported activities can easily draw one's attention and time from God and his kingdom to lower things. Technological practice, which involves a reciprocal relationship between technological objects and their users, thus sets up patterns of valuing that are in conflict with the first principle.

Other Evils

Thinking critically and Christianly about technology reveals many other violations of the principles, but space limitations preclude all but the mention of a few of them. For example, technological objects increase the pace and the "busy-ness" of life to the detriment of spirituality.[63] Our present obsession with technological objects amounts to idolatry. Technology fuels the pervasive culture of materialism. The great power that technological objects give us seemingly obviates God's grace. It can lead to a tyrannical dominion of nature.

Conclusion

In the preceding pages, I have explained what I mean by thinking critically and Christianly about technology and have defined technology in several senses. I presented three biblical principles and applied them to arrive at some obvious and some not-so-obvious judgments about technology. To draw a broad conclusion from all this requires an answer to the question, "From a Christian perspective, is technology good or evil?"

Most would dismiss the question with the response that technology is value-neutral. Intrinsically speaking, I would agree, going even so far as to say that, aside from the rare device that is the object of a collector's or fancier's affections, technological objects have no intrinsic value at all. But by the definition I have used, technology considered in all its dimensions has instrumental value and that is how the question must be addressed. The answer has three parts.

From the evidence behind the approbation I have or could have offered, the first part of the answer is that technology is good. From the stated and possible disapprobation, the second part is that technology is evil. The third part of the answer is more difficult. Is technology *predominantly* good or evil, or is there a *tendency* in technological innovation and practice toward good or evil? While I have devoted more words to its condemnation than to its praise, I do not think that we can say that, on the whole, technology is good or that it is evil. Bentham's hedonic calculus notwithstanding, there are simply no metrics that can be

applied across disparate goods and evils, intrinsic or instrumental. But I do believe that there is an axiological tendency to technology that can be induced from the following considerations.

First, we live in a universe that tends to disorder, and disorder is more commonly associated with evil than with good. Technological objects are particularly vulnerable to the disorder of deterioration, which compromises both function and safety.[64]

Second, the human body and mind are fallible, and that leads to errors in the operation of technological objects, often with evil results. We have sensory and perceptual limitations that cloud our awareness. We forget important things to consider and do. We carry a host of cognitive biases that compromise our ability to make sound decisions and judgments. We have limited physical speed, accuracy, and strength that reduce our ability to affect our environments in the ways we intend. These fallibilities[65] manifest themselves not only in the frustrating difficulties we have in the operation of technological objects every day, like problems with can openers and computers, but in large-scale technological disasters like air crashes.[66] Moreover, not only do the fallible human users and operators of technological objects cause unintended evil,[67] fallible designers make design errors that sometimes lead to serious problems.[68]

Third, the human heart is sinful. We know from the Bible and from personal experience that humans are by nature evil,[69] and that evil nature is usually expressed with the aid of technological objects. The September 11 attacks, for example, used Boeing 767s.

Fourth, if Ellul and I are right about the ambivalence of technology, technological practice involving any technology brings evil as well as good. Some of that evil can be anticipated, but there will always be unknowns, evil surprises, as it were. Although some of the evil is intended, in general, most of it is not. For example, automation is often introduced to improve efficiency and reduce human drudgery and error, but automation also puts people out of jobs and sometimes seriously challenges the users and operators that remain.[70]

Fifth, technology amplifies and exacerbates the human tendency toward evil. Technological objects and technological practice set up a milieu that fosters evil behaviors and actually alters our value systems. Technology creates an environment in which speed, power, and efficiency dominate our thinking and the ends to which it propels us become merely matters of personal choice, one being equivalent to any other. Technology's many great successes encourage us to trust in our own capacities to solve our own material problems and to elevate our own material conditions, as if we were independent of God's power and grace. Technology distracts us from the higher good and conditions us to attend mostly to the lower good. Technology not only changes the material world. In these and many other ways, it changes us morally, and not for the better.

The inescapable conclusion is that, instrumentally, technology is good, technology is evil, and the tendency of technology, like that of the human heart, mind, and body of which it is an extension, is toward evil.

Some would challenge the significance of this conclusion, saying that technology's ambivalence and propensity for evil make it no different from any other human institution, like eating, sex, politics, or the university. To a certain extent I agree, but three factors distinguish technology from these other things. First, while most people acknowledge the obvious evil effects of technology, it is not apparent that they are aware of the potentially more dangerous and subtle effects technology has on us and on our valuing. Second, technology is an instrument of virtually all human institutions. Therefore, third, technology as an extension of human capabilities acts as an amplifier and increases the potential for abuse of other institutions.

My conclusion would seem to condemn the whole technological enterprise, including my own career in engineering education and research. But humans were created in God's image[71] and as God is creative, so we too are creative, and technology is a natural and proper manifestation of our creativity. For some of us, responsible technological innovation is a legitimate, even a noble, vocation, as Calvin would say, "a post assigned [us] by the Lord."[72] Technology is required to fulfill the cultural mandate[73] and the great commission.[74] The basic necessities of the world's population could not be met without technology, and technology is used not only out of necessity, but also for legitimate delight.[75]

Recommendations

Thus, to abandon technology completely would not be desirable, even if it were possible. Rather, prudent[76] technological innovation and practice are required. This is not a new idea, for Socrates placed prudence above ingenuity millennia ago,[77] nor is it unique today. E. F. Schumacher,[78] Jacques Ellul,[79] and other critics of technology have said as much in the last few decades, and even technologist Bill Joy recently urged great caution in certain technological innovation.[80]

Here is a great opportunity for Christians to be salt and light in a technological world,[81] for I believe that many of our frantic, disappointed, distressed, debt-ridden, distracted contemporaries are nearly ready for some good examples of technological prudence. Prudent technological practice involving any and all technological objects would be directed by ongoing, careful, and above all, prayerful attention to considerations such as those

Article

Thinking Critically and Christianly About Technology

presented in Table 1, a guide to prudent technological practice.

The guide is not intended to be a rigid framework and it falls short of addressing all of the complexities and subtleties one might encounter in dealing with this difficult challenge. Rather, it is intended as a tool to help one think critically and Christianly about one's technological practices with respect to the principles presented above. The levels of agreement one can give to the assertions in the main part of the guide and, more importantly, the thinking required to make those assessments, should be useful in determining how or even if the practice should be conducted. In most cases, prudence would dictate that some carefully considered limitations be placed on the practice, in terms of function (i.e., for what purposes the practice may be pursued), time (i.e., when it may be pursued), or space (i.e., where it may be pursued).[82]

The challenge of prudent technological innovation is harder, for the Christian innovator (applied scientist, engineer, or inventor) would have to consider the level of

Table 1. A Guide to Prudent Technological Practice

Consider a technological practice involving one or more technological objects and rate your level of agreement with the following assertions. Practice includes acquisition, learning/training, preparation, use, consequence mitigation, and disposal.	SD = Strongly Disagree D = Disagree N = Neutral A = Agree SA = Strongly Agree
1. This practice places me or someone else in physical, mental, or emotional states that, to the best of my understanding, are conducive to communion with God.	SD D N A SA
2. This practice increases someone's awareness and understanding of God and his kingdom.	SD D N A SA
3. This practice does not require time, attention, or resources that I would otherwise devote to God.	SD D N A SA
4. This practice and its intended outcome in no way diminish my trust in God nor my dependence upon him for my or anyone else's spiritual or material good.	SD D N A SA
5. I acknowledge that this practice is possible and effective only through God's sovereignty, power, and grace.	SD D N A SA
6. This practice helps preserve someone's life or promotes someone's welfare.	SD D N A SA
7. This practice does not harm, annoy, or inconvenience anyone.	SD D N A SA
8. In this practice I do not seek power or status over others.	SD D N A SA
9. This practice does not require time, attention, or resources that I would otherwise devote to others, especially those dear to me.	SD D N A SA
10. This practice does not harm the natural world.	SD D N A SA
11. This practice uses amounts of natural resources commensurate with the good it yields.	SD D N A SA
12. If this practice replaces an older one (perhaps in that it involves a new technological object), it is not merely newer, faster, cheaper, smaller, or just more appealing to me. The primary good it is intended for is served much better.	SD D N A SA

If, in the above, the tendency is to ...	then the practice should be ...
(strongly) agree	subject only to normal Christian prudence.
be neutral	subject to functional, temporal, or spatial limitations.
disagree	subject to severe limitations.
strongly disagree	rejected or relinquished.

agreement that potential users of the new technological object would give to assertions such as those in the guide—a truly daunting task. But principled, prayerful thinking about those considerations should be helpful in deciding what to work on—or not.[83] Such thinking might be aided by, for example, something like Failure Modes and Effects Analysis (FMEA), a technique of proven effectiveness in anticipating and avoiding technical problems with devices and systems. A variant of FMEA to facilitate prudent technological innovation might consider failure modes suggested by the assertions in the guide.

Technology, like humans, may be fallen, but I believe that it has a role to play in God's kingdom, and therefore God intends the redemption of technology. If we are to be instruments of that redemption, we must learn prudent technological innovation and practice. For that, we must learn to think critically and Christianly about technology. ▣

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Notes

[1]Romans 12:2. Scripture taken from the *New American Standard Bible*, © 1960, 1962, 1963, 1968, 1971, 1972, 1973, 1975, 1977, by the Lockman Foundation. Used with permission.

[2]1 Thessalonians 5:21–22.

[3]Liddell and Scott, *Greek-English Lexicon* (Oxford: Oxford University Press, 1891/1996), s.v. *"dokimazo"* (δοκιμαζω).

[4]Gerhard Kittel, ed., *Theological Dictionary of the New Testament* II, trans. Geoffrey W. Bromiley (Grand Rapids, MI: Eerdmans, 1964), 255–60, s.v. *"dokimazo"* (δοκιμαζω).

[5]The views expressed in this article are those of the author and are not an official position of Oregon State University.

[6]This article was written by a Christian, primarily for Christians. But, independent of its sectarian Christian perspective, it is intended as an example of thinking critically about technology from the perspective of any worldview. Were a thinker from any of the world's major religions to follow the same approach, I believe that he would reach similar conclusions and recommendations.

[7]Jacques Ellul, a historian and sociologist of institutions and a lay theologian in the Reformed Church of France, certainly wrote *The Technological Society* (New York: Vintage Books, 1964), *The Technological System* (New York: Continuum, 1980), and *The Technological Bluff* (Grand Rapids, MI: Eerdmans, 1990) from a Christian perspective.

[8]A Christian perspective is also clear in E. F. Schumacher's *Small Is Beautiful* (New York: Harper & Row, 1973), which is primarily about economics, but addresses technology in that context.

[9]Albert Borgman gives a thoughtful critique of technology from a mainstream Christian perspective in *Power Failure* (Grand Rapids, MI: Brazos Press, 2003).

[10]Stephen V. Monsma, Clifford Christians, Eugene R. Dykema, Arie Leegwater, Egburt Schurman, and Lambert Van Poolen, *Responsible Technology* (Grand Rapids, MI: Eerdmans, 1986).

[11]I will point out how my approach differs from that of Monsma, et al., *Responsible Technology*, in several subsequent notes.

[12]To some readers, "thinking critically" will immediately suggest the concept of "critical thinking," but critical thinking focuses on developing rational thought processes for arriving at valid conclusions (cf. P. A. Facione, *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction: "The Delphi Report"* [Millbrae, CA: The California Academic Press, 1990]). Critical thinking is thus limited almost exclusively to a logical dimension of thought. But human judgment is not limited to assessing the validity of assertions, and when the apostle Paul wrote of proving and examining, he was not speaking primarily of that. Many, if not most of our judgments are judgments of value. It is value on which I wish to concentrate, so I use the permutation "thinking critically" to distinguish it from critical thinking.

[13]Axiology, from the Greek *axios* (ἀξιος, s.v. "worthy," Liddell and Scott, *Greek-English Lexicon*), deals with value of all kinds, moral (i.e., the rightness of a human action) and non-moral (i.e., the goodness of a thing or condition). Therefore, axiological principles are standards of goodness and morality.

[14]Cf. Martin Heidegger, "The Question Concerning Technology" in *The Question Concerning Technology and Other Essays*, trans. William Lovitt (New York: Garland Publishing, 1977), 3–35; Ellul, *The Technological Society*, *The Technological System*, and *The Technological Bluff*; Ray Kurzweil, *The Age of Spiritual Machines* (New York: Viking, 1999).

[15]Liddell and Scott, *Greek-English Lexicon*, s.vv. *"techne"* (τέχνη) and *"logos"* (λόγος).

[16]That *techne* and therefore technology cannot be separated from the people that apply them, witness the surnames, Smith, Miller, and Carpenter.

[17]I am indebted to Paul Grabow for pointing out the importance of including the extension of human capabilities in any definition of technology (Paul Grabow, "An Alternative to an Instrumentalist View of Technology," paper presented at The Two Tasks National Faculty Leadership Conference, Alexandria, VA, 22–25 June 2006).

[18]A strict philosophical naturalist might argue that Leonardo da Vinci used his rational faculties to paint the Mona Lisa and that the appreciation of beauty in that painting merely reflects certain patterns of neural firings in the observer's brain and thus the masterpiece is technology. Another might say that the running back uses inductive and deductive methods to thread his course through opposing players so that the football he is carrying might be physically placed beyond the goal line and thus football is technology. I think both arguments push the definition a little too far.

[19]Monsma, et al. offer eight normative principles for technology (*Responsible Technology*, 71–5), based on Dooyeward's "modalities" or aspects of reality (Herman Dooyeward, *Roots of Western Culture: Pagan, Secular, and Christian Opinions* [Toronto: Wedge, 1975]). I find an organization of principles based on a biblical hierarchy of value to be more conducive to thinking Christianly about things. Moreover, in my view, Monsma, et al. omit the most important ones or only address them secondarily.

[20]Intrinsic goods are things that are good in and of themselves, that is, ends and not means.

[21]Aside from the three about to be mentioned, certain artifacts like works of art, artistic performances, and buildings may have intrinsic aesthetic value—or they may simply be instrumental to human happiness. I am not prepared to say at this time.

[22]Mark 1:14–15.

[23]Matthew 6:33.

[24]Augustine, *City of God*, XIX.IV.

[25]Mark 10:17–23.

[26]Mark 10:26–27.

[27]John 17:3.

[28]John 14:20; 17:20–23.

[29]Matthew 22:37–38; Mark 12:28–30.

[30]Exodus 20:3.

[31]1 Chronicles 28:9; Job 41:11; Psalm 83:18, 95:4, 103:19, 115:16, 139:16; Proverbs 3:6; Isaiah 33:13; Lamentations 3:37; John 19:11; Romans 1:28, 9:19; Ephesians 2:10, 4:6; Revelation 4:11, 19:6.

[32]1 Corinthians 10:31; Colossians 3:17, 23.

[33]Proverbs 3:5, 7, 13; Isaiah 31:1; John 14:1, 16:33.
[34]Deuteronomy 6:6–8, 11:8; Matthew 5:6, 10; Romans 13:14.
[35]Proverbs 3:34, 27:1; Isaiah 66:2; Matthew 5:3, 5.
[36]Matthew 6:26–30. But by declaring love of neighbor the subject of the *second* greatest commandment (Matthew 22:39), Jesus implicitly placed people and their welfare second in the hierarchy of the good.
[37]Genesis 1:27.
[38]Genesis 1:31.
[39]John 3:16.
[40]Leviticus 19:18; Matthew 19:19, 22:39; Galatians 5:14.
[41]Matthew 7:12, 22:39; 1 Thessalonians 5:15.
[42]Matthew 5:6, 10; Romans 13:14.
[43]Matthew 5:3, 5.
[44]1 Corinthians 14:23; 1 Timothy 2:1–2.
[45]Matthew 6:25; Luke 10:41,12:22-31; John 14:1; Philippians 4:6.
[46]Genesis 2:18; John 17:21.
[47]In the Sermon on the Mount, Jesus affirms the value of the non-human creation, using examples of the birds of the air and the grass of the field (Matthew 6:26–30), but clearly makes it inferior to the value of human beings.
[48]Genesis 1:10, 12, 18, 21, 25.
[49]Genesis 1:28, 9:1, 7; Revelation 21:24.
[50]Genesis 1:26, 28; Psalms 8:6.
[51]Genesis 2:15; Matthew 25:1–13, 14–30; Luke 15:11–32, 19:22–27.
[52]John Calvin, *Institutes of the Christian Religion*, trans. Fred Lewis Battles (Philadelphia: The Westminster Press, 1559/1960), bk. III, chap. X.
[53]Instrumental (or extrinsic) goods are means by which intrinsic goods are realized, directly or indirectly. The extent to which an instrumental good contributes to the realization of an intrinsic good, or to another good instrumental to realizing an intrinsic good, is its instrumental value.
[54]Monsma, et al., *Responsible Technology*, give inadequate emphasis to this principle, their principles focusing primarily on the two lower levels of the hierarchy of the good.
[55]Human welfare includes, but is not limited to safety, health, comfort, happiness, and social integration.
[56]Ellul, *The Technological Bluff*.
[57]Luke 12:16–21.
[58]Ray Kurzweil, *The Singularity is Near* (New York: Viking, 2005).
[59]Romans 1:28.
[60]Luke 10:38–42.
[61]Matthew 22:39.
[62]"For as a lesser evil is a kind of good, even so a lesser good is a kind of evil if it stands in the way of a greater good ..." (Gottfried Leibniz, *Theodicy: Essays on the Justice of God and the Freedom of Man*, trans. E. M. Huggard [London: Routledge & Kegan Paul, 1951], Part 1, sec. 8).
[63]In Daniel 12:4, the prophet wrote "... until the end of time; many will go back and forth and knowledge will increase." I am not sure if there is a principle for us here or, if so, what it is. But Daniel seems to have described our time quite well.
[64]Examples of the evil effects of disorder in technological practice are plentiful in commercial aviation, one case in point being Alaska Airlines flight 261, 31 January 2000, where the deterioration of a horizontal stabilizer trim system component led to loss of control in flight. The ensuing crash into the Pacific Ocean off the California coast killed 88 passengers and crew (National Transportation Safety Board, *Aircraft Accident Report, Loss of Control and Impact with Pacific Ocean, Alaska Airlines Flight 261 McDonnell Douglas MD-83, N963AS, About 2.7 Miles North of Anacapa Island, California, January 31, 2000* [Washington, DC: National Transportation Safety Board, 2002, http://www.ntsb.gov/Events/2000/Aka261/default.htm]). Another example is TWA flight 800, 17 July 1996, where ignition of the flammable fuel/air mixture in a fuel tank caused an explosion that destroyed the aircraft over the Atlantic Ocean east of New York, and killed all of its 230 passengers and crew (National Transportation Safety Board, *Aircraft Accident Report, In-flight Breakup Over the Atlantic Ocean, Trans World Airlines Flight 800, Boeing 747-131, N93119, Near East Moriches, New York, July 17, 1996*, NTSB/AAR-00/03 [Washington DC: National Transportation Safety Board, 2000, http://ntsb.gov/Publictn/2000/AAR0003.pdf]). Most of my examples of technological disasters are chosen from aviation, for much of my research career has been devoted to aviation safety. Moreover, aviation, which is relatively quite safe, serves to illustrate the point that even when we are incredibly careful in technological innovation and practice, as we are in air transportation, bad things still happen.
[65]Francis Bacon enumerated several of these fallibilities as his "idols of the tribe" in aphorisms 45–52 in Book I of *Novum Organum* (New York: P. F. Collier & Son, 1900). More up-to-date and better attested summaries are presented by C. D. Wickens and J. G. Hollands (*Engineering Psychology*, 3rd ed. [Upper Saddle River, NJ: Prentice Hall, 2000]).
[66]Considering human fallibility and error, here again aviation provides examples, one being the loss of Eastern Airlines flight 401 in 1972, where the flight crew became distracted by an equipment problem and allowed the aircraft to descend into the ground. The crash killed 99 passengers and crew and injured 75 more (National Transportation Safety Board, *Aircraft Accident Report: Eastern Airlines, Incorporated, L-1011, N310EA, Miami, Florida, December 29, 1972*, PB-222 359 [Washington: National Transportation Safety Board, 1973]). The worst aviation disaster in history, in which two Boeing 747s collided on a runway at Tenerife, Canary Islands, killing 583 passengers, was precipitated by a miscommunication between a tower controller and a pilot. (Flight Safety Foundation, AviationSafetyNetwork database [http://aviation-safety.net/database/record.php?id=19770327-0] and [http://aviation-safety.net/database/record.php?id=19770327-1], last accessed 5 July 2007).
[67]To generalize the aviation examples given so far, more than 60% of aircraft accidents are due primarily to pilot error (Boeing Commercial Airplane Group, *Statistical Summary of Commercial Jet Airplane Accidents, Worldwide Operations, 1959-2004* [Seattle, WA: Boeing Commercial Airplane Group, 2005]). As cited in the text, between 48,000 and 98,000 Americans die each year due to medical errors (L. T. Kohn, J. M. Corrigan, and M. S. Donaldson, eds., *To Err Is Human: Building a Safer Health System* [Washington, DC: Institute of Medicine, 2000]). The great technological disasters of the twentieth century—including the Titanic, Tenerife, Three Mile Island, Chernobyl, and Bhopal—were all due largely to human error.
[68]The in-flight loss of control of China Eastern Airlines flight 583 in 1993 (two fatalities, 149 injuries, major damage to the aircraft) was due in part to the flawed design of a flight deck control lever (National Transportation Safety Board, "Brief of Accident DCA93MA037" [Washington, DC: National Transportation Safety Board, 1994, http://ntsb.gov/ntsb/GenPDF.asp?id=DCA93MA037&rpt=fi]). The losses of Alaska Airlines flight 261 and TWA flight 800 can be partly attributed to design deficiencies as well.
[69]That human nature is evil is said to be the only empirically verifiable claim of Christianity. There is certainly ample biblical authority for it. Genesis 3, 6:5, 8:21; 2 Chronicles 6:36; Psalms 51:5, 143:2; Ecclesiastes 7:20, 9:3; Isaiah 53:6; Jeremiah 17:9; Matthew 12:34; John 3:19; Romans 3:23, 5:12; Galatians 5:17; Ephesians 2:3.
[70]Computer-based aircraft automation was introduced in the last decades of the twentieth century in large part to reduce pilot error, which was always a major cause of aircraft accidents. This was partially successful in that certain kinds of navigational and flight control errors were virtually eliminated by flight management systems and advanced autopilots. But new, unexpected and significant errors emerged as a consequence. For example, autopilots were introduced that provide a variety of ways to control an airplane's flight path. These require the pilots to select a mode of operation, then set one or more parameters. In 1992, while approaching Strasbourg, France, for a landing, the flight crew of an Air Inter Airbus A320 selected an autopilot mode then set the autopilot parameter for a *different* mode, causing the aircraft to descend more rapidly than appropriate and impact the ground short of the runway, killing 87 passengers and crew (Investigation Commission of Ministry of Transport—France, *Rapport de la Commission d'Enquete sur l'Accident survenu le 20 Janvier 1992 pres du Mont Sainte Odile (Bas Rhin) a l'Airbus A.320 Immatricule F-GGED*

Exploite par lay Compagnie Air Inter, official English translation from the Ministere de l'Equipement, des Transports et du Tourisme, France, Ministere de l'Equipement, des Transports et du Tourisme, [Paris, France: Investigation Commission of Ministry of Transport—France, 1993]). Newer aircraft automation allows the navigation systems to be pre-programmed to fly a specific route. In 1979, a DC-10's navigation system was programmed to fly a new route for a sight-seeing tour over Antarctica and the plane's crew was not informed of the change. They permitted the aircraft to fly into a mountain, destroying the airplane and killing all 257 people on board. (Flight Safety Foundation, AviationSafetyNetwork database [http://aviation-safety.net/database/record.php?id=19791128-0]). Automation-related errors like these, though they could in principle have been foreseen, were not anticipated to the extent that effective countermeasures were introduced to prevent them.

[71]Genesis 1:27.

[72]John Calvin, *Institutes of the Christian Religion*, III.X.VI.

[73]Genesis 1:28.

[74]Matthew 28:19–20.

[75]Ecclesiastes 2:24–25, Calvin, *Institutes of the Christian Religion*, III.X.I.

[76]Proverbs 22:3; Luke 14:28–32; 1 Timothy 3:2. To be prudent is to exercise restraint. "Prudence differs from wisdom in this, that prudence implies more caution and reserve than wisdom, or is exercised more in foreseeing and avoiding evil, than in devising and executing that which is good" (Noah Webster, *An American Dictionary of the English Language*, facsimile ed. [San Francisco: Foundation for American Christian Education, 1828/1967], s.v. "prudence").

[77]Of Socrates, Xenophon wrote: "Skill in speaking and efficiency in affairs, therefore, and ingenuity, were not the qualities he was eager to foster in his companions. He held that they first needed to acquire prudence. For he believed that those faculties, unless accompanied by prudence, increased in their possessors' injustice and power for mischief" (Xenophon, *Memorabilia*, IV.III.I). In Xenophon's accounts of Socrates in *Memorabilia* and *Oeconomicus* may be found more ancient wisdom for our times.

[78]Schumacher, *Small Is Beautiful*.

[79]Ellul, *The Technological Society*, *The Technological System*, and *The Technological Bluff*.

[80]Bill Joy is co-founder and chief scientist of Sun Microsystems, a firm that has played a major role in the development of the internet. In a controversial critique of technology, Joy wrote: "And if our own extinction is a likely, or even possible, outcome of our technological development, shouldn't we proceed with great caution?" ("Why the Future Doesn't Need Us," *Wired* 8.04, [http://wired.com/wired/archive/8.04/joy.html]). Joy was reacting to Ray Kurzweil's *The Age of Spiritual Machines*, which describes a "utopian" future where we achieve a happy immortality through genetic engineering, nanotechnology, and robotics. Based on Joy's experience with the fragility of engineered systems, he is not optimistic that things will go as well as Kurzweil expects.

[81]Matthew 5:13–16.

[82]For example, at present, I use the internet almost exclusively for my work and almost always in my office, and I do not use a cellular telephone at all. I do not mean to imply by this that all Christians should do likewise.

[83]For example, a Christian electrical engineer employed in the design of expensive, high-end consumer electronics might become increasingly concerned about the assessments potential users of the devices would have to give to considerations 1–5 and 9–12. A growing awareness that the benefits of the new technologies (consideration 6) would accrue almost exclusively to wealthy, privileged users might ultimately persuade him to take a job opportunity to design control systems for small-scale, solar- or biofuel-powered electrical generating equipment for small communities in under-developed nations. By this I do not mean to trivialize the genuine difficulties of a mid-career professional facing such a dilemma nor do I urge that anyone use this as a literal model. Equally plausible and less extreme measures are possible. For instance, while my earlier research was directed to military technology, I have been fortunate to be able to focus my more recent innovative activities on understanding and mitigating the ill effects of human error in civil aviation and medicine.

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Paul F. Lurquin & Linda Stone, *Evolution and Religious Myths: How Scientists Respond*, Oxford University Press, 225 pages, 2007

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Phil Mundt, *A Scientific Search for Religious Truth*, Bridgeway Books, 485 pages, 2007

Jay Newman, *Pious Pro-Family Rhetoric: Postures and Paradoxes in Philosophical Perspective*, Peter Lang, 200 pages, 2007

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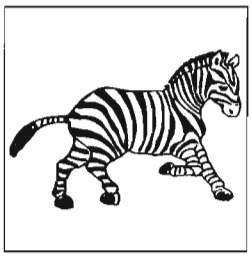
Michael Windelspecht, *Genetics 101*, Greenwood Press, 195 pages, 2007



I Think He Made Zebras by Hand

Dorothy M. Wedemeyer

In the opalescent evening
Of the Seventh Day
When God had sent the universe
Out and far away,
Then I think He made zebras by—hand.

Made a little zebra
(made tens and tens of him).
Striped his hide in black and white,
Varied him in dark and bright,
And set him in the grasses
With the wind.

Wild was he and fractious,
No beast of burden he.
Made to gallop in the grasses
On the plain.

Natty little zebra,
Feet with echoes shod
You're printed with the
Finger marks of God.

Dorothy M. Wedemeyer *was born in Albany, Missouri, in 1913. Although she leaned toward the liberal arts from an early age, she also had an interest in science, and today numbers a marine biologist, chemical engineer, physician, and computer scientist among her children and grandchildren. After raising her family, including ASA member Gary A. Wedemeyer, she published her first poetry at the tender age of 80. Now 93, her poem "I Think He Made Zebras by Hand" reflects her continual sense of wonder at the workings of God in nature.*

"Both his divine power and divine nature have been clearly seen in the things God has made ..." Romans 1:20.

From Scientific Method to Methodological Naturalism: The Evolution of an Idea

Harry Lee Poe and Chelsea Rose Mytyk

In response to the appearance of Scientific Creationism and its growing popularity in conservative Protestant circles in the 1960s, Paul de Vries proposed a way of thinking about the scientific enterprise that he named "methodological naturalism." As a professor of philosophy at Wheaton College, de Vries found himself at the intellectual center of American evangelicalism and sought to offer his students an alternative to Scientific Creationism on the one hand and "evolutionistic scientism" on the other, both of which de Vries thought distorted science and manipulated faith.[1]

The term *methodological naturalism* first appeared in print in "Naturalism in the Natural Sciences," an article written by de Vries that appeared in *Christian Scholars Review* in 1986. De Vries had used the term for many years in his classes and in conversation with his colleagues at Wheaton before publishing his article. Since the publication of the article, the term "methodological naturalism" has gained some acceptance in the scientific, theological, and philosophical communities that deal with science and religion. The term is used by physicist-theologian Robert Russell who approves of it, and mathematician-philosopher William Dembski who disapproves of it.[2] Karl Giberson and Donald Yerxa have argued that the term is the focus of a quarrel within the Christian community, but that "the quarrel over methodological naturalism and theistic science does not engage the average scientist in a lab coat ..."[3]

Partisans in favor of the concept include Richard H. Bube, Denis Lamoureux, Howard Van Till, Keith B. Miller, and Robert O'Connor.[4] Opponents include Alvin Plantinga, J. P. Moreland, and Stephen C. Meyer.[5] This group of opponents reject the concept primarily because it leaves no room for direct action by God in science. They would like for science to include ultimate or final causality as well as immediate causality. They write as though the suggestion that science should only deal with immediate causality represents a modern innovation, when science, as Francis Bacon (1561–1626) defined it in *Novum Organum*, does not deal in final causes.

Technically speaking, the word "science," coming from the Latin word *scientia*, originally meant "knowledge." When the medieval scholastics spoke of theology as the "queen of the sciences," they spoke of all the realms of knowledge. The meaning of words, however, changes over time under the influence of the forces of culture, including different philosophical understandings. For Plato, sensory knowledge was merely opinion, but for Aristotle it was the surest form of knowledge. Since the Middle Ages, under the influence of Aristotle's view of knowledge filtered through the thought of Thomas Aquinas, the word "science" has come to mean sensory knowledge. Since the nineteenth century, the word has been used for what was once known as natural philosophy. Over time, natural philosophy came to be called natural science, and natural science was shortened simply to science.

Harry Lee Poe

Chelsea Rose Mytyk

ASA member **Harry Lee Poe** *serves as Charles Colson Professor of Faith and Culture at Union University in Jackson, Tennessee. He has published several books on science and religion, including* Designer Universe *and* Science and Faith: An Evangelical Dialogue *with Jimmy Davis and* What God Knows: Time and the Question of Divine Knowledge *with Stan Mattson. In his spare time, Poe serves as president of the Edgar Allan Poe Museum of Richmond, Virginia.*

Chelsea Mytyk *graduated in 2006 with a BS in biology from Union University where she attended as a Provost Scholar. As an undergraduate, she was president of Sigma Zeta national science and mathematics society and was honored as outstanding biology student her senior year. She studies medicine at the University of Missouri School of Medicine and intends on pursuing her interests in surgery, studying the relationship between science and faith, and providing healthcare to the underserved.*

Communication

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Science does not exclude other forms of knowledge, but science is only qualified to describe what it can learn through sensory observation. Even if God acts directly in the physical world, science is left to describe what it can physically observe, not what the scientist believes to be the ultimate cause of the observation. People may believe that God knitted them together in their mothers' wombs on the authority of Scripture. To be science, however, it is necessary to describe what that knitting looks like physically in the body. Oddly, those who debate the value of the term do so without reference to de Vries, the article in which he introduced the rationale for the term, or Bacon and his scientific method. Instead, they speak vaguely of "science."

Perhaps of equal significance with those who disagree about the term are those who discuss the issues related to methodological naturalism, but who do not use the term. We have not found that John Polkinghorne, Arthur Peacocke, Stephen Jay Gould, Richard Dawkins, Russell Stannard, or Paul Davies use the term. Some use other terms. Peacocke speaks of "theistic naturalism" by which he means that God is actively "creating ... through what we call 'chance' ..."[6] Giberson and Yerxa speak of "methodological agnosticism."[7] On the other hand, Plantinga, citing Basil Willey, characterizes methodological naturalism as "provisional atheism."[8]

In "Naturalism in the Natural Sciences," de Vries claims that methodological naturalism is only "a matter of disciplinary method" and is an entirely different entity than the metaphysical Darwinian naturalism.[9] He completely separates methodological naturalism from metaphysical naturalism:

> Methodological naturalism is quite different from metaphysical naturalism. Metaphysical naturalism is a philosophical perspective that denies the existence of a transcendent God. Methodological naturalism does not deny the existence of God because this scientific methodology does not even raise the question of God's existence. Unfortunately, these two kinds of naturalism have often been confused. As a result, it has seemed to the philosophically careless as if the natural sciences under the guidance of methodological naturalism have provided evidence for metaphysical naturalism. This confusion is regrettable and certainly inexcusable.[10]

De Vries goes on to warn us not to get caught up in "language games" and reminds us that contradictions or semantics should not detract from the essence of the idea. He insists that Christians need to be "enthusiastic supporters of the naturalistic methodology of the natural sciences."[11] Through this methodology, we can uncover many of God's mysteries and give him praise. However, de Vries cautions that while immersed in the natural sciences, we should not be distracted by "theological or philosophical speculation."[12] He emphasizes that, "a naturalism that is a matter of method still leaves all the philosophical and theological questions completely unanswered."[13] Methodological naturalism has its limits and will always fail to answer the big "Why?" questions, while it more readily answers the "How?" questions.

The natural sciences must be regulated by methodological naturalism, but outside of those disciplines methodological naturalism is "a disaster."[14] As much as de Vries is concerned by the approach of Scientific Creationism and evolutionistic scientism, he has an equal concern over the inappropriate efforts to apply the scientific method to disciplines outside the sciences. He believes that methodological naturalism will prevent the scientific method from being "pushed into fields in which it is not competent."[15]

Francis Bacon's Scientific Method

In the science and religion dialog, the term "methodological naturalism" refers to the need for science to proceed as though God did not exist, or at least as though God has no part to play in the physical world. The term serves to remind scientists and theologians of the need for objectivity in research. The reason for using a term like "methodological naturalism" is to create a neutral mindset that leaves theological consideration out of science. But is "methodological naturalism" a neutral term that promotes objectivity? In fact, might the term actually undermine Bacon's aspirations of a scientific method free of metaphysical prejudices?

The great advance in knowledge of the physical world that has come to be called "science" came with a great explosion at the beginning of the seventeenth century. A trickle of ideas related to the motion of the planets had seeped out of the late Middle Ages through people like Copernicus and Kepler, but the great surge began with Bacon's proposal for a new disciplined method for the study of the physical world. Bacon recognized that the development of what we would now call scientific knowledge could not proceed as long as scientists continued to rely on the metaphysical foundation of the Greek philosophers. Though most of the sciences came from the Greeks, Bacon observed that Greek learning tended to be "rhetorical" rather than experimental, that the pursuit of truth involved disputation, and that the philosophers "were too susceptible to the ambition and vanity of founding a sect and winning popular favour."[16]

Through a process of logic based on philosophical premises, Aristotle and other Greek philosophers had explained how the physical world "works." Aristotle explained the absolute time, the infinite space, and the eternal matter of the world. He explained the perfect, spherical shape of the heavenly bodies and their perfect, circular orbits based on his understanding of the Unmoved Mover. Aristotle's god was Narcissus who spends eternity contemplating his own beauty while the whole universe revolves around him. In the late Middle Ages, science meant making one's observations fit the metaphysical system of Aristotle. Bacon did not propose his new method to rid science of God, because God had not caused any problems with the advance of knowledge. Rather, Bacon conceived an approach to the study of how the world works based on observation rather than metaphysical ideas. Space does not allow an examination of the related contemporary debate over whether a scientific method actually exists, but the existence of the debate illustrates how the philosophical debates of the humanities have filtered over to the natural and social sciences.

Bacon distinguished between categories of causes for phenomena. Metaphysics speaks to final or ultimate causes, but observations of the world itself tell us about the immediate causes within the world of experience. Metaphysical ideas were not seen as conflicting ideas so much as they were seen as ideas that touched on a different level of experience. On the other hand, Bacon clearly believed that some metaphysical ideas were wrong. Galileo came to this same conclusion about the same time with regard to Aristotle's account of the heavens. Yet, the scientific method rests on several huge metaphysical assumptions that derive from biblical faith: (1) a real world exists that can be known through the senses, and (2) this world has such an order about it that its patterns can be described and predicted in such a way that they might be called "laws." The distinction between Bacon's metaphysical assumptions and those of the scholastics is that Bacon's assumptions did not contain specific explanations of how the world works. For Bacon, belief in the Creator in no way constricted what he might discover about how the world works.

Metaphysical Connotations of Naturalism

Though de Vries would prefer that we not play word games over the use of the term "naturalism," words are the tools we have for communicating ideas, and they cannot be ignored. Can naturalism be described as a method for pursuing scientific understanding without involving the metaphysical connotations with which the word has always been associated? In fact, the word group nature/natural/naturalism represents a tradition of Western thought ripe with latent philosophical and theological implications.

The word "nature" is a poetic synonym or metaphor for the physical world of phenomenological experience with a number of metaphysical connotations not found in the more scientific term "physical." The habit of referring to physical reality or the material world as "nature" grew out of the allegorical poetry of the Chartres school of poets in the fourteenth century. In a period in which Aristotelian philosophy was on the rise, the Chartres school held to the Platonic view of the world that had dominated before the eleventh century. They reconciled Genesis and Plato's *Timaeus*, reverencing the material world and studying it. Thus, in the allegorical poetry of the Chartres poets, the created order of the physical world appears as Nature, the goddess who does God's bidding by correcting the unnatural. The Latin word *natura* does not refer to the physical world as such. Instead, it refers to birth, character, constitution, or the course of things.[18] Other related words to *natura* include natal, nativity, and native. By choosing *natura* as the name for the personification of the physical order, the poets imply that the character, the course of things, or the "nature" of the physical order is to do God's bidding.

In English, "nature" in its many uses has referred to the essential qualities of a thing, the powers of a thing, or the powers at work within a thing. The use of "nature" with respect to the physical world has a highly metaphysical definition in the *Oxford English Dictionary*: "The creative and regulative physical power which is conceived of as operating in the material world and as the immediate cause of all its phenomena."[19] Of course, Wittgenstein has taught us that the meaning of a word comes from how it is used rather than from how a dictionary may define it. The value of understanding how the word "nature" came to be used by scientists and others when speaking of the physical realm comes in appreciating that it brings with it a subliminal connotation that tends to think and speak of nature as doing things. Nature as the physical world, however, does nothing. It just is. Things happen within

Naturalism is the philosophical view that all phenomena can be explained entirely by "natural" or physical causes without reference to any metaphysical explanations. Note that naturalism does not help at all with the examination of the physical world.

the realm of nature, but nature takes no initiative. It just is.

The modern tendency to think of nature in a more animated way does not come directly from the medieval allegorical poets who first personified creation as Natura. Rather, it comes from the Enlightenment, reinforced with modern rationality by metaphysical philosophers like Hegel, Marx, Nietzsche, Spinoza, and Leibniz who infused Nature with a driving force and goal. The nineteenth century filled Nature with a "principle" which Gregory Thornbury says served as a "God substitute."[20]

The word "naturalism" takes the concept of nature one step further. On the surface, it may appear to suggest the idea of objectivity when, in fact, it suggests something quite different. Naturalism is the philosophical view that all phenomena can be explained entirely by "natural" or physical causes without reference to any metaphysical explanations. Note that naturalism does not help at all with the examination of the physical world. To speak of the "natural" state of things is to speak of the "normal constitution of things" or things as they are. The constitution of something, however, does not limit a thing to the physical. One must add another way of speaking which separates the "natural" from the "spiritual" in order to get to the notion that a "natural" explanation exhausts all that can be said about a thing.

The scientific method had long since established that science is concerned only with the examination of the physical world and what can be learned from observing physical phenomena. Naturalism does not contribute to the scientific method which already restricts science to the examination of physical phenomena. Instead, it tells us that "natural" or physical causes explain all phenomena. It tells us that only scientific analysis of a question leads to legitimate answers. It tells us that empiricism (knowledge through sensory experience) is the only valid form of knowledge. The problem with naturalism is that it contributes nothing to enhance scientific knowledge but discourages the exploration of other kinds of knowledge.

Bacon saw that metaphysical explanations of how the world works stifles further inquiry. The concept of "chance" is just such a metaphysical explanation in the modern world, but "chance" is not the language of science. It is the language of Las Vegas and Monte Carlo. Within naturalism, "chance" is the great explanation. It covers every situation. It is an all embracing explanation for everything. If we know that something happens by chance, we have no need to explore the matter further. We have no need to look for a mechanism as yet unknown. A chance event has no cause. Science, however, is in the business of discovering causes, even the causes behind random events. In this regard, presupposing the existence of God does much more to advance science than presupposing chance. God provides a basis for order and pattern that may be discovered in the physical world. Chance, on the other hand, is a final cause that also functions as an efficient cause—a metaphysical explanation for a physical occurrence!

Methodological naturalism suggests that scientific study should be conducted with the perspective that God plays no part in the physical world. If the scientific method is only concerned with observation and description of the physical world, why raise the issue of God at all? With methodological naturalism, the scientist uses a philosophical position as a methodology that incorporates metaphysical ideas not germane to the scientific question under examination.

An Experiment

Consider a simple scientific experiment. We want to know how heavy a loaf of bread is that sits on a table. A boy tells us that his mother placed the bread on the table. Another child tells us that the next door neighbor placed the bread on the table. Someone else tells us that the bread has always been on the table. None of these possible statements of origin affects the weight of the bread. It is not necessary to assume that someone placed the bread on the table (theism or deism) or that the bread has always been there (naturalism) or even to believe that someone placed the bread on the table but that the bread should be weighed as though it has always been there (methodological naturalism). To weigh the bread as though it has always been there (even when we believe it was placed there by someone) contributes nothing to the results of weighing the bread.

The word "nature" is a poetic synonym or metaphor for the physical world of phenomenological experience. The word "nature" has also served as an allegorical personification of the physical world through the identification of physical reality with the feminine deity, Natura. The personification meant nothing metaphysical or religious when it came into popular usage in the eighteenth and nineteenth centuries, because many people in the West no longer believed in a spiritual of divine aspect to the physical world. In the twentieth century, however, we have observed the re-sacralization of the physical world through the intersection of the ecological movement, radical feminist theology with its renewed interest in the mother goddess, and the tendency to ascribe thought and decision and will to the process of evolution.

Ironically, this re-sacralization has occurred during a period that has witnessed the death of poetry within the broad culture of the West. People who write poetry for themselves and a small elite still inhabit the fringes of society, but the masses no longer read or listen to poetry for pleasure. They no longer understand it. It no longer speaks to them. The ability to count and the ability to observe, "Its fleece was white as snow ...," are two aspects of a single piece. Science depends upon symbolic representation and analogy. The death of the poetic imagination into a dry, factual literalism does not enhance science.

Naturalism dominated liberal theology in the late nineteenth and early twentieth centuries as scholars sought "natural" explanations for religious phenomena. The trend in biblical studies was to propose natural explanations for miracles, prophecy, revelation, the incarnation of Christ, and the full range of faith convictions held by the Christian church. Naturalism denies that any transcendent reality operates within the physical world of phenomenal experience. For this reason, naturalism is closely related to the philosophical concept of materialism which states that only the material world exists.

Does the use of the term methodological naturalism advance science? Should atheists be expected to adopt methodological agnosticism in order to be objective in their scientific work? We do not think so, because it brings God into the method in an inappropriate way, just as methodological naturalism does.

In the thought of Richard Dawkins and others like him, we see the view that once a phenomenon has been described, it has been explained. They move beyond methodological naturalism to methodological materialism, which is even more removed from the scientific method. While the scientific method restricts itself to a discussion of what can be empirically observed within the realm of nature, methodological naturalism assumes that what occurs in the empirically observable world exhausts all that can be known or all that can contribute to an understanding of a phenomenon. Furthermore, it gives the impression to the philosophically uninitiated that naturalism is true and that science is based on naturalism.

Dawkins commits this error in *The God Delusion* and predetermines what can be understood about the world because of the theory he imposes upon the data before it is examined. This was the same method displayed by Galileo's opponents who imposed Aristotle's theories upon all data related to observations of the heavens. This was the very error in method that Bacon attacked in *Novum Organum* when he proposed the scientific method. Bacon understood that the great threat to scientific understanding did not lie in theology which had its focus elsewhere, but with philosophy which established the very thought patterns by which people unconsciously view their world.

The proposal by de Vries to consider the work of science as methodological naturalism was well intended and addressed a serious problem arising from Scientific Creationism on the one hand and what he has called evolutionistic scientism on the other. To those Christians who make literal interpretations of some biblical texts as immediate causes, de Vries' approach argues that science is only concerned with what it can discover through examination of the physical world. To those who argue from immediate causes that only the physical world exists, de Vries' approach argues that naturalism is only a method of research. Unfortunately, neither camp pays attention to the points de Vries intends by his term. The Scientific Creationists have a hermeneutical commitment that is coterminous with their faith, and they will not be likely to give up their position to methodological naturalism unless they can be shown that their understanding of the Bible is wrong. People like Dawkins who have a commitment to naturalism (and to materialism and atheism) will not restrict naturalism simply to a method when they believe it is the best view of reality.

Rather than freeing science from the restrictive explanations of metaphysics, methodological naturalism tends to enforce naturalism as the proper metaphysical explanation. If the method of science is based on naturalism, then naturalism must be true. Barbara Forrest has drawn out the lines of this train of thought. She suggests that de Vries' naturalism is also an epistemology, while philosophical naturalism is purely a metaphysical idea. She goes on to say that if supernatural causality exists in a situation, then methodological naturalism is plausible. On the other hand, if nature is the ultimate cause, then an independent method is unnecessary because only philosophical naturalism is logically sound. Furthermore, since empirical evidence for supernatural phenomena or influences has evaded scientists, the most logical conclusion is that philosophical naturalism is the more legitimate idea.[21]

Of course, the method of science is not based on naturalism or any other metaphysic. It is based on metaphysical neutralism. It is important for the scientific enterprise

Communication

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Of course, the method of science is not based on naturalism or any other metaphysic. It is based on metaphysical neutralism. It is important for the scientific enterprise to maintain this distinction, precisely because a wide unbreachable gulf does not exist between the physical and the metaphysical ...

to maintain this distinction, precisely because a wide unbreachable gulf does not exist between the physical and the metaphysical as the Enlightenment ideal supposed. The two are so easily confused and intermingled by both theists and atheists. Unfortunately, we tread the metaphysical only clumsily. We are more conscious of our own physical identity even though most human experience is mental. We tend to define the physical in terms of our metaphysical commitments, but only after we have first defined the metaphysical in terms of our physical prejudices. Thus, we need the discipline of the scientific method. A different project for the philosophers in collaboration with scientists would be to examine the relationship, if any, between the physical and the metaphysical.

In an essay reviewing several books on science and religion that ranged from the faith position of Owen Gingrich and Francis Collins to the atheism of Daniel Dennett and Richard Dawkins, Cornelia Dean rightly observed:

> This is where the scientific method comes in. If scientists are prepared to state their hypotheses, describe how they tested them, lay out their data, explain how they analyze their data and the conclusions they draw from their analyses—then it should not matter if they pray to Zeus, Jehovah, the Tooth Fairy, or nobody.
>
> Their work will speak for itself.[22] ▣

Notes

[1]E-mail correspondence from Paul de Vries to Chelsea Mytyk, April 28, 2006; Paul de Vries, "Naturalism in the Natural Sciences: A Christian Perspective," in *Christian Scholars Review* 15, no. 4 (Summer 1986): 390.

[2]See, Robert John Russell, "Eschatology and Scientific Cosmology: From Conflict to Interaction," in *What God Knows: Time and the Question of Divine Knowledge*, ed. Harry Lee Poe and J. Stanley Mattson (Waco, TX: Baylor University Press, 2005), 107; William A. Dembski, *Intelligent Design: The Bridge Between Science & Theology* (Downers Grove, IL: InterVarsity Press, 1999), 19, 67, 69, 119, 223–4, 257.

[3]Karl W. Giberson and Donald A. Yerxa, *Species of Origins* (Lanham, MD: Rowman & Littlefield, 2002), 2008.

[4]Ibid., 210.

[5]Ibid., 208. Plantinga, Moreland, and Meyer are particularly concerned that a place for God be made in science. If one believes in God and creation, then this belief ought to affect how one goes about one's scientific research. These three appear to be more concerned with how faith might frame a program of research in terms of what one pursues. They focus on God as final cause rather than God as immediate cause, but they are concerned for a view of science that allows God to act directly in the world. This focus appears to be an issue of philosophy rather than a question of scientific methodology. They are legitimately concerned about the basic presuppositions about reality that guide scientific research. Their position would probably not be so strident if de Vries had not proposed a method of science that assumed naturalism as its starting point. See, Alvin Plantiga, "Methodological Naturalism?" *Perspectives on Science and Faith*, 49 (September 1997): 143–54, available on line at www.asa3.org/ASA/PSCF/1997/PSCF9-97Plantiga.html.

[6]Arthur Peacocke, *Paths from Science towards God* (Oxford: Oneworld, 2002), 136, 51, 135–8, 159, 161, 163, 165, 186.

[7]Giberson and Yerxa, *Species of Origins*, 10.

[8]Plantiga, "Methodological Naturalism?"

[9]De Vries, "Naturalism in the Natural Sciences," 389.

[10]Ibid.

[11]Ibid., 394.

[12]Ibid.

[13]E-mail correspondence from Paul de Vries to Chelsea Mytyk, April 25, 2006.

[14]De Vries, "Naturalism in the Natural Sciences," 394.

[15]E-mail correspondence from Paul de Vries to Chelsea Mytyk, April 28, 2006.

[16]Francis Bacon, *The New Organum*, ed. Lisa Jardine and Michael Silverthorne (Cambridge, UK: Cambridge University Press, 2000), 59.

[17]C. S. Lewis, *The Allegory of Love: A Study in Medieval Tradition* (New York: Oxford University Press, 1958), 88. The most important of the Chartres poets and their works are Bernardus Sylvestris (*De Mundi Universitate sive Magacosmos et Microcosmos*), Alanus ab Insulis (*Anticlaudianus* and *De Planctu Naturae*), and Johannes de Altavilla (*Architrenius*).

[18]See the derivation given by *The Compact Edition of the Oxford English Dictionary* I (New York: Oxford University Press, 1971), 1900.

[19]Ibid.

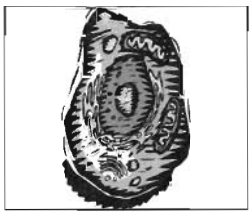
[20]Harry Lee Poe is indebted to Gregory Thornbury, with whom he regularly dialogues, for this insight.

[21]Barbara Forrest, "Methodological Naturalism and Philosophical Naturalism: Clarifying the Connection," *Philosophy* 3, no. 2 (Winter 2000): 7–29.

[22]Cornelia Dean, "Faith, Reason, God and Other Imponderables," Books on Science, *The New York Times*, July 25, 2006, available at www.nytimes.com/2006/07/25/science/25books.html.

Upcoming ASA Conferences

Aug. 1–4, 2008:	George Fox University, Newberg, Oregon
July 31–Aug. 3, 2009:	Baylor University Waco, Texas



The Origin of Eukaryotic Cells

Michael Buratovich

The cells of modern organisms come in two main structural types: prokaryotic and eukaryotic. Prokaryotic cells, which are represented by the eubacteria and archaea, contain precious little internal compartmentalization and have transcriptionally coupled translation, whereas eukaryotic cells, which compose plants, fungi, algae, animals, and a widely diverse group of unicellular protists, are equipped with a large cadre of intracellular compartments that are functionally specialized for specific intracellular tasks.[1]

The origin of the more complicated eukaryotic cell type has been partially elucidated by the now widely-accepted endosymbiont theory, which posits that two of the major membrane-bound compartments of eukaryotic cells—mitochondria, the energy-making organelles, and chloroplasts, the organelles where photosynthesis occurs in plant cells—were formed from ancient bacteria that invaded the cytoplasm of an ancient proto-eukaryotic cell and eventually took up residence in that cell. Given the impressive molecular and genetic similarities between modern mitochondria and one specific group of bacteria, the α-proteobacteria,[2] and modern chloroplasts and cyanobacteria,[3] this hypothesis has won widespread acceptance among biologists and is a common staple of most high school and college biology textbooks.

While the endosymbiont theory is the best present answer to the question of eukaryotic cell origins, there is still widespread uncertainty regarding the identity of the original cell that hosted the initial endosymbiosis. The prevailing model asserts that the host cell initially invaded by those ancient bacteria that eventually became modern mitochondria had a nucleus, and, therefore, the genesis of mitochondria occurred after the formation of the nucleus and played no mechanistic role in nuclear formation.[4] However, problems abound with this scenario.[5]

In an attempt to resolve this mystery, William Martin and Eugene Koonin have devised a revolutionary and wonderfully novel hypothesis to explain the origin of the nucleus.[6] The following features of this hypothesis with the accompanying evidences that argue in its favor are outlined below. (Also, see Figure 1.)

1. *The original host of the initial endosymbiosis that led to mitochondria was a prokaryote related to the modern archaea and not a nucleated proto-eukaryote.*

Phylogenetic analyses of ribosomal RNAs strongly suggested that eukaryotes are a sister group of the archaea.[7] However, the utilization of different genes in another set of phylogenetic analyses suggested that eukaryotes are more closely related to the eubacteria.[8] An analysis with completely sequenced genomes has shown that eukaryotic genomes result, at least in part, from a fusion between archaeal and eubacterial genomes.[9]

Other studies not only corroborate the dual contribution of archaeal and eubacterial genes to eukaryotic genomes but also strongly suggest that the primitive cell that played host to the original α-proteobacterial invader did not have a nucleus. For example, those proteins specific to the nuclear envelope and components of the nuclear pore complexes, which allow the transport of large molecules to and from the nucleus, are cobbled together from protein domains specific to eubacteria and archaea, with various eukaryotic innovations.[10] Also proteomic

Michael Buratovich

The origin of the ... eukaryotic cell type has been partially elucidated by the now widely-accepted endosymbiont theory ...

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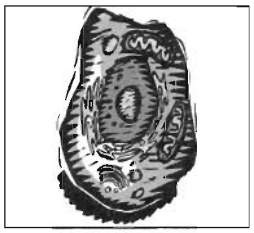


Communication

The Origin of Eukaryotic Cells

William Martin and Eugene Koonin have devised a revolutionary and wonderfully novel hypothesis to explain the origin of the nucleus. ... Despite ... drawbacks, Martin and Koonin's hypothesis is a fresh, new and thought-provoking piece of theorizing that should spur new experimental examinations into eukaryotic cellular origins.

analyses of the proteins in the nucleolus, that dense portion of the nucleoplasm where ribosomal RNAs are transcribed and ribosome biogenesis occurs, have also demonstrated that these proteins are derived from eubacterial and archaeal ancestors.[11] These data are best explained if the nucleus and nucleolus arose in a cell that already contained a eubacterial endosymbiont as a source of eubacterial genes.

2. *The presence of transposable, self-splicing group II introns in the genomes of the invading bacterium posed problems for the host organism, since its genome was soon colonized and overrun by transposons whose excision was rather slow.*

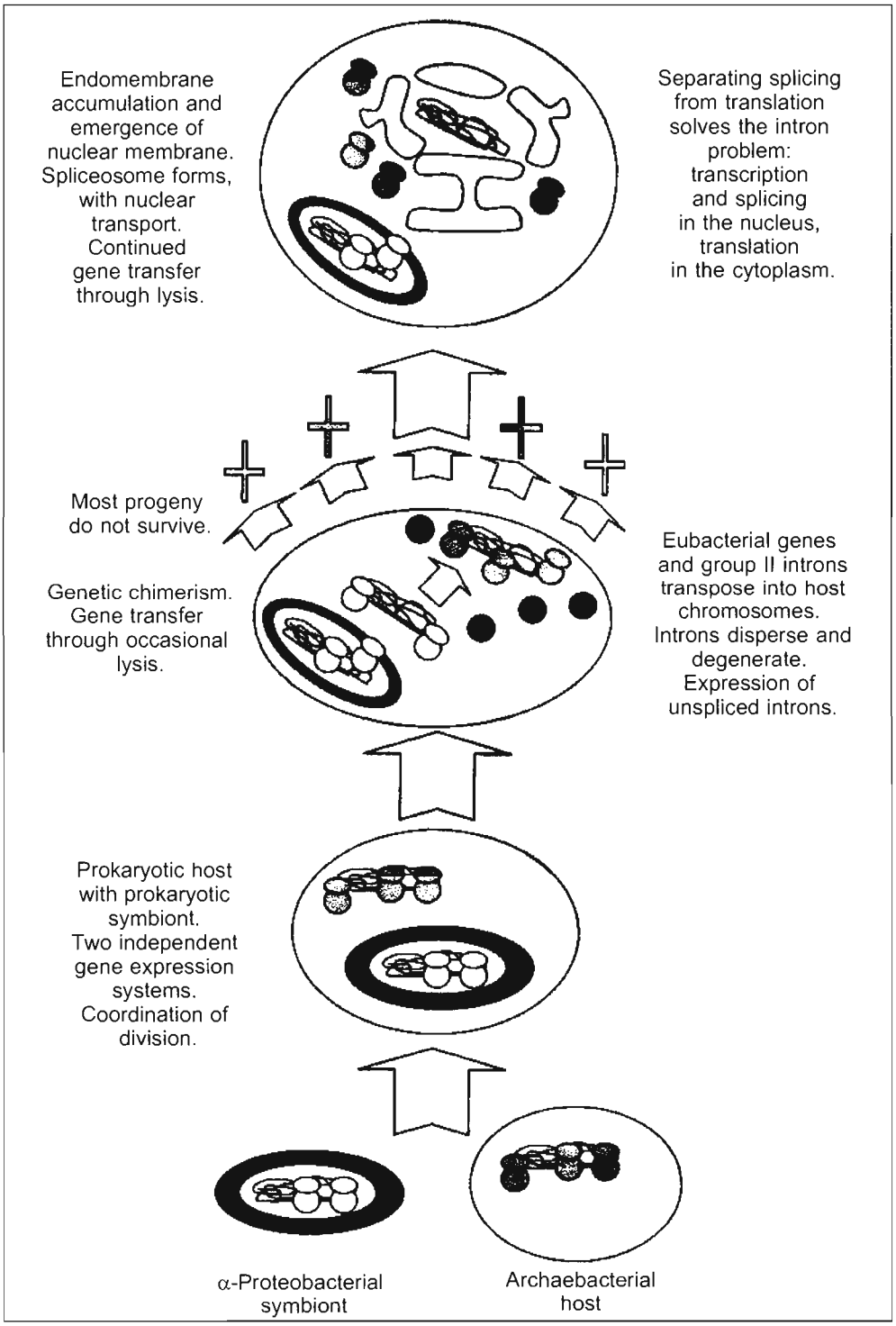


Figure 1

Modern eukaryotic genomes are loaded with intervening sequences called introns that interrupt coding sequences. Introns are initially transcribed when the initial messenger RNA (mRNA) is synthesized but are subsequently removed by a process called RNA splicing prior to nuclear transport of the mature mRNA to the cytoplasm for translation. RNA splicing is executed by a complex of proteins and small nuclear RNAs (snRNAs) called the spliceosome.[12]

Spliceosome-excised introns are widely viewed as having evolved from self-splicing group II introns. An impressive list of structural, biochemical, and functional similarities between group II introns and the processing of nuclear introns by the spliceosome supports this claim. First of all, the catalytic mechanisms employed by the two types of introns and their use of metal catalysts are strikingly similar.[13] Secondly, *in vitro* experiments have established that, like group II introns, the RNA component of the spliceosome forms its catalytic core.[14] Third, the metal-binding domain of II introns (domain V) can functionally substitute for the metal-binding portion of one of the RNA components (the U6atac snRNA stem-loop) of the spliceosome.[15] Finally, one of the RNA components of the spliceosome (snRNA U5) can functionally substitute for a particular portion of the group II intron (ID3 subdomain stem-loop).[16] These remarkable mechanistic resemblances and functional equivalences imply that spliceosome-dependent introns are the evolutionary descendants of group II introns.

Group II introns, however, are very common in eubacteria but extremely rare in the archaea.[17] Furthermore, group II introns are mobile genetic elements that can transpose from one location within a genome to another and require an intron-encoded reverse transcriptase/maturase protein for transposition and proper splicing.[18] If the host cell was a member of the archaea, its genome would have been bereft of introns. The invading α-proteobacterium, however, probably had several group II introns, just like their extant relatives. The transposition of these groups II introns into the genome of the host would have been inevitable, but would have also created problems for the host cell.

3. *The colonization of the host chromosomes with transposable type II introns led to a crisis in the life of these cells, since the excision of the intron was slow, but translation of the mRNAs made from these intron-infested genes was relatively fast, thus leading to the formation of junk protein.*

Messenger RNA splicing is a relatively slow process; modern splicing occurs at a rate of 0.005–0.1 introns removed per second.[19] However, translation is a relatively fast process, operating at a rate of one amino acid per second in modern eukaryotes.[20] Mutational inactivation of the intron-encoded maturase would have further slowed the process of splicing, but not stopped it completely, since the maturase can act in *trans*, but does so less efficiently.[21] Under these conditions, this early "proto-eukaryote" would have certainly made some nonfunctional protein.

The spliceosome components seem to have evolved from group II intron mRNAs and the Sm protein domain, which is involved in RNA-processing reactions in archaea.[22] The recruitment of Sm domain proteins to replace the function of the group II intron-encoded maturase provided the impetus for the formation of the spliceosome. The modern spliceosome contains some twenty paralogous Sm-domain-containing proteins, and this core complex is common to all eukaryotes and, therefore, must have been present in the last common ancestor of all eukaryotes.[23]

4. *Natural selection therefore pressured cells to physically separate the slow process of intron excision from the fast process of mRNA translation in order to preserve the integrity of gene expression.*[24]

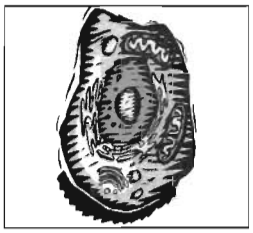
This early cell was under tremendous selective pressure to isolate the genome from the translational apparatus to prevent the constant synthesis of junk protein.

The nuclear envelope is contiguous with another internal cell membrane system: the endoplasmic reticulum. The cell uses the endoplasmic reticulum to initiate the syntheses of membrane-specific proteins, secreted proteins, membrane phospholipids and steroids. Gene duplication patterns suggest that the endoplasmic reticulum arose before the nucleus.[25] This means that the nuclear membrane might have resulted from the membranes of the already-existing endoplasmic reticulum aggregating around the region that contains the genome (nucleoplasm).[26] Once surrounded by these membranes, this barrier would have effectively isolated the genome from the translational machinery.

The formation of the nucleus in order to solve the problem of junk protein synthesis also potentially explains the origin of the nonsense-mediated decay (NMD) system in eukaryotes. The NMD system degrades incorrectly processed mRNAs and assures that only correctly processed mRNAs are translated into protein.[27] The formation of NMD as a direct consequence of interrupted genes makes sense and an examination of the NMD machinery shows components constructed from archaeal translation systems and eubacterial post-segregation killing systems.[28]

The Martin-Koonin hypothesis (MKH) of eukaryotic cell origins satisfyingly synthesizes a wide range of conflicting data. However, there are difficulties with this hypothesis. First of all, the MKH is contradicted by the observation that translation occurs in the nucleus,[29] but this is not a fatal objection since this result has been called into question.[30]

More importantly, the period of time before the formation of the nucleus and after the invasion of the genome by



The self-directing capacity of evolution is certainly compatible with a Creator-God who made heaven and earth and continues to sustain them. ... [M]aterial hypotheses ... cannot only provide fodder for further scientific inquiry, they can also help us tease out how God created the wonderfully complex and beautiful cells that compose all the plant and animal life ...

group II introns represents an almost intractably deleterious hurdle for the proto-eukaryotic cell to clear. Clearly if the nucleus formed after the invasion of the "proto-mitochondrion," not only would this cell and its descendants not have fared well for some time, but it potentially would have been driven to extinction by stiff competition from its faster-growing and more efficiently operating prokaryotic neighbors. Many of its progeny would have died as the cell searched for strategies to mitigate its junk-protein problem. For the MKH to be correct, the formation of the nucleus must have occurred rather quickly after the invasion by the cell that gave rise to the mitochondrion.

Also, the MKH depends upon the existence of a proto-endoplasmic reticulum to aid in the formation of the nuclear membrane. This potentially explains why the outer leaf of the nuclear membrane is contiguous with the endoplasmic reticulum, but also postulates the existence of a complex organelle that is not found in extant archaea.

Fourth, members of an extant group of eubacteria called the planctomycetes possess bonified nuclei, which shows that endosymbiosis is not necessary for the formation of a nucleus.[31]

Finally, an examination of "eukaryotic signature proteins," in the organelles of eukaryotic cells has shown that the proteins of eukaryotic cells are not simply admixtures of sequences from archaea and eubacteria, but are, in many cases, unique in their own right. This makes the notion that the genomes of eukaryotes are simple combinations of eubacterial and archaeal genes unlikely.[32] Despite these drawbacks, Martin and Koonin's hypothesis is a fresh, new and thought-provoking piece of theorizing that should spur new experimental examinations into eukaryotic cellular origins.

Not everyone is enthusiastic about the endosymbiont theory. Young-earth creationist Don Batten, for example, writes that we should expect that

> there would be many similarities in many of the genes for photosynthesis or respiration between prokaryotes and eukaryotes—they have to achieve the same chemistry ... Furthermore they have the same Designer.[33]

Batten concludes his critique of the endosymbiont theory by insisting that

> it is the atheistic bias of modern practitioners of science that prevents them from seeing the abundant evidence, right under their noses, for the unseen Creator of life.[34]

He implicitly argues that individuals who accept the mainstream interpretation of the large body of evidence that argues in favor of the endosymbiont theory do so because of a predisposed atheistic bias.

This convenient dismissal of the endosymbiont theory ignores the deep molecular similarities between modern mitochondria and chloroplasts and members of specific groups of extant eubacteria; similarities that have little to do with their chemistry. Secondly, Batten patently ignores modern examples of microorganisms that are presently in the process of becoming organelles, which constitute intermediates in organelle formation.[35] These data are best explained by postulating an ancestral relationship between these contemporary organelles and ancient bacteria. While we might wholeheartedly agree with Batten that prokaryotes, mitochondria, and chloroplasts have the same Designer, such an assertion does not tell us how the Designer went about fashioning them.

Even more troubling is the assumption that by searching for nature-bound causes to the origin of various cell types, we are somehow putting God out of a job. On the contrary, God's creative work does not end with the initial creation. Psalm 104:30 declares: "When you send your Spirit, they are created, and you renew the face of the earth" (NIV). Thus God not only sustains the universe but is active in the process of its continuous creation.[36] John Polkinghorne suggests that God influences creation through the input of active information, which gives form, place and time to matter.[37] Robert John Russell goes one step further and proposes that God inserts this information at the level of quantum indeterminacy so that quantum particles act in one manner and not another.[38] Niels Gregerson has argued that evolution is a self-organizing process that God directs from within.[39]

Thus the self-directing capacity of evolution is certainly compatible with a Creator-

God who made heaven and earth and continues to sustain them. Furthermore material hypotheses like the MKH cannot only provide fodder for further scientific inquiry, they can also help us tease out how God created the wonderfully complex and beautiful cells that compose all the plant and animal life we see on this planet. ▣

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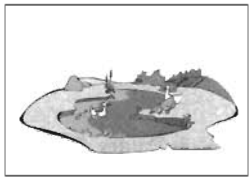


Stewardship of an Aquatic Habitat on the Campus of Oral Roberts University, Tulsa, Oklahoma

John Korstad

John Korstad

Environmental stewardship means that we love our Creator and seek to obey him in caring for his magnificent creation.

Many colleges have natural areas such as forests, grasslands, streams, lakes, or ponds on or near their campus where people can relax and enjoy outdoor activities. These natural areas are often adversely affected by the impact of campus activities and development. However, these natural areas must be recognized as integral parts of God's creation. We should never take these natural areas for granted, but rather we should seek God's wisdom whenever we develop around these areas (see Ezek. 34:18–19).

Environmental stewardship means that we love our Creator and seek to obey him in caring for his magnificent creation. This may mean preserving and protecting natural areas or sometimes restoring them as much as possible to how they were before development.

Lake Evelyn, at the center of the Oral Roberts University (ORU) campus, is an example of the practical challenges of development and stewardship on a Christian college. In 1980, the lake had a surface area of about 1 hectare and a maximum depth of about 7 m. Blue-green algal blooms were visible over much of the surface water during every summer. The lake was in a classic eutrophic ("well-nourished") condition.

Every semester, students in the ecology class sampled the lake water for various physical, chemical, and biological parameters and wrote lab reports incorporating the data in graphs and discussing the status of the water body. In addition, at least one student conducted more thorough sampling along with a faculty member every year. This often culminated in the students presenting their results in written format as a senior paper and in oral format at professional meetings such as the Oklahoma Academy of Science and the Tri Beta Biological Honor Society.

In 1995, Lake Evelyn still had a surface area of about 1 hectare, but the maximum depth was only 1.5 m. This indicated that the lake was accumulating sediment at the rate of about 0.3 m per year. Prominent aquatic macrophyte beds were encroaching toward the middle of the lake (Fig. 1). In October

Figure 1

ASA member **John Korstad** *always wanted to be a teacher. His role models were his mother and father who dedicated much of their lives to teaching. He joined the Oral Roberts University faculty in 1980. Currently he is a professor of biology and also Honors Program Director. His family lived in Norway during two sabbatical years, the most recent funded by a Fulbright Fellowship in 1993–1994. He loves to go on field trips and marvel at God's beautiful creation. One of the highlights of the past eleven summers has been teaching the limnology course at the Au Sable Institute in northern Michigan. He and his wife are the proud parents of four daughters, all of whom graduated from ORU. They currently have four wonderful grandchildren.*

1995, following weather conditions with warm temperatures and no wind, there was a moderate "fish kill." It was determined that this was due to the low dissolved oxygen concentrations in the water caused not only by the weather, but also by high bacterial decomposition rates on the accumulated organic matter at the bottom of the lake.

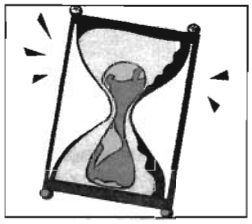
In the summer of 1996, the ORU administration and faculty in the biology department agreed that Lake Evelyn needed restoration. During that summer, the lake was drained and then dredged to about 4 m depth (Fig. 2). Crushed rock ("rip rap") was placed around the shoreline to stabilize the edges. The lake was refilled and two fountains were added at both ends of the lake to adequately aerate the hypolimnetic ("bottom") water.

Figure 2

Since the summer of 1996, Lake Evelyn has shown obvious signs of restoration. There have been no more summer blue-green algal blooms, no more fish kills, and most campus residents would agree that the lake is "aesthetically pleasing" (Fig. 3). The university and Student Association worked together to purchase benches that were placed around the edges of the lake and picnic tables that were placed under trees near one area of the lake. It is a joy to see the increased activities around the lake that have subsequently occurred every year since 1996. Students routinely occupy the benches or other areas around the lake to do their studies or talk with friends. In addition, campus groups have regularly had picnics in this area.

Figure 3

The main message that we see in this story is that it is important for administrators, faculty, and students to work together to be better stewards of God's creation. Faculty and students collaborating in research is a positive factor in student learning. This fulfills the additional purpose of providing practical data for use in advising administrators on how to better manage this aquatic habitat. We still see further areas for improvement and look forward to enhancing this working relationship between students, faculty, and administrators. ▣



Communication

Residual Radiocarbon in an Old-Earth Scenario

Robert Rogland

Robert Rogland

I believe that the data cited by the RATE group ^{14}C paper can be accounted for in an old earth framework, i.e., the conventional geological time frame accepted by the vast majority of geologists.

A Challenge to Conventional Geological Dates

In 1997, seven scientists from three major creationist organizations initiated a research initiative they styled Radioisotopes and the Age of the Earth (RATE). The RATE initiative focused on interpreting the geological evidence for large amounts of nuclear decay according to a young earth model. Several of the RATE scientists were convinced that episodes of greatly accelerated nuclear decay rates had occurred within thousands of years, only a few thousand years ago.[1]

In 2003 Baumgardner, et al. published a paper, "Measurable ^{14}C in Fossilized Organic Materials: Confirming the Young Earth Creation-Flood Model.[2] The RATE group ^{14}C paper analyzes data from 90 studies (tabulated by Giem[3]) which report residual radiocarbon in organic samples taken from various parts of the geological column. The abstract of the paper summarizes its findings and conclusions:

> Given the short ^{14}C half life of 5730 years, organic materials purportedly older than 250,000 years, corresponding to 43.6 half-lives, should contain absolutely no detectable ^{14}C ... An astonishing discovery made over the past twenty years is that, almost without exception, when tested by highly sensitive accelerator mass spectrometer (AMS) methods, organic samples from every portion of the Phanerozoic record show detectable amounts of ^{14}C! $^{14}C/C$ ratios from all but the youngest Phanerozoic samples appear to be clustered in the range 0.1–0.5 pmc (percent modern carbon), regardless of geological "age." A straightforward conclusion that can be drawn from these observations is that all but the very youngest Phanerozoic organic material was buried contemporaneously much less than 250,000 years ago. This is consistent with the biblical account of a global Flood that destroyed most of the air breathing life on the planet in a single brief cataclysm only a few thousand years ago.

Accounting for Residual Radiocarbon in the Conventional Geological Time Frame

As an old earth creationist (OEC), I believe that the data cited by the RATE group ^{14}C paper can be accounted for in an old earth framework, i.e., the conventional geological time frame accepted by the vast majority of geologists.

RATE scientists have anticipated and endeavored to refute several explanations of residual radiocarbon consistent with the conventional geological time scale. These are: the creation of ^{14}C by nuclear synthesis *in situ* after the fossil remains were deposited, contamination of the samples with ^{14}C from elsewhere (in the ground or during sample preparation), and measurement error.[4] Although I would not be surprised if these explanations proved to be correct, I do not intend to argue for them here. Instead, for the sake of argument, I assume that the data represent genuine residual radiocarbon. But the conclusions I draw are very different from those of Baumgardner, et al. My analysis follows.

The equation for exponential decay with an invariant rate constant is well known: $N = N_0 e^{-kt}$, where N = the quantity of material remaining after elapsed time = t, k = the rate constant , and N_0 = the quantity of material present when the organic sample was

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deposited (i.e., when t = 0). If we follow Baumgardner and Giem and arbitrarily let N_0 = 1, then N = the decimal equivalent of the pmc. The equation for exponential decay becomes

$$N = e^{-kt}$$

For the sake of argument, let us agree with Baumgardner, et al. that k is *not* constant, but rather time-dependent. However, rather than supposing that there was a burst of accelerated nuclear decay at the time of the Fall or the Flood, I hypothesize that k increases in a regular way with time: Let $k = At^B$, where A and B are constants. Substituting At^B for k we have:

$$N = e^{-At^{1+B}}$$

The RATE group ^{14}C paper presents two frequency distributions of $^{14}C/C$ ratios drawn from the 90 studies summarized by Giem, one for non-biological Precambrian samples and one for biological Phanerozoic samples. The authors report that the mean $^{14}C/C$ ratio for the Precambrian non-biogenic samples is .062 pmc, with a standard deviation of .034 pmc. They do not report the mean age of the Precambrian samples, but let's suppose it is 2.5 billion years, the midpoint, more or less, of Precambrian time. The authors also report that the mean $^{14}C/C$ ratio for the Phanerozoic biogenic samples is .29 pmc, with a standard deviation of .162 pmc. Let's suppose the mean age of the Phanerozoic samples is 275 million years, the midpoint, more or less, of Phanerozoic time.

I first picked the mean Precambrian and Phanerozoic $^{14}C/C$ ratios cited by Baumgardner, et al. to solve for A and B, viz., an "average" Precambrian sample with N = .062 pmc and t arbitrarily set at 2.5×10^9 years ago (ya) and an "average" Phanerozoic sample with N = .29 pmc and t arbitrarily set at 2.75×10^8 ya.[5] Straightforward algebra gives $A = 1.00 \times 10^{-3}$ and 1 + B = .362. The equation for N then becomes:

$$N = e^{-\left(1.00\times10^{-3}\right)t^{.362}}$$

I then calculated N for other data reported by Baumgardner, et al., as well as for a sample just 5730 years old (i.e., one half-life old), and compared them with the observed values. Here are the results:

sample	*t*	N_{obs}	N_{cal}
Precambrian graphite	2×10^9 ya	.04	.10
Pennsylvanian coal (average of 4 samples)	3×10^8	.27	.31
Cretaceous coal (average of 3 samples)	1×10^8	.21	.46
Eocene coal (average of 3 samples)	4.5×10^7	.26	.55
Pleistocene foraminifera (average of 115 samples)	4.6×10^5	.23	.89
Hypothetical sample with $t_{½}$ = 1	5730	.50	.98

Here, as in the initial calculation of A and B, the times represent the midpoints of the particular periods, eras, or epochs that the samples represent. The equation with a time-dependent decay constant yields expected values of N well within an order of magnitude of the observed values. The average N_{calc} is almost twice the average N_{obs}, promising but not impressive.

We can achieve even better agreement between observed and predicted values of N with a modification of the calculation. Each of Baumgardner's frequency distributions had a pronounced mode: in the case of the Precambrian, the modal pmc, 0.04, represented 40% of the samples, and in the case of the Phanerozoic, the modal pmc, 0.16, represented nearly a quarter of the samples. If we take the modes rather than the means of Baumgardner's frequency distributions to calculate A and B, using the same values of t, the equation for N becomes

$$N = e^{-\left(1.3\times10^{-2}\right)t^{.255}}$$

And the results of comparing N_{obs} and N_{calc} are:

sample	*t*	N_{obs}	N_{calc}
Precambrian graphite	2×10^9 ya	.04	.05
Pennsylvanian coal (average of 4 samples)	3×10^8	.27	.16
Cretaceous coal (average of 3 samples)	1×10^8	.21	.24
Eocene coal (average of 3 samples)	4.5×10^7	.26	.31
Pleistocene foraminifera (average of 115 samples)	4.6×10^5	.23	.70
Hypothetical sample with $t_{½}$	5730	.50	.88

The results here are better: on average, N_{calc} is about 50% greater than N_{obs}.

Whether we use the mean or the modal values of the frequency distributions given by Baumgardner, et al. to derive the constants for the equation where k is time dependent, calculated values for residual radiocarbon agree tolerably well with the observed values considering the uncertainties in the values of N_{obs} and t used to derive the constants A and B. The standard deviations of the two frequency distributions are, in both cases, over 50% of the mean values; moreover, the choice of t representing the middle of the Precambrian and Phanerozoic periods, though reasonable, was entirely arbitrary.[6]

Conclusions

In the light of the numerical uncertainties in the values of N and t used to calculate values of A and B, I consider the results of my calculations satisfactory for my purposes. Starting with the general idea that decay rates might be increasing over time, we find that a simple hypothesis,

viz., that $k = At^B$, allows us to demonstrate that residual radiocarbon should be present in even the oldest materials containing carbon; moreover, we find that the calculated values of pmc agree tolerably well with the observed values.

Let me stress that I am *not* proposing at this time that nuclear decay rates actually do increase over time. Indeed, I put little stock in the hypothesis underlying the above analysis. The chief difficulty, in my opinion, is that the accepted quantum mechanical understanding of radioactive decay would have to be radically revised if the hypothesis were true—a difficulty for Baumgardner, too, though he does not seem to recognize it (his paper contains no mention of it). I proposed the hypothesis of increasing nuclear decay rates simply to show that one can account for residual radiocarbon in "radioactively dead" samples within an old earth framework if in fact such residual radiocarbon really exists. (On the other hand, if the radiocarbon in old samples cannot be accounted for by contamination, measurement error, or ^{14}C synthesis *in situ*, i.e., if that radiocarbon is truly residual, then the hypothesis of increasing nuclear decay rates is worth a more serious look.) ▣

Notes

[1]*Creation Research Society Quarterly Journal* 41, no. 1 (June 2004).
[2]J. Baumgardner, et al., "Measurable ^{14}C in Fossilized Organic Materials: Confirming the Young Earth Creation-Flood Model," in *Proceedings of the Fifth International Conference on Creationism*, R. L. Ivey, Jr., ed. (Pittsburgh, PA: Creation Science Fellowship, 2003), 127–42.
[3]P. Giem, "Carbon-14 Content of Fossil Carbon," *Origins* 51 (2001): 6–30.
[4]Ibid.
[5]The values of t correspond to the midpoints of the Precambrian and Phanerozoic eras respectively.
[6]It is perhaps worth noting that the frequency distributions presented by Baumgardner, et al. are not symmetrical. Both are skewed right, toward higher pmc values.

Book Reviews

FAITH & SCIENCE

GOD FOR THE 21ST CENTURY by Russell Stannard, ed. Philadelphia: Templeton Foundation Press, 2000. 194 pages. Paperback; $12.95. ISBN: 1890151394.

This book contains very short summary-length papers (three to five pages each) from fifty contributors. They are gathered into eleven groupings on important topics: Origins; The Universe as a Home for Life; Evolutionary Biology; Life in the Universe; Genes and Genetic Engineering; Faith, Medicine, and Well-being; The Mind; Personhood and the Soul; Quantum Physics and Relativity; Limitations to Science; Science/Religion Dialogue.

Under these categories, a wide variety of interesting material is available. Many of these provide informative summaries and short arguments about current discussions and debates. For example, ASA Fellow Owen Gingerich, professor emeritus of astronomy and the history of science at Harvard University, recounts arguments about the Big Bang and the possibility that it "spawned a vast number of sister universes." Some argue that in the "multiuniverse model," humans find themselves in the one universe that just happens to be right—accidentally right—for intelligent life. Atheists argue that such an accidental home among so many possibilities does not count as evidence for God's creativity or providence. But Gingerich notes there is more that needs to be said.

> The theists point out that any other such universes would be forever invisible. We could only accept them on faith because there would be no possible way to observe them. So, say the theists, everyone must accept something on faith, and it's an interesting choice to make (p. 20).

As with this example, many contributors took complicated discussions and cut through stacks of books and articles to lay before us the basic arguments in very readable, understandable language.

Here is another example. Writing on the human genome project, ASA Fellow Elving Anderson, professor emeritus of genetics at the University of Minnesota, discusses the question of determinism. Is it possible that humans and human behavior are solely determined by their genes? Such claims are sometimes made.

> Several lines of evidence, however, contradict these claims. For a start, complex adaptive systems (including those formed by genes) are not fully predictable, even in principle. Identical twin pairs do not show identical behaviors. Furthermore, genes always act within a context, so that gene discovery and the development of effective treatments require a careful examination of the whole individual" (p. 81).

Most of the contributions were from scientists and theologians, scholars and educators, people of solid achievement in their field of study. Their short contributions are reliable and fit well into the book. Most but not all. A couple of the contributions seemed second rate and not worthy of inclusion. For example, Barbara Smith-Moran, of Boston Theological Institute, writes:

> Could it be that God and people coevolved? ... The coevolution of orchids and bees suggests that God and people might be creators of each other. Neither would have a monopoly on the creative power ... God and people have a need for each other (p. 53).

Something more is needed to make this coherent. Did God exist before humans were created, or is God a mere projection of human imagination? What does it mean to create? Should we distinguish between the God who actually exists and changing human perceptions of God? As the article stands, there is such looseness in language and logic that it makes serious ontological discussion about God rather difficult.

Be that as it may, the overall quality of the majority of contributions is very good. They present important aspects of the interrelationship between science and religion. I find this book to be helpful on the level of presenting good, short overviews of current discussion. Relevant books by the contributors are noted along with biographical information at the end of each piece, which is helpful to any who may want to read more on that subject. Not every piece will appeal to every reader, but among the various chapters there are some real gems. My one wish is that some of these gems were longer and came with extended bibliography.

Reviewed by Mark Koonz, Emmanuel Lutheran Church, Walla Walla, WA 99362.

JACOB'S MIRROR: A Reconciliation of Science and Religion by Bill McKee. Philadelphia: Xlibris Corporation, 2006. 48 pages. Hardcover; $20.00. ISBN: 142723276. Paperback; $10.00. ISBN: 142723268.

Bill McKee is a 1974 graduate of the University of Texas School of Law and currently practices law in San Antonio, Texas. He is the author of "A Test of the Scientific Method" (*Philosophy of Science* 69 [September 1993]: 469).

This book is a third edition. The previous editions were published under the title *Is Objectivity Faith? A Reconciliation of Science and Religion* (Kearney, NE: Morris Publishing, 1995, 1997). The current edition is very similar to the first edition except for the deletion of three chapters that were in the first edition: "The Nature of God," "The Nature of Ethics," and "There is No Evil."

Although there are a total of forty-eight pages, the book has only about sixteen and one-half pages of text plus six pages of notes and a one and one-half page bibliography. There is no index. In fact, the author covers at least 30% of the book in his four-page summary on the Internet at www.jacobsmirror.com.

The author's thesis is that science and religion cannot both be correct. He states:

> If the universe originated in the Big Bang, with stars and planets slowly coalescing from the dust of the explosion, and life arising and evolving from the

> brew, then we humans are nothing more than late-arriving accidental products of physical and chemical processes. We are not children of God (p. 12).

It seems to me that this statement ignores the possibility that God could have guided the process. The author then states:

> ... if religion is right, then science must be mistaken. If prayers are ever answered, then events are not at the mercy of objects. If God's hand is at work in the world, then the world cannot be fundamentally physical. Physical laws that are contingent on the will of God are not laws ... I came to believe that science must be flawed because it cannot account for the ability of faith to manipulate events (p. 12).

The author's solution is to "question a most basic scientific assumption: that the universe exists external to and independent of us. I don't think it does."

The author's hypothesis is "that the perception of externality, that the world is external to and independent of us, is merely the subjective reflection of our original sin, the preconception of autonomy, what we call the ego" (p. 33).

The author then offers three reasons for challenging externality: (1) a thought experiment (chapter 4): "the ability of an internal act of faith to change the seemingly external world would prove that the world was not external," (2) personal experience (chapter 5): solving problems by means of faith has worked better for the author than solving problems by acting on them, and (3) testimony of the mystics (chapter 6), in which the author quotes Joel Goldsmith (a Christian Scientist), Franklin Merrell-Wolff (a Hindu), the Upanishads, Krishna, Sankaracharya, and Lao Tsu, in addition to Meister Eckhart, Jacob Boehme, and St. Teresa of Avila.

The author's conclusion (chapter 7) is that "faith would not work if the world were external ... Thus, we can reconcile science with religion by renouncing science's allegiance to externality."

It seems to me that unless the reader is willing to accept assumptions like "science must be flawed because it cannot account for the ability of faith to manipulate events," this book does not add much to the study of the relationship of science and religion.

Reviewed by Paul R. Bruggink, 143 Hummingbird Lane, Clarington, PA 15828.

EDEN'S GARDEN: Rethinking Sin and Evil in an Era of Scientific Promise by Richard J. Coleman. Lanham, MD: Rowman & Littlefield Publishers, 2007. 301 pages. Paperback; $26.95. ISBN: 074255239X.

Coleman is a retired minister in the United Church of Christ. He is a graduate of Johns Hopkins University, Princeton Theological Seminary, and a participant in the pastor-theologian program sponsored by the Center for Theological Inquiry in Princeton, New Jersey. His book is an attempt "to restore some sanity to what otherwise is a future seen through rose-tinted glasses. As such, the book is a theological gloss on the posthuman debate about the nature of being human" (Foreword).

As the book's subtitle suggests, Coleman is interested in the meanings of sin and evil in an increasingly materialistic and science-driven society. After a short introduction, the book's content is divided into three parts. The first and third parts of the book deal with science's meteoric rise and future trajectory, respectively, while the second part is a meditation on sin. Embedded in the center of the book is an exposition of Genesis 3, though Coleman freely admits his concerns are sociological and theological, not exegetical.

In Part 1, the author focuses on "how the creators of knowledge too powerful to be ignored become the engineers of knowledge too good not to be ignored" (p. 2). Using Oppenheimer as a case study, Coleman traces the beginnings of the military-industrial complex in the mid-twentieth century. While he recognizes a certain amount of presumption in his judgment, he nevertheless labels the Manhattan Project as the stirrings of sin in the professional scientist. The close of World War II brought a newfound political importance to scientific questions, which resulted in the creation of Big Science under the aegis of Vannevar Bush. Coleman views that nascent alliance between science and the commonwealth as potentially hazardous, however inevitable it may have been.

From the atomic bomb, the author turns his attention to biotechnology as the new threat, where the public expects returns from their significant investment in science without due regard for the social consequences of such returns. He is (justifiably, in my view) concerned about the potential social and ethical consequences of blithely employing stem cells, cloning techniques, genetic screening and "enhancement," and behavior-altering pharmaceuticals. His treatment of this material is somewhat desultory but suitably wide-ranging; and it is peppered with helpful literary examples, from several genres, of the fruits of technology gone amok.

Yet Coleman seems even more alarmed at the emergence of public-private partnerships and university technology transfer offices. This is a persistent and recurring theme in the book: in Part 3, he yearns for the day when "the communal sense of ownership is restored and the eroding nature of market forces is countered" (p. 261). While he cites the false demarcation of basic and applied science, as well as long tradition of patronage in science, as evidence against his naiveté, I am not convinced. His view of the days prior to Big Science seem romanticized, a halcyon world of disinterested "pure" scientists and ingenious lone inventors. If the intrusion of private funds into medical research is to be resisted on moral grounds, a comprehensive discussion should also consider the moral argument for the enormous regulatory hurdles on the results of such research. Coleman's discussion is thus incomplete on this point.

Coleman is at his best in Part 2, an insightful treatise on the past (evolution), present, and future of sin. In his view, the Fall is to be understood as "the prototypical act of overreaching" (p. 25); he points out that Adam and Eve must have already had some capability to make good or bad decisions, else the snake's offer would be futile. Sin, then, is the deliberate transgressing of boundaries set for us. It is original because we have the capacity to transgress those limits, and the atrocities and humanitarian disasters of the past century clearly assert sin's relevance even

today. As we make the world in our own image with the tools of science, Coleman holds that we have a duty to individually and corporately guard these limits. My summary cannot do justice to his profound argument, so I would recommend this book to anyone who desires to better understand that duty.

Reviewed by Christopher J. Barden, Dalhousie University, Halifax, NS, Canada, B3H 4J3.

HISTORY OF SCIENCE

MYSTERIES OF THE MIDDLE AGES: The Rise of Feminism, Science, and the Arts from the Cults of Catholic Europe by Thomas Cahill. New York: Nan A. Talese/Doubleday, 2006. 343 pages, index. Hardcover; $32.50. ISBN: 0385495552.

This is the fifth installment in Thomas Cahill's projected seven-volume *Hinges of History* series, begun over a decade ago with *How the Irish Saved Civilization*. The ambitious series has been wildly popular, no doubt because Cahill is such an engaging writer and because he offers readers what many academic historians do not: lively, accessible stories of how key people at pivotal moments in the past "contributed immensely to Western culture and the evolution of Western sensibility" [from his official web site]. This is a worthy goal, especially at a time when the historical guild probably overemphasizes the complexity of the past, which in turn rewards overspecialization and leads to an unfortunate fragmentation of historical knowledge. But it is a project fraught with conceptual potholes, and Cahill does not escape them. This is especially evident in *Mysteries of the Middle Ages*.

Cahill wants his readers to appreciate how the Middle Ages was so much more than a period of cultural and intellectual decline. Far from being merely the Dark Ages, this was a time of rebirth in scholarship, art, and science; indeed, here was the dawn of Western civilization. He invites the reader to take a pilgrimage through the Middle Ages highlighting several key people—"gift givers" in his words—and places. Hildegard of Bingen and Eleanor of Aquitaine, for instance, illustrate not only the cult of the Virgin Mary and courtly love—fairly standard topics when discussing the medieval period. But they also point to attitudes that one day will find expression in feminism: treating women with dignity and welcoming their entrance into arenas of power dominated by men. And, more to the interests of the readers of *PSCF*, Cahill uses Roger Bacon as his point of entry into a very brief discussion of the impact of Aristotlean thought, the practice of accumulating natural knowledge by means of observation, and the alchemist's quest. From these intellectual seeds modern science will eventually grow.

Cahill's strength is his ability to bring his cast of historical characters and their environs to life. His descriptions of Paris, Padua, and Florence are wonderful, and the many illustrations that adorn the book are striking. But this remains a frustratingly curious book. It is a great read, but one that leaves the reader unsatisfied. This brings us back to those conceptual potholes. Historians must keep two things in creative tension: the need to understand the past in its original context, to the extent it is possible to do so, and the responsibility to make sense of the past for the present. Overemphasis on the former leads to antiquarianism, while too much of the latter yields an overly familiar and sanitized past. Cahill here offers up an essentially whiggish account of the Middle Ages, one that—to borrow from the great British historian G. R. Elton—frequently seems to forget that the past did not exist to provide us the present. He is so intent on bringing these medieval gift givers to life that he makes them too modern, too much like us. There is not enough otherness, strangeness to Cahill's Middle Ages. And he certainly does not help his cause by his breezy, presentist analogies—the most egregious example occurred when he likened one of Hildegard's letters to the dialogue from an episode of *Desperate Housewives*, followed by the unnecessary comment "Take that, bitch."—and his bitter critique of the contemporary Catholic Church and passing digs at George W. Bush.

All that said, Cahill does perform a service. *Mysteries of the Middle Ages* kindles interest in this rich and fascinating period of history. But readers desiring a deeper understanding of subjects like the medieval roots of modern science would do well to move directly to far more substantive works like Edward Grant's *The Foundations of Modern Science in the Middle Ages* or David Lindberg's *The Beginnings of Western Science*.

Reviewed by Donald A. Yerxa, editor of Historically Speaking, *The Historical Society, Boston, MA 02215-2010; Professor of History, Eastern Nazarene College, Quincy, MA 02170.*

ORACLES OF SCIENCE: Celebrity Scientists Versus God and Religion by Karl Giberson and Mariano Artigas. New York: Oxford University Press, 2007, 273 pages, index. Hardcover; $29.95. ISBN: 0195310721.

Karl Giberson, physics professor at Eastern Nazarene University and an ASA member, is well known as the former editor-in-chief of both *Science and Theology News* and *Science & Spirit* which achieved global circulation in the field of science and religion studies. He couples his knowledge of this arena with that of his physics, philosophy of science, and Roman Catholic priest colleague, Mariano Artigas of the University of Navarra in Spain. The result is a splendid book that presents the writings of six contemporary science "oracles": biologists Richard Dawkins, the late Stephen Jay Gould, and Edward O. Wilson and physical scientists Stephen Hawking, the late Carl Sagan, and Steven Weinberg, to each of whom a chapter is devoted. On each Giberson focuses on his main ideas and how he pushes viewpoints that transcend science. The final chapter summarizes the similarities and dissimilarities of these oracles.

The authors do not delve into the many philosophical and theological responses that could be made to the various views expressed by these oracles, so readers should not expect to find references to the voluminous science and religion/theology literature. Rather, they concentrate on summarizing the views of each oracle, clearly indicating at which points and exactly how their views go well beyond science into the metaphysical. On this ground, these oracles are unreliable guides whose views should be

given no more credence than anyone else. The antireligious bias of the majority of these oracles is well documented and described without, I think, misrepresentation.

The authors make a good case for how the misuse of science to advance philosophical and quasi-religious or antireligious ideas fails to reckon with the limitations of science. It is the polemics of these oracles and their chief antagonists, couched in what purports to be "scientific language" that obscure rather than illuminate the complex nature and meanings of human existence.

The book is highly recommended.

Reviewed by Dennis W. Cheek, Vice President of Education, Ewing Marion Kauffman Foundation, 4801 Rockhill Rd., Kansas City, MO 64110.

NATURAL SCIENCES

A MEANINGFUL WORLD: How the Arts and Sciences Reveal the Genius of Nature by Benjamin Wicker and Jonathan Witt. Downers Grove, IL: InterVarsity Press, 2006. 257 pages. Paperback; $18.00. ISBN: 0830827994.

A Meaningful World aims to show that the universe's inherent intricacies require a meaningful existence pointing to an overall purpose for life. Surprisingly few times is this purpose explicitly equated with God. This acerbic attack on materialist reductionism is written by two nonscientists: Benjamin Wicker, who teaches theology part-time at the Franciscan University of Steubenville; and Jonathan Witt, who has a Ph.D. in English and is listed as a writer in residence at the Discovery Institute in Seattle. Both authors are fellows of the Discovery Institute, which features a "Dissent with Darwinism" and promotes intelligent design.

The book falls roughly into two halves: the first three chapters use Shakespearean literature to demonstrate that ideas are more than disconnected letters on a page; the following six chapters attempt to demonstrate that materialist reductionism eliminates an essential component of life. The opening linguistic analysis (chap. 2) begins with an experiment run in 2002 in which a computer left in the care of six Sulawesi crested macaques was used to gauge the success of Huxley's proposition that given enough time, monkeys on computers could generate a Shakespearean play. Over ensuing pages the argument is made that random chance could not possibly produce the beauty of Shakespeare's plays.

> To imagine that Darwinian selection mechanisms could have seized upon a series of small but immediately beneficial genetic variations to produce a species capable of producing a Newton or an Einstein works no better than explaining Shakespeare by such means (p. 86).

Dawkins' works are singled out for attack focusing on his use of Shakespeare in his cumulative selection analogy. The vitriolic style and the irrelevant linguistic analysis of Shakespeare make tiresome reading.

> In short, we need to *experience* Shakespeare's genius. Having done so, we will be immune to the materialist's reductive treatments of the Bard and, to some degree, immunized against the violently reductive treatments of nature and ourselves as well (p. 63).

After plowing through four chapters, the reader is presented with the first scientific evidence for a meaningful world. The authors develop Wigner's "unreasonable effectiveness of mathematics" as pointing to an underlying order in creation instilled by the creator. Unfortunately a good portion of the chapter is devoted to Pythagoras's mathematical proof for right-angled triangles in the belief that the conceptual elegance will demonstrate that the world is meaningful. The authors advance the unsubstantiated argument that a scientist's search for understanding "couldn't be the result of an indifferent and pointless cosmos" (p. 145). The assertion is contradicted by the authors' quotes from *The First Three Minutes* where Steven Weinburg writes that "[t]he more the universe seems comprehensible, the more it seems pointless" (p. 13). Despite Weinburg's belief in a pointless universe his scientific contributions were of such significance that he was awarded the 1979 Nobel Prize in physics.

Chapters 6–9 draw heavily from "The Privileged Planet" as evidence that the universe's fine tuning is not a chance event. "It has been a great surprise that water, seemingly humble and humdrum, is so wonderful a solvent against the disanthropic materialist reductionism that has had us in its grip for so long" (p. 188). Given the availability of significantly better books such as *The Privileged Planet* (Regnery 2004) and *Rare Earth* (Springer 2003) one wonders if the intended market is for a less scientifically literate, and more easily swayed, Christian audience.

After being affronted for two hundred pages by a constant tirade against materialism and reductionism, the authors' message is clear: they believe reductionism has completely failed. The authors interpret science's inability to generate life as an implicit demonstration that God is somehow intricately involved in every cell in a new form of vitalism. The hidden intelligent design agenda is hinted at in the acknowledgments where "the fellows of the Center for Science and Culture [are thanked], for thinking we can win." The book offers no new ideas and is likely to undo valuable work of the ASA and similar organizations to educate the public in complex issues of science and faith.

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

ORIGINS & COSMOLOGY

EVOLUTION: A Scientific American Reader edited by Scientific American. Chicago, IL: University of Chicago Press, 2006. 355 pages. Paperback; $22.00. ISBN 0226742695.

This volume consists of thirty-three essays that originally appeared in full in the pages of *Scientific American* over the period from 1993 to 2005. Several authors took advantage of this publishing opportunity to update their original essays. The editors have split the book into four sections of approximately equal length covering, respectively, the evolution of the universe, cellular evolution, dinosaurs and other monsters, and human evolution.

The first section has Jim Peebles, Martin Rees, Bob Hazen, and Steve Schneider, among others, providing eight excellent summaries of current thinking regarding the evolution of the universe including the first stars, the existence of multiverses, the fate of the universe, misconceptions about the Big Bang, and the evolution of Earth. Nobelists Christian De Duve and Manfred Eigen join other cellular biologists and immunologists like Sir Gustav J. V. Nossal in exploring via seven chapters the birth of complex cells, viral quasispecies, how cells respond to stress, cellular communication, the immune system, and cybernetic cells.

The late Stephen Jay Gould and other paleontologists explore in seven essays ocean life in the Jurassic period, *Tyrannosaurus rex*, Madagascar's Mesozoic life, and the origin of birds, etc. The final section features primatologists, paleoanthropologists, and anatomists such as Ian Tattersall, Meave Leakey, Alan Walker, and Tim White examining early hominid fossils from Africa, Neanderthals, the emergence of the human race, and ancient cannibalism. It concludes with a provocative piece by Olshansky, Carnes, and Butler about what humans would look like if they were "intended" to live over a century since the biomechanics of the human body pose enormous problems with the onset of aging.

The book is recommended for its crisp, accurate presentations of ideas on origins, evolution, and history of life on Earth. The black and white illustrations that accompany the articles greatly enhance the narrative, although one might wish that the publisher had reproduced the full-color images of the original *Scientific American* presentations. Readers of *PSCF* will, of course, diverge considerably from writers of these essays on particular points, but there is substantial food for thought in these stimulating essays.

Reviewed by Dennis W. Cheek, Vice President of Education, Ewing Marion Kauffman Foundation, Kansas City, MO 64110.

DARWIN'S NEMESIS: Phillip Johnson and the Intelligent Design Movement by William Dembski, ed. Downers Grove, IN: InterVarsity Press, 2006. 357 pages. Paperback; $25.00. ISBN: 0830828362.

The contributions to this *festschrift* in honor of Phillip Johnson are diverse yet each relates in some way to the Intelligent Design (ID) movement. Included are testimonials showing that Johnson's analytic critique of neo-Darwinian claims, and exposure of the underlying commitment to philosophical naturalism, did have an impact on various scientists who once held a friendly disposition to evolutionary theory. Others had previous doubts validated by the books of Johnson and Michael Denton. The first four chapters tell how and why Johnson was able to change minds and redirect the focus of scientists and philosophers key to the ID movement.

Some contributions highlight the relevance of ID to specific contexts. Nancy Pearcey provides a good analysis of the fact-value split in Western thought. She notes that our civilization used to have a unified theory of truth and knowledge and argues, in agreement with her sources, that this unity began to unravel largely under the impact of Darwinism and the rise of the naturalistic worldview. While her overall argument is sound, I would note that Darwinism, which may have added great impetus to the problem of these destructive dualisms, did not create them. They go much farther back into Enlightenment thought, and the possible demise of the neo-Darwinian Goliath may be helpful but not sufficient to eradicate them. T. F. Torrance has shown that, under the impact of Einstein and others, the science of physics has advanced by the rejection of dualisms deriving from Galileo and Newton, Descartes and Kant. Yet many still cling to invalid dualisms and retard progress and discovery. Long-held philosophical commitments are not easily dropped.

Michael Ruse is a contributor who is known for his criticism of ID. While he is not a Christian believer and does not seek to defend Christianity, he does disagree with Richard Dawkins on the necessity of holding an atheistic position as a scientist or philosopher. Hence he defends "the integrity of the Darwinian who wants to be a Christian."

J. Budziszewski provides a stringent critique of Larry Arnhart's effort to establish moral law on a naturalistic basis. An atheistic worldview cannot provide any concept of right and wrong which must be universally acknowledged and respected. Budzisqewski's writing is as clear as his logic is sound.

ASA member William Dembski discusses the backlash against ID, and provides some interesting comments on theistic evolutionists, among whom must be numbered some vocal opponents of ID. Dembski notes:

> Theistic evolutionists have now become marvelously adept at rationalizing not only how their religious faith makes sense in the light of evolution but also how evolution enhances their religious faith. Let's not play this game. The issue for us is not how evolution relates to religious faith but whether evolution, as currently understood by science, is true. If, as we argue, it is not true, then exploring its religious ramifications constitutes a vain exercise (p. 101).

Stephen Meyer's article on the origin of biological information and the Cambrian explosion is reprinted here. It first appeared in *Proceedings of the Biological Society of Washington* (2004), after it went successfully through the peer-review process. The editor, who has two earned doctorates and a position at the Smithsonian, was harassed and fired for publishing it. He "continues to face great persecution" (p. 313). There is no fair play when critics serve as gatekeepers forbidding ID contributions while they simultaneously claim ID is not supported in the peer-review journals.

ASA Fellow Walter Bradley, joint-author of *The Mystery of Life's Origin*, provides the interesting observation that the ID "beachhead is greatest in physics and least in biology." He claims that the field of physics is more open to new ideas.

Speaking of physics, Wesley Allen and ASA Fellow Henry Schaeffer III contributed "Complexity, Chaos, and God." They connect a helpful primer on chaos theory to a discussion on free will, determinism, and providence.

One can only hope they will turn their article into a book-length discussion.

Twenty authors make this book varied and informative, and of interest to students and teachers. The contributions are readable because they are well written and because they lack vitriol. It is a fine testimony to the human quest for truth, and also a reminder that those who question a dominant theory, and its underlying philosophy, may face relentless hostility for some time. I recommend this book both to friends and critics of ID.

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UNDERSTANDING GENESIS: Contemporary Adventist Perspectives by Brian Bull, Fritz Guy, and Ervin Taylor, eds. Riverside, CA: Adventist Today Foundation, 2006. 195 pages; index. Paperback; $19.95. ISBN: 0978614119.

Written in plain, accessible language, *Understanding Genesis* will appeal to readers interested in exploring the historical and pre-scientific contexts of the biblical creation and flood narratives. The editors and contributors, all with appropriate expertise, carefully and concisely articulate their positions, providing documentation for those interested in digging deeper into the issues.

Some potential readers, as was this reviewer's initial impression, might suppose that this text is written exclusively to Christians in the Adventist traditions or that the Adventist traditions have a unique perspective regarding these issues. And indeed, the text was written by Adventists to fellow Adventists for the purpose of trying to provide some clarity on important issues. However, the quantity of "in-house" denominational conversation is minimal and not distracting to those outside the Adventist traditions.

The central goal of the text is to convince readers of two things: (1) that the young-earth position is not supported by scientific evidence; and (2) that historically-informed hermeneutics also do not support a young-earth position. In pursuing this goal, they explore a range of issues including the "red in tooth and claw" quality of nature, the theological purpose of Scripture, and the so-called flood geology. A discussion of scientific integrity and the role of the professional Christian scientist is particularly significant: "If the data for a young earth is as obvious and compelling as we have been led to believe by some creationists, to what do we attribute this deafening silence?" (p. 108).

Another highlight was the extensive discussion of ancient worldviews and the challenge and importance of trying to see natural events through another's culture:

> What we can do ... is read the ancient texts, not as poetic expressions of our world's understanding, but as literal expressions of the biblical world's understanding. Only by so doing can we hear the text of Genesis as it came to the ears of those who first heard it thousands of years ago (p. 62).

For readers who consider themselves "on the bubble" about whether the earth is ancient or young, this is an excellent text providing a broad and convincing discussion. Readers who find themselves convicted of a need to defend a young-earth position will likely not be moved by the book. For such readers, the authors rightly caution that the young-earth position has no scientific basis and should be recognized as being a "faith statement based on textual authorities we trust" (p. 109). Readers firmly convinced of an ancient earth may not gain as much from discussions about the physical issues surrounding the creation and flood narratives, but there are excellent discussions about ancient worldviews and the Bible.

This is a weak point in the book: the authors propose a strong separation between the domains of science and the domains of theology. They suggested that "fences make good neighbors" (p. 25), and that the apparent conflict between science and faith originates in a failure to maintain a proper perspective about their distinct roles, functions, and expertise. The authors might consider that such a strong separation could reinforce the notion that one perspective trumps the other, thus intensifying an "us versus them" mentality.

I am pleased to recommend *Understanding Genesis* to a variety of readers from a variety of backgrounds. It is informative reading and well written. Additionally, it has the potential to find a wide audience among those looking for suitable material on creation and flood topics. The editors are to be commended for the book's clarity, level of presentation, and respectful tone.

Reviewed by Sean M. Cordry, Associate Professor of Physics, Northwestern College of Iowa, Orange City, IA 51041.

COSMIC JACKPOT: Why Our Universe Is Just Right for Life by Paul Davies. Boston: Houghton Mifflin, 2007. 295 pages, index. Paperback; $26.00. ISBN: 0618592261.

The book was published in the UK with the title *The Goldilocks Enigma*. Davies is a well-known physicist and cosmologist who is now at Arizona State University. He was the recipient of the 1995 Templeton Prize. His previous books include *The Mind of God* and *The Fifth Miracle*.

Recent spectacular advances in observational cosmology have led to serious consideration of the possibility that the laws of physics might be fine-tuned for life, and many big questions of existence are now on the scientific agenda. The present book is a discussion of these matters. In the early chapters, Davies sets out the basic concepts of modern physics and cosmology and then describes the multiverse theory and the arguments for and against it. Later he takes a critical look at the various responses to the fine-tuning issue. He says that in spite of the emphasis on the deep and meaningful, he intends his book to serve as a straightforward nontechnical introduction to modern cosmology and physics.

In successive chapters, Davies discusses the big bang, modern high-energy particle physics, grand unified theories, dark matter and dark energy, and the origin of the elements that make the universe fit for life, with emphasis on the Goldilocks "just right" aspects. He then discusses whether the Goldilocks enigma might be solved by the idea that our universe may be a fragment of a vast and heterogeneous system, the multiverse, with the laws of physics and the initial state varying from one "universe" to another.

The last two chapters, titled "Intelligent and not-so-intelligent design," and "How come existence," comprise one-third of the book. Here Davies sees Paley's watchmaker argument as one of the "God-of-the-gaps" variety, which in the Intelligent Design (ID) movement in the US is making a comeback. For Davies, ID in biology is magic, not science. The ID argument strikes Davies as not very intelligent at all.

Davies examines the Christian doctrine that God is a necessary being whose existence needs no explanation in terms of something outside itself. That requires a reconciliation of a necessary God with a contingent universe. Davies says that he is not an accomplished enough philosopher to evaluate the arguments, which are abstract, subtle, and convoluted. If the concept of God runs into a logical and existential quagmire, then the multiverse fares little better. One can ask why the multiverse exists and who or what designed it. To make this point, Davies questions the many assumptions that underpin the multiverse theory.

In his final chapter, Davies discusses the two routes that he favors. The first route involves the acceptance of a life principle that constrains the universe/multiverse to evolve toward life and mind. It builds purpose into the workings of the cosmos at a fundamental level, without positing an unexplained pre-existing purposive agent. Davies recognizes that by thus introducing teleology one is making a decisive break with traditional scientific thinking. The second route involves the acceptance of a self-explaining universe (but we are still left not knowing why *this* self-explaining system is the one that exists).

Reviewed by Donald Nield, Associate Professor of Engineering Science, University of Auckland, Auckland, New Zealand.

LIVING WITH DARWIN: Evolution, Design, and the Future of Faith by Philip Kitcher. New York: Oxford University Press, 2007. 192 pages. Hardcover; $20.00. ISBN: 0195314441.

The author, Philip Kitcher, is John Dewey Professor of Philosophy at Columbia University, and he has written several books including *Abusing Science: The Case against Creationism* (1982).

Kitcher's first chapter is introductory. He states that from the perspective of almost the entire community of natural scientists worldwide, the continued resistance to Darwin is absurd. He asks how can the allegedly massive evidence in favor of Darwin's central claims be overlooked? Why is there such a vehement opposition? He sets this in the context of the claim that Intelligent Design (ID) is not a religious perspective but a genuine scientific alternative to Darwinian orthodoxy. ID makes two major claims. The negative thesis is that some aspects of life and its history cannot be understood in terms of natural selection. The positive thesis is that these aspects must be understood as the effects of an alternative causal agency, one that is properly characterized as "intelligent." Some people argue that ID is not science. Kitcher takes a different view. He argues that ID is "dead science," a doctrine that has had its day but is now rightly discarded.

Chapters 2 and 3 present briefly some of the scientific evidence in answer to critics of Darwin such as Phillip Johnson. The pattern of fossil evidence and the geological and physical data rule out "Genesis creationism" based on a literal reading of Genesis. The biological data rule out "novelty creationism" (separate creation of major novelties). Recognizing a single tree of life can account for innumerable details of the organic world that creationism can only regard as the whimsy of intelligence.

In chapter 4 Kitcher responds to Behe's claims that certain molecular machines could not have been built up in stages by natural selection. He says that at the heart of the ID movement are two types of argument, both designed to question the thought that natural selection scales up, from microevolution on a short time scale, to macroevolution on a large time scale. The "concrete case" argument selects a collection of evolutionary changes, discusses them in detail, and tries to show that there is no conceivable process of natural selection that could start with the original group of organisms and end with the finally modified group. The "computational" argument abstracts from the details of individual cases, presents them in terms of a more skeletal description, which is used to assign some basic probabilities. This then allows the calculation of the probability that the transition could have come about by the action of natural selection. Since the estimate is tiny, the conclusion is that causation by natural selection is, to all intents and purposes, impossible. Neither argument is original to contemporary ID advocates. What is new is that an "intelligent" agent is involved.

The arguments are flawed in that the intermediate forms are specified (e.g., that the proteins in the bacterial flagellum must have been added one at a time). Since Darwinians have no commitment to simpleminded stories of sequential addition of components, there is no reason to accept Behe's description. The computational argument depends on successive events being statistically independent and the principle of indifference, but in the biological situation these assumptions do not hold. On the positive ID thesis there are two issues to be considered: (1) on what grounds should we apply the label "intelligent," and (2) what help can ID provide in understanding the phenomena in question? On the first question, Kitcher says that it is a fallacy to suppose that because a particular structure or mechanism appears to be complex, then the casual agent that brought it about must be appropriately characterized as having "foreseen" or "planned" or "designed" the outcome. Even if the IDers were right in supposing that the phenomena they indicate could not have evolved by natural selection, they would then need to more explicitly identify the causal mechanism before they could justify the conclusion that the mechanism is intelligent. On the second question, neither in Behe's writings nor those of any other IDer is there the slightest indication of how intelligence performs the magic that natural selection cannot do.

In his fifth and concluding chapter, Kitcher discusses religious beliefs. He sees Christianity in retreat and ID as something being put forward by desperate people. In my opinion, this is a superficial discussion. The possibility of a theistic evolutionist position is ignored. However, the first four chapters are well worth reading.

Reviewed by Donald Nield, Associate Professor of Engineering Science, University of Auckland, Auckland, New Zealand.

Book Reviews

PHILOSOPHY & THEOLOGY

THE ORDER OF THINGS: Explorations in Scientific Theology by Alister E. McGrath. Malden, MA: Blackwell Publishing, 2006. 255 + xxix pages, bibliography, index. Paperback; $37.95. ISBN: 1405125551.

This is a continuation of McGrath's scientific theology project. The previous major works in this project are *"A Scientific Theology"* in three volumes, entitled *Nature* (2001), *Reality* (2002), and *Theory* (2003). Previous books by McGrath reviewed in *PSCF* include *The Science of God: An Introduction to Scientific Theology* and *A Scientific Theology: Nature*. McGrath is a prolific writer on theology, and his current scientific theology project promises to be one of the most important of this era.

McGrath begins this book with a long preface in which he describes much of the background for his project. He then briefly introduces each of the ten essays which comprise the remainder of the book. Chapter 1, written by Benjamin Myers, entitled "Alister McGrath's Scientific Theology," is a review of the 3-volume Scientific Theology series. Chapter 2, which was my favorite chapter, is entitled "Is a 'Scientific Theology' Intellectual Nonsense? Engaging with Richard Dawkins." McGrath responds (superbly, in my view) to five misguided ideas presented in Dawkins' writings. In chapter 3, "A University Sermon: On Natural Theology," McGrath explores whether the wonders of the world that we see can lead us to a recognition of the possibility that the physical world is not all there is. In chapter 4, "Towards the Restatement and Renewal of a Natural Theology: A Dialog with the Classic English Tradition," he discusses some of the problems with the natural theology that were developed in the eighteenth and nineteenth centuries, including problems with the natural theology developed by William Paley and the challenges of Darwinism. He also interacts with some of Karl Barth's criticisms of natural theology.

Chapter 5, "Stratification: Levels of Reality and the Limits of Reductionism," includes a discussion of the stratification of reality and its emergent properties. McGrath also argues against methodological uniformity in the study of reality. In chapter 6, "The Evolution of Doctrine? A Critical Examination of the Theological Validity of Biological Models of Doctrinal Development," McGrath discusses several evolutionary topics that might be related to development of theology, including Darwinian vs. Lamarckian evolutionary patterns, Dawkins' memes and Gould's evolutionary contingency vs. Conway Morris' islands of stability.

In chapter 7, "Assimilation in the Development of Doctrine: The Theological Significance of Jean Piaget," he includes Piaget's model of assimilation and accommodation in a discussion of how specific cultural settings have influenced theological developments relating to Ebionitism, Pelagianism, and the Anglo-Saxon "Hero" model. Chapter 8, "A Working Paper: The Ordering of the World in a Scientific Theology," includes a discussion of a variety of ways that the universe is ordered, including creation, redemption and righteousness. In chapter 9, "A Working Paper: Iterative Procedures and Closure in Systematic Theology," McGrath proposes and describes how an iterative process has been and can be used to develop theology, with the actuality of the church as the starting point. The final chapter, chapter 10, "The Church as the Starting Point for a Scientific Dogmatics," argues that an empirical Christian theology begins with the existence of the church.

McGrath is an extremely thoughtful writer; he draws from an exceptionally wide background. He received a doctorate in molecular biophysics from Oxford and one in historical theology from Oxford. He is currently the President of the Oxford Centre for Christian Apologetics and also holds a Senior Research Fellowship at Harris Manchester College. Also, he will be presenting the 2009 Gifford Lectures.

This book is not for the faint-hearted. It is one of the more challenging that I have read, but in the end, it definitely was worth the effort. The title may be a bit misleading. The focus of the book is primarily on the development of theology, rather than whether there is conflict or concordance between some aspect of science and theology, such as the typical creation/evolution debate.

I am eager to read the results of the effort described in this book—the Scientific Theology itself. I am confident it will be a significant contribution to our understanding of theology in this scientific age. While this book seems to be written primarily for theologians, scientists and other laypersons with a serious interest in the interactions between science and theology will benefit from reading it.

Reviewed by James Behnke, Professor of Chemistry, Emeritus, Asbury College, Wilmore, KY 40390.

UNCERTAINTY: Einstein, Heisenberg, Bohr, and the Struggle for the Soul of Science by David Lindley. New York: Doubleday, 2007. 260 pages, index. Paperback; $26.00. ISBN: 0385515065.

David Lindley, an astrophysicist and former editor of *Nature, Science*, and *Science News*, is well qualified to write this book having to his credit such successful works as *The End of Physics* and *Boltzmann's Atom*.

In his account of the fast-paced development of physics in the first half of the twentieth century, Lindley does a clean job of characterizing the ideas, personalities (Bohr, Einstein, Sommerfeld, Rutherford, Schrödinger, Pauli, Planck and Heisenberg, among others), and intellectual bantering that transpired over this remarkable period in the history of science. The reader is taken from a masterful explication of the atom in classical physics through the maturation of nuclear and quantum mechanics, into relativity theory and out the other side to a "precise" explanation of Heisenberg's principle and quantum indeterminacy. Probabilists of all stripes will appreciate Lindley's description of the palpable angst experienced by many of the principals as they contended with the realization that the scientific method was abandoning them only to be superseded by a disquieting uncertainty.

Lindley weaves a tale through eighteen readable chapters beginning with "Irritable Particles" where he recounts how Brownian motion failed to be understood by the gen-

eral scientific community leading to its being ignored for decades. Next he illustrates how statistical reasoning crept into the understanding of the atomic nature of matter through Boltzmann's work on the random nature of atomic motion concluding with Rutherford's declaration that the atom possesses a dense nucleus and the subsequent proclamation of the birth of nuclear physics. Bohr then ushered in the quantum era with what Lindley describes as "a mix of physical reasoning and inspired guesswork." Eventually Heisenberg, characterized by the author as the impudent newcomer to 1920s physics community, ceremoniously unveiled his uncertainty principle.

Lindley's skill in effortlessly communicating confusing ideas is exceeded only by his ability to capture the truly human side of the personalities engaged in this scientific struggle. The story has all of the qualities of a good drama with name-calling, petty jealousies, and unhealthy competition. Once the uncertainty principle began achieving traction, Lindley makes it clear that

> the Copenhagen interpretation was crystalliz[ed] into the standard view of quantum mechanics. It has been over the decades as elusive as it has been influential. Those who subscribe to it talk of its profundity and power while acknowledging they can't easily put it into words. Precisely the problem, say its critics. It has acquired de facto authority even though no one seems to be able to say quite what it is.

As an example of the frustration felt by some of these pioneers of early twentieth century physics, Einstein is quoted as having told Schrödinger that "the soothing Heisenberg-Bohr philosophy—or religion?—is so nicely contrived that for now it offers the true believer a soft pillow from which he is not easily rousted. So let him lie."

Not content to address only the historical facts of the development of uncertainty, Lindley skillfully summarizes the philosophical upheaval this new paradigm engendered in the physics community. Although the uncertainty principle dealt a body blow to logical positivists, Lindley describes the length to which "more traditional philosophers" such as Karl Popper went to disprove quantum theory on philosophical grounds, all of this despite Einstein's pronouncement that "the experiment that Popper had proposed [to disprove the uncertainty principle] wouldn't do the job." But, as Lindley adroitly concludes: "Nowadays most physicists ... are belligerently uninterested in what philosophers make of their theories."

The book ends with a chapter appropriately titled, "Anarchy at Last." It is clear, as Lindley points out, that "Heisenberg's paradoxically precise uncertainty principle has ascended to a remarkable level of intellectual celebrity," one might even say, infamy. The author lampoons nonphysicists as far-ranging as journalists and fictional television politicians for attributing cultural fuzziness (as well as the belief of many folk in an apparent lack of absolute truths) to the uncertainty principle. What these modern day Heisenberg groupies fail to grasp, but what Lindley makes clear, is that "even in physics, the uncertainty principle is by no means of ever-present relevance."

Certainly, physicists would find much of the history laid out in this book familiar. However, I suspect most others with an interest in the sciences (including physicists) would find Lindley's account of the clashes resulting from intellectual protectionism, simple envy and philosophical predispositions, not to mention the surprisingly wide-ranging impact of the uncertainty principle outside the realm of physics, both enlightening and insightful.

Reviewed by Thomas W. Woolley, Professor of Statistics, Samford University, Birmingham, AL 35229-2306.

PANENTHEISM: The Other God of the Philosophers—From Plato to the Present by John W. Cooper. Grand Rapids MI: Baker Academic, 2006. 368 pages, name index, subject index. Hardcover; $34.99. ISBN: 9780801027246.

Classical theism, the standard mainstream doctrine of God until the twentieth century, was based on the Bible and honed by Catholic and Protestant scholars from Augustine to Warfield along with their Muslim and Jewish counterparts.

> ... God in himself in maximal Being—is absolutely self-sufficient, eternal, immutable, omnipotent, omniscient, completely active, and most excellent in every way ... God eternally and freely chooses to create the world from nothing and sustain it through time. He is immanent in the sense that he is supernaturally present to all beings and events at all times and places ... empowering creatures and effectuating his eternal knowledge and will through their natural existence and free actions. But God in himself is utterly transcendent, all-determining and changeless, eternal and immutable even in relation to his creation (pp. 14–5).

Classical theism based these attributes on scriptural grounds. However, in the last century a rising number of theologians—non-Christians, liberal and conservative Christians—have modified the classical doctrine to a greater or lesser extent to meet social, scientific, and religious challenges of the day. Because classical theism borrowed from Greek philosophy, modern critics dubbed it the "God of the philosophers." Aptly, Cooper argues that panentheism finds deep roots in Neoplatonism and thus deserves to be called "The other God of the Philosophers."

Panentheism today is defined: "The Being of God includes and penetrates the whole universe, so that every part exists in Him, but His Being is more than, and not exhausted by the universe" (p. 27). Panentheistic theologies fall somewhere between the classical theism of conservative Christianity and pantheism where God and the world are one. The term was first used by Karl Krause (1781–1832) to distinguish his theology from these categories. Charles Hartshorne brought it into popular use in the late 1940s. Those who embrace panentheism are not at all agreed on what it is or whether it fits their views. It finds application in liberal theology and more recently among evangelicals who speak of a relational God, involved in real time, one who takes chances.

Cooper has produced a landmark historical overview of this field. Professor of Philosophical Theology at Calvin Theological Seminary since 1985, he has written an accessible and well-organized introduction to a complex subject. Early readers of his work praise his evenhanded and thorough treatment.

Today's prominent cosmologies are linked to earlier thinkers. These writers accept the current scientific perspective of an evolving universe and find a panentheistic approach to offer the best synthesis of theology and science. Concordist schemes are eschewed in favor of broad pictures that emphasize the immanence of God and a different view of redemptive history. Classical theism views sin and the Fall as *distinct* from the basic structure of the world and the culmination of the kingdom of God as a gracious undertaking that is not a mere outcome of a natural process. Panentheism, however, typically views creation and the Fall as *part* of the cosmic process as are redemption and consummation. Christian panentheists view the earthly existence of Jesus Christ as either the *central cause* of the outcome of the process (Teilhard, Pannenberg, Moultman) or a *primary symbol or example* of the process (Tillich, Cobb). Each approach is at odds with classical theism.

Chapter 13 considers the thought of Ian Barbour (qualified process panentheism), Paul Davis (uniformitarian panentheism), Arthur Peacocke (naturalistic sacramental panentheism), Philip Clayton (emergent personal panentheism), and John Polkinghorne (escatological panentheism).

Polkinghorne seems closest to a classical position in choosing to modify overzealous transcendence.

> In the kind of dipolar theism that I am seeking to espouse, God is understood to have chosen to possess only a current omniscience, temporally indexed ... God does not yet know all that will eventually become knowable (quoted, p. 316).

He espouses a panentheistic future where "God's ... creatures ... [will] ... enjoy fully the experience of the unveiled divine presence, and so share in the divine energies" (p. 317).

Cooper mentions, all too briefly, two Christian theists (William Lane Craig and Nickolas Wolterstorff) who find theological space for an eternal or everlasting God who changes with time.

The closing chapter "Why I am not a Panentheist" offers a brief study of why he rejects panentheism. It is essential reading for all conservative Christians who wish to analyze the leading current options for a Christian cosmology. What is sadly lacking today is an evangelical position that has credibility and about which a consensus can be drawn. Can one strike a more judicious balance between transcendence and immanence focusing on Jesus Christ, divine and human, Creator and Savior?

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

THE PASSIONATE INTELLECT: Incarnational Humanism and the Future of University Education by Norman Klassen and Jens Zimmerman. Grand Rapids, MI: Baker Book House, 2006. 208 pages, index. Paperback; $13.25. ISBN: 0801027349.

This book explores the themes of whether, and how, Christians can develop a rich and passionate life of the mind. Although it is written for Christian students bound for university, it is useful for any Christian who is serious about the intellectual life.

One of the authors' goals is to defuse the "warfare" mentality concerning faith and "secular" learning that some Christians, particularly those who are not very mature in the faith, often seem to develop. They propose to do this through the model of "Incarnational Humanism."

"Incarnational Humanism" takes the incarnation of Christ as a starting point for a Christian approach to learning. "In Christ," the authors state, "all fragmentation ends and a new humanity begins, a new creation in which all knowledge is united (or taken captive, as Paul puts it) under the lordship of Christ because in him the divine and the human are firmly joined forever." The pattern of the incarnation suggests that we should expect to find that truth is not "an abstract, timeless concept," but rather is mediated through human language, culture, and tradition. Therefore, Christians should not be afraid of truth located outside the hermetically sealed world of their particular religious subcultures.

In short, the authors place a Kuyperian notion of "common grace," as mediated for generations of Christian college students by Arthur Holmes' famous dictum that "All Truth is God's Truth," into the postmodern context. While the authors thus acknowledge the postmodern turn, they firmly deny the destructive Nietzschean postmodernism, evident in figures such as Michael Foucault, that rejects any notion of classical humanism in favor of a heuristic of power relationships.

However, the authors suggest that the answer to Nietzsche and Foucault is not a resurgent Christian rationalism dusted off from the fundamentalist-modernist controversy. Rather, they hearken back to the sort of humanism that was evident in many of the Church's great minds, such as Augustine, Aquinas, Luther, and Calvin, prior to the Enlightenment. In this classical Christian humanism, truth is more than power—indeed, truth in many ways is the antithesis of power—because the divine Truth became man and *gave* himself for us.

There are many riches in this book. "Incarnational Humanism" is a beautiful phrase that deserves broad attention, and it is high time that "All Truth is God's Truth" be given a postmodern reading. There is also, however, a glaring weakness in the authors' arguments: they do not deal adequately with the effects of sin. A model of truth that hearkens back to Augustine, but that glides over any reading of Augustine's thoughts on sin, will not present a thoroughly *Christian* humanism. I wish the authors had acknowledged the tension between the incarnation and human sinfulness, and had contextualized it, as Scripture and the Christian humanist tradition do, within the "already/not yet" of the Kingdom of God.

Nevertheless, this is a valuable addition to the literature on the intellectual life as a Christian vocation. Let us hope that a holistic, incarnational understanding of faith and learning once again infuses the Church, rather than the rationalist, atomistic, confrontational approaches that so often seem to dominate our thinking.

Reviewed by David W. Opderbeck, Associate Professor of Law, Seton Hall University School of Law, Institute of Law, Science & Technology, South Orange, NJ 07079.

THE EVOLUTION OF RATIONALITY: Interdisciplinary Essays in Honor of J. Wentzel Van Huyssteen by F. LeRon Shults, ed. Grand Rapids, MI: William B. Eerdmans Publishing Company, 2006. 426 pages. Hardcover; $50.00. ISBN: 0802827896.

Nearly everyone recognizes the problem these days: you cannot get away with claiming to really "know" something any more. In science, in theology, in ethics, in every conceivable discipline, knowledge claims are in deep trouble. On the one hand, genuine knowledge has to be certain, stable, unassailable; "true" knowledge has to be anchored in a secure foundation that will not shift beneath us. But such foundations have become notoriously difficult to locate and to sustain. And so—on the other hand—our cultural default position on the question of what we can actually *know* in science, theology, ethics, and other domains, is an uneasy state of denial. There are no foundations, so there can be no real knowledge. There are only subjective and eccentric opinions and perspectives, constrained and transient judgments whose value is strictly local and immediate.

In a word, this is the modern problem of rationality. Rationality is a problem because no one is any longer quite sure where its center is, or what its limits are. Compounding the dilemma is the historical fact that so many philosophers, scientists, and various schools of thought have tried to co-opt rationality for their own special projects. Consider the logical positivists, who at the turn of the twentieth century sought to restrict the expressions of rationality to definitions (tautologies) and to observation statements, all in the name of cleaning up scientific language. But such a strategy leaves theological and ethical discourse outside the bounds of rationality. God-talk and moral norms are reduced to private, personal matters, and thus are not fit for reasonable and public conversation.

Contemporary philosopher and theologian J. Wentzel van Huyssteen has been working for more than three decades to mediate the extremes of foundationalist positivism and nonfoundationalist relativism when it comes to these core epistemological issues. Through a series of heralded books and articles, van Huyssteen has offered a number of penetrating insights into the nature of rationality as applied to both scientific and theological endeavors. His efforts—which have ranged from the original development of a "critical realist" methodology in theology (derived largely from the respective works of Karl Popper and Thomas Kuhn) to a more recent interest in evolutionary epistemology and psychology—have been directed toward the articulation of a model of rationality that is comprehensive enough to account for the common rationality of both science and theology.

The text at hand is a Festschrift of articles written to honor van Huyssteen on the occasion of his sixty-fifth birthday. The title, "The Evolution of Rationality," seeks to capture the essence of van Huyssteen's work over the past thirty-five years, and the articles are suitably divided into three categories: "Philosophical Explorations," "Scientific Explorations," and "Theological Explorations." The list of authors is a litany of familiar names in contemporary philosophy and theology of science: Philip Clayton, Keith Ward, Holmes Rolston III, Arthur Peacocke, Neils Henrik Gregersen, Michael Ruse, Calvin O. Schrag, Mikael Stenmark, and John Hedley Brooke are among the twenty-two prominent contributors to this volume.

Unlike many similar celebratory anthologies, the quality of the articles is consistently strong and their content appropriately diverse. The topics included range from Peacocke's reflection on music as a measure of divine creativity to Brooke's assessment of Darwin's impact on the scientific study of the "knowing self" to Gregersen's thoughtful theological critique of evolutionary psychology. Some of the articles directly utilize van Huyssteen's work as a basis for further investigation (such as Stenmark's analysis of different conceptions of science), while some do not even mention van Huyssteen at all (for instance, the careful and provocative piece by Holmes Rolston III on the five "looming questions" that must be addressed by science regarding the origin of life on earth).

For those interested in the philosophical, and specifically the epistemological, questions that are at the forefront of philosophy of science, and of the increasingly sophisticated dialogue between science and Christianity, this text cannot be recommended highly enough. It is thick with information, analysis, and proposals that will enrich those who seek to broaden their understanding of this field. And for those who are drawn to explore further the exciting and exacting work of van Huyssteen, pick up a copy of *Duet or Duel: Theology and Science in a Postmodern World* (1998) or *The Shaping of Rationality* (1999).

Reviewed by Thomas D. Pearson, Associate Professor of Philosophy, The University of Texas-Pan American, Edinburg, TX 78539.

ESCAPE FROM REASON: A Penetrating Analysis of Trends in Modern Thought by Francis A. Schaeffer. Downers Grove, IL: IVP Books, 2006. 123 pages. Paperback; $8.00. ISBN: 0830834052.

Schaeffer is incredibly difficult to pin down. He has been described as a (compassionate, inconsistent and modified) presuppositionalist, an inconsistent empiricist and a verificationist—this is, I suspect, because he is more an evangelist and apologist than an academic philosopher. Schaeffer's books have been incredibly influential, not least his trilogy originally printed in 1968 of which *Escape from Reason* is the second part—the first being *The God Who Is There* and the final part *He Is There and He Is Not Silent*. *Escape from Reason* is the shortest of the three and has sometimes been mistaken for the introduction to the trilogy.

Reading Schaeffer is a bitter-sweet experience. I rejoice at his desire to see the lordship of Christ expressed over every area of life, but get frustrated at his broad brush strokes that often over-simplify. Schaeffer is rarely subtle!

The villain of this piece is Aquinas. It is perhaps an understatement to say that Schaeffer is a little hard on Aquinas; a better Reformed analysis of Aquinas is found in Arvin Vos's *Aquinas, Calvin, and Contemporary Protestant Thought*. Nevertheless, Schaeffer does highlight the problems scholastic dualism has caused Christianity.

He sees the most crucial problem facing Christians today as being rooted in the Middle Ages and in Aquinas in particular. It was Aquinas who opened the way for

autonomous rationality. According to Schaeffer, Aquinas claimed that the human will but not human intellect is fallen. This assumption, once popularized, provided the fertile soil for the belief that humans could become independent, autonomous.

In *Escape from Reason*, Schaeffer examines the relationship between "grace" and "nature." He argues that nature has slowly been "eating up" grace. Yet a "line" or "gap" exists between the supposed upper realm of grace and the lower realm of nature. Western society has gone below this line and it has led to despair. This despair is revealed first in philosophy; subsequently, it spreads to art, then music and general culture, before reaching theology.

Schaeffer had a way of communicating Christianity to modern culture – we need more like him today. He awoke his generation to the presence of secular humanism and showed that it was possible to think and be a Christian at the same time. This book provides an excellent introduction to his ideas, though it shows its origin in the lecture format: there are few footnotes and references. His analysis is often derivative of the Dutch Christian philosopher Herman Dooyeweerd. Schaeffer's close friend Hans Rookmaaker once remarked that "*Escape from Reason* is Schaeffer's version of what Dooyeweerd develops in *In the Twilight of Western Thought*."[1]

It is a shame that this book is not illustrated, for Schaeffer makes some excellent points regarding grace and nature using descriptions of art works and having them illustrated would have greatly enriched the reading experience.

This reprint has a brief foreword by James Moreland and a two-page index. It is a welcome addition to the IVP Classics series.

Note

[1]Herman Dooyeweerd, "A Dutch View of Christian Philosophy" in *The Complete Works of Hans Rookmaaker* 6, Part III, The L'Abri Lectures, ed. Marleen Hengelaar-Rookmaaker (Piquant, 2005).

Reviewed by Steve Bishop, City of Bristol College, Bristol, UK.

RELIGION & BIBLICAL STUDIES

THY KINGDOM COME: How the Religious Right Distorts the Faith and Threatens America by Randall Balmer. New York: Basic Books, 2006. 206 pages, endnotes, index. Hardcover; $24.95. ISBN: 0465005195.

Randall Balmer describes himself as a "jilted lover," and it shows. Balmer, a professor of American religious history and an evangelical Christian, wrote *Thy Kingdom Come* to protest the way the Religious Right has "hijacked" the faith that in earlier times would have cared more about the poor and less about political power. His writing sometimes displays the bitterness of one whose beloved has betrayed him.

Balmer begins by analyzing the formation of the alliance between evangelical leaders and the political right in the 1970s. Considerable space is devoted to "the abortion myth," the popular story that the movement primarily arose as a response to *Roe v. Wade*. Balmer shows that the catalyst was instead threats to the tax status of Christian schools that practiced racial segregation. This is enlightening material, spiced up by a pro-choice quote (endorsing *Roe v. Wade*) from conservative Southern Baptist patriarch W. A. Criswell.

Chapter 2 ("Where Have All the Baptists Gone?") relates the long history of Baptist advocacy for church-state separation and liberty of conscience. Balmer laments how Baptist leaders have forsaken this heritage in favor of enforced orthodoxy and promotion of Christianity by government power. Chapter 3 describes what the author sees as efforts to undermine the public education system that he feels is vital to a healthy democracy.

Chapter 4 discusses creationism in various forms, particularly the Intelligent Design (ID) movement. Insights include placing ID in the context of a broader agenda to increase Christian influence in academia, and the observation that requiring science to legitimize faith "subjects religious belief to the canons of Enlightenment rationalism." Sadly lacking is any mention of evangelicals who reject creationism and ID as not only bad science but bad theology. Someone needs to introduce Balmer to George Murphy, Keith Miller, or Francis Collins.

Chapter 5 concerns the environment. The Au Sable Institute and the Evangelical Climate Initiative are held up as positive examples. This is the least pessimistic section, as the author sees growing Christian support for creation care, even as he describes efforts by some to continue giving profits priority over God's Earth.

Only briefly in the concluding section are suggestions given for improving the situation. Balmer advocates chipping away at the hegemony of the political right over evangelicals, starting with a few issues like environmental stewardship and opposition to government-sanctioned torture. Existing groups like Evangelicals for Social Action are not mentioned. Balmer also wants us to recognize the historical lesson that it is best for both church and state when the church speaks as a prophetic voice from outside the centers of political power, rather than grasping that power which leads to compromise and corruption.

I liked this book less than I expected to. I share the author's frustration that our faith has been co-opted by political forces who favor the rich over the poor, who would entangle church and state, and who promote arrogant nationalism. While I am not as far to the left as Balmer, I found his critique of the Religious Right convincing, enlightening, and often insightful.

So why was it a disappointment? Balmer offers little to appeal to the many politically moderate evangelicals who are uneasy with the tactics and stances of Dobson, Falwell, et al. He seems to adopt uncritically all the positions of the political left. The book is mostly complaint, with little evidence of Christian hope. Perhaps most troubling, the tone seems unworthy of a Christian scholar, often using demonizing language not much better than one might find in a Christian Coalition mailer or an Ann Coulter rant. For more constructive and less vitriolic coverage of similar ground, I recommend Stephen Carter's *God's Name in Vain* and Tom Sine's *Cease-Fire*.

Reviewed by Allan H. Harvey, 1575 Bradley Dr., Boulder, CO 80305.

THE NIGHT IS FAR SPENT by Thomas Howard. San Francisco, CA: Ignatius Press, 2007. 355 pages. Paperback; $16.95. ISBN: 1586171321.

Thomas Howard, an English professor for thirty years, is the author of *Evangelical Is Not Enough*, *Lead Kindly Light*, and *Chance or the Dance*. His book *On Being Catholic* written ten years after his conversion from an evangelical background to a communicant of the Roman Catholic Church, offers insights on Catholic dogma, spirituality, and practice.

This volume is a collection of thirty-one of Howard's writings on a wide range of topics selected by Vivian Dudro. In the first section, he writes of things literary with articles on such luminaries as C. S. Lewis, Malcolm Muggeridge, and Charles Williams. The second section contains articles on the sacred including the cross, sacraments, spirituality, and orthodoxy. The third and final section is devoted to "Self, Society and God," and includes articles on identify, gender, honor, fatherhood, and worship.

His comments about his conversion to the Roman Catholic Church are all irenic and benign. He appears to feel a need to explain his switch, but he succeeds in being warm and congenial when he is dissecting his faith, as in his article on "Catholic Spirituality," a talk delivered to mostly evangelical students at Gordon College.

A few observations: the use of British punctuation in placing the comma after the quotation mark seems somewhat unique for an American writer; the print size was challenging for my aging eyes; and I am curious how the article selection might have varied if it had been done by Howard rather than Dudro.

One of the most poignant articles was the last one entitled "Being Forgotten." It is about oblivion and what we leave behind at death. Howard, who works in the emergency room at Massachusetts General Hospital, observes that he (we) should not expect to escape the hair-raising suffering and daily death that parades through the hospital. Also, Howard acknowledges that he is supplied with the necessities of life: anything else, a Bentley, a royal dwelling, etc., "would obstruct most inconveniently my efforts to climb the heavenly steps" (p. 355). In this article, Howard states that, although having written a dozen books, "I threw in the sponge on writing books many years ago, not solely in a fit of pique, but also because I realized I had nothing more to say ..." (p. 334). But he has plenty to say in this book. Howard has been a popular Christian writer for decades. Read this book and it will become obvious why!

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

RELIGION IN SCHOOLS: Controversies around the World by R. Murray Thomas. Westport, CT: Praeger, 2006. 234 page, bibliography, index. Hardcover; $49.95. ISBN: 0275990613.

Education researcher R. Murray Thomas, professor emeritus at the University of California Santa Barbara, examines twelve representative cases of religious conflict in schools in this schematic, precise study that offers several frameworks for comparative analysis in the so-called "culture wars." Thomas masterfully negotiates the research and conceptualization hurdles set by this task. Establishing a careful methodology, defining terms, and offering useful and varied summaries of the relevant information, Thomas is a model of the thorough scholar. He has no particular expertise in the religious issues (as opposed to the educational issues) involved in the cases he chooses, but his treatment of them is accurate. Readers looking for insight into the peculiar challenges posed by religious doctrines and forms of *communitas* will not find it here; Thomas focuses on empirically available externals and stated motivations, not theological niceties.

The study is divided into three sections. The first outlines the methodology to be used to study the twelve cases at hand. Thomas' thesis is that conflicts involving religion and schooling involve four factors: "the nature of belief constituencies"; "the influence of cultural tradition"; "critical events" that bring those traditions into view through perceived threats, regulation, or attempts to change them; and power relationships among these constituencies. His method, then, is to identify the belief constituencies involved in a controversy; examine the relevant traditions found in these constituencies; describe the critical events that led to the conflict; and analyze the power relationships that affected the outcome.

In the second section, the bulk of the book, Thomas methodically applies this framework to twelve selected cases. They were chosen to achieve a balance between Eastern and Western religious traditions (six each), and for their newsworthiness, currency, and variety. Thomas examines headscarf regulations in French schools; teachers' refusal to participate in nationalistic ceremonies in Japan; the addition of nonreligious belief systems to the recommended religious education curriculum in England; the inclusion of pro-Hindu material in history textbooks in India; required Catholic or comparative religion classes in Spain; illegal imports of the Bible into China; crucifixes on classroom walls in Italy; curriculum reform in schools in Pakistan; a proposal to eliminate the word "evolution" from state curriculum standards in the US; government-run Islamic schools in Thailand; science standards that included respect for indigenous beliefs in Australia; and the arrests of foreigners accused of teaching Christianity in Saudi Arabia. At least two of these cases stretch the meaning of "education" beyond schooling to include Sunday schools or proselytizing classes—those from China and Saudi Arabia. While it is unfortunate for the unity of the book that no more rigorous examples could be found from these important cultures and traditions, it is understandable given the total government control and lack of meaningful dissent or dialogue in the educational systems of those countries.

A final chapter that comprises the book's third section proposes ways in which diverse controversies can be fruitfully compared and notes broad trends illuminated by the case studies. Of significance here is the short-term, incomplete nature of the resolutions of these twelve crises. Thomas concludes that tensions are rarely eased through the controversies. Instead, a new administration reverses policy, a compromise is reached, or one side is forced to back down. The underlying structure of pluralism and

its implications for education are not exposed to the light and thought through. Perhaps this is to be expected in the heat of these conflicts, but Thomas' conclusion cannot help but provoke regret that these opportunities for resolution are lost.

The strength and weakness of *Religion in Schools* is its unwavering rigor. Thomas refuses to speculate beyond his data, which makes his book highly valuable as a resource work for students interested in making their own analyses of the topic, but will disappoint others looking for cultural analysis and commentary, perhaps even a proposal for managing such conflict. The cases treated in the book are so fascinating and rich that one could hope for a set of twelve books elaborating on each in a more lively, interdisciplinary style.

Reviewed by Donna Bowman, Assistant Professor, Honors College, University of Central Arkansas, Conway, AR 72035.

THE WELL AND THE SHALLOWS by G. K. Chesterton. San Francisco: Ignatius Press, 2006. 203 pages. Paperback; $12.70. ISBN: 1586171267.

Gilbert Keith Chesterton (1874–1936) was an Englishman whose prolific writings included philosophy, history, poetry, biography, fiction, and theology. He is perhaps best known and appreciated by Christians for his apologetic arguments. Chesterton was converted in 1922 to the Roman Catholic Church, an experience he described as "the chief event" of his life. Like C. S. Lewis, he is appreciated by conservatives and liberals, both Romans Catholics and Protestants.

Chesterton authored one hundred books over a period of thirty-five years. This is a reprint of a volume first issued in 1935 in London, one year before Chesterton's death. It contains a series of short articles on a variety of subjects which Chesterton described as "autobiographical and grotesquely egotistical" (p. 13). Dale Ahlquist notes in his introduction that it is amazing that no discernible difference exists between Chesterton's pre-conversion and post-conversion writings, because he was defending the values of the Church long before he became a Roman Catholic.

In *The Well and the Shallows*, Ahlquist notes that Chesterton "defends the Catholic faith from all angles, from all attacks, which means writing about anything and everything" and " these essays are more specifically Catholic than his other works" (p. 7). Chesterton believed that cultures falling away from Roman Catholicism fall into falsehood (p. 197), and that the Protestant Reformation continues to mislead and bewilder Christendom (p. 30). Although Chesterton is critical of Protestantism, he defends Christianity as the "Well." Everything else is the "Shallows." Thus the title of this book! (In the light of present day ecumenism, Chesterton's view that the only factor Protestants share in common is their anti-Catholicism seems somewhat antiquated, p. 9). Chesterton was accused of being anti-Semitic, but he said he would die defending the last Jew in Europe.

Chesterton always offers opinions which stimulate. For example, Protestantism tends to prohibit rather than to curtail or control (as in alcoholic prohibition, p. 195). Capitalism has destroyed the family (p. 112). Communism is the only complete and logical working model of capitalism (p. 173). Erotic religion exalts lust and forbids fertility; it narrows love merely to enjoying sex (pp. 172–3).

Chesterton thought that birth control is a scheme for preventing birth in order to escape control (p. 38). "[M]oral movements are much more utterly and ruthlessly repressive than the past forms of mysticism or fanaticism that commonly affected only the few" (p. 94). He cautioned that Christians should not be too impressed with the findings of science. He believed geologists treat fossils, "the Testimony of the Rocks," like sacred hieroglyphics (p. 30).

Chesterton exerted substantial influence on the culture and religion of his day and his impact continues to be felt today. Ahlquist observes that Chesterton "is more important now than he was in his lifetime—and he will be even more important in the future" (p. 10). Good enough reason to become acquainted with this influential Christian through his writings. This book is a good starting place.

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

THE AGE OF REASON by Meic Pearse. Grand Rapids, MI: Baker Books, 2006. 457 pages, including index. Hardcover; $29.99. ISBN: 0801012783.

The years 1570 to 1789 were tumultuous years for Christianity throughout the world. There is the triumph of the Great Awakening led by George Whitefield and the Wesley brothers, the great Welsh revivals, and missionary advance to the Far East. On the other hand, there are the Hugenot wars, conflict among Protestants and Eastern Orthodox, and the rise of Enlightenment rationalism. Meic Pearse, assistant professor of history at Houghton College, has taken to the task of narrating the story of global Christianity here in Volume Five of the "Baker History of the Church Series."

Pearse covers the period starting from the Wars of Religion in Europe to the eve of the French Revolution. He manages to cover many facets of church history, including the growth of Pietism and other Protestant movements in mainland Europe and the British Isles, Catholic and Eastern Orthodox Christianity in the shadow of Turkish Islam, and Jesuit activity in Latin America. He even includes a chapter on the arts and music during the time period. Pearse jumps around in his narrative, leaving one story to go to another and then returning back to pick up where he left off. This is forgivable simply because of the complex breadth of Christianity from the late sixteenth to the eighteenth century.

The Age of Reason reads somewhat like an introductory college textbook to church history, which is probably intended. Pearse includes a handful of helpful black and white maps and illustrations. Nevertheless, it is sometimes difficult to hold the story together with all of the players involved with just the text and the sparse illustrations. However, if you already have some knowledge of the historical time period, then Pearse is a wonderful guide to help you dig deeper. At the back of the text there is a time line, a useful index, an annotated bibliography, and endnotes. Unlike many textbooks, Pearse interjects

his own analysis at various points, offering to bust provocative myths along the way. For example, the most influential American founding fathers were Deists, not evangelical Christians. Pearse later argues that the immense social changes associated with the Great Awakening have been grossly exaggerated. Pearse, who recently also authored a contemporary evangelical Christian analysis of Islam and America in *Why the Rest Hates the West*, gives the reader plenty to ponder.

Probably the most disturbing aspect of Pearse's narrative covers the horrific amount of bloodshed associated with the Thirty Years War and many other interreligious conflicts. This culminates in Pearse's chapter on "Reason and Power: Rationalist Theology and the Divine Right of Kings." Knowing the sad story of how so many were killed in the name of church and state, it is easier to see how Enlightenment thinkers sought to ground ethics and republican politics in the natural philosophies of Galileo and Newton instead of the contentious arena of biblical revelation. The challenge for Christians today is to faithfully appropriate biblical revelation in a genuinely Christ-like way marked by forbearance and civility without falling into the snare of Enlightenment rationalism.

Reviewed by Clarke Morledge, College of William and Mary, Information Technology: Network Engineering, Jones Hall (Room 18), Williamsburg, VA 23187.

PAUL MEETS MUHAMMAD: A Christian-Muslim Debate on the Resurrection by Michael R. Licona. Grand Rapids, MI: Baker Books, 2006. 175 pages. Paperback; $13.99. ISBN: 0801066026.

Mixing science-fiction, history, and apologetics in this fictional debate between the apostle Paul and the prophet Muhammad, Michael R. Licona tackles the deeply emotional and eternally significant topic of the veracity of the resurrection of Christ. Licona's credibility as a resurrection apologist is based on his career as an itinerate apologetic's speaker and Director of Apologetics Evangelism for the Southern Baptist North American Mission Board. He is also a Ph.D. candidate and co-author of *The Case for the Resurrection of Jesus* with Gary R. Habermas. He delivers his resurrection research results with the clearly stated intent to assist Muslims and Christians in making a personal, informed response to Christ based on his evidence. He achieves his purpose by presenting four, carefully researched and cited, evidence-based arguments for the veracity of Christ's death and resurrection.

Licona's main strength as a Christian apologist is that he never attacks the Islamic faith. The fictional holograms of Paul and Muhammad are strong in their own beliefs, yet remain courteous and respectful to others at all times. Christian or Muslim readers, while taking offense at the beliefs of others, do not have any reason to take offense at Licona's presentation of those beliefs. Another strength of his writing is how he answers common Muslim arguments. He does not presuppose all readers believe the Bible contains truth, but uses logic and reason to show how the Qu'ran contradicts itself regarding Christ. He only offers the Bible as a proof once, and never regarding the resurrection itself. Paul's hologram explains that using the Bible as evidence is only useful if all parties believe the Bible.

The debate format allows Licona to present his evidence for Christ's resurrection alongside popular Islamic arguments against that evidence and gives Christian readers ready answers for many of the questions that Muslims may raise. Paul, as the one who bears the burden of proof, begins the debate with his opening statement. Muhammad continues with his opening statement. Paul and Muhammad are then each given a chance for rebuttal. Seven chapters follow in which the moderator asks specific questions of both men, allowing them greater depth in their responses. The book finishes with closing remarks from Muhammad, Paul, and the moderator. The result is entertaining and makes this book a quick read and hard to put down. Readers will find themselves pushing on to see how Paul refutes Muhammad's arguments.

The weakness in this style of presentation is its tendency to confuse readers in the same way listeners to a live debate are often left confused. Upon the first read, the reader is left wondering if Paul and Muhammad even argued the same issues. Upon the second read, the reader may be left choosing "the winner" based on previous biases; a debate winner is not chosen in the story. Upon the third read, armed with a notebook as the chapter notes suggest, Paul's argument becomes clearly evidence-based, not relying on a subjective belief in holy writings. Muhammad's arguments, on the other hand, presuppose the Qu'ran is truth from God.

This book will appeal to the scientific community as Licona's arguments are based on evidence, not blind belief in scripture. Yet, this book is written in nontechnical and "non-religious" terminology so that all readers can understand the arguments presented. It does require careful study, though. With increasing confrontation between the followers of Christ and the followers of Allah, this book is a solid base on which to base peaceful and loving interreligious dialogue about the Christian claim of a living Christ.

Reviewed by Lisa Cutforth-Anderson, Learning Resource Technician, Alberta Bible College, Calgary, AB, Canada, T2K 3J6.

DOUBTING: Growing through the Uncertainties of Faith by Alister McGrath. Downers Grove, IL: InterVarsity Press, 2006, 156 pages. Paperback; $13.00. ISBN: 0830833528.

McGrath is president of the Oxford Center for Christian Apologetics and professor of historical theology at Oxford University. He was the keynote speaker at the 2007 joint meeting of the Christians in Science and the American Scientific Affiliation held in Edinburgh, Scotland. He has published numerous books on Christian theology and apologetics. This book had its origins in some talks that McGrath gave to students from Oxford University in 1988 and the first edition of the book was subsequently published in 1990. He states in the preface of this edition that two factors caused him to rewrite it in 2005. These factors include the major cultural changes that have occurred since that time and his own deepened experience of engaging with the questions that trouble so many people.

In the first few chapters, McGrath explains "as simply and clearly as possible" what doubt is and how it arises. Since he once was an atheist, he devotes one chapter to the

place of doubt within atheism. This is followed by a chapter on the main images and analogies of doubt that are contained in the New Testament. He then moves on to deal with a series of specific doubts and anxieties that many Christians experience, often in the first few years of their lives as believers. These include doubts about the gospel message, the resurrection of Jesus Christ, the existence of God, and the possibility of a personal relationship with God. The book concludes with a chapter that provides practical guidelines for handling doubt and another that suggests ways of putting doubt in proper perspective.

The main theme of the book, which is stated in the preface, is that "doubt is an invitation to grow in faith and understanding, rather than something we need to panic about or get preoccupied with. We must all learn to grasp and value what Alfred Lord Tennyson calls the sunnier side of doubt." According to McGrath, doubt is not a sign of spiritual weakness, rather it is an indication of spiritual growing pains. While admitting that doubt is probably a permanent feature of the Christian life, he argues convincingly that faith and doubt are not mutually exclusive. Instead of suppressing it, or becoming overwhelmed by it, Christians need to view doubt from a more positive perspective by focusing on the spiritual benefits that it can provide. Doubt should be seen as an opportunity to rediscover the full depths of faith and as a way of strengthening the foundations of our relationship with God.

McGrath writes in a conversational manner which makes this book accessible to a wide variety of readers. Helpful illustrations, quotes from well-known authors, and an abundance of biblical references are included throughout the text. While there are no endnotes and the book lacks an extensive bibliography, a short "for further study" section directs the reader to other books that deal with Christian apologetics. The Ravi Zacharias International Ministry website is also recommended as a valuable resource. (Zacharias authored the forward to this book.) This book could easily be used as a discussion guide in a small group setting. While it appears to be written mainly for college students who have doubts about their Christian faith, anyone with questions about the veracity of Christianity should benefit from reading this book.

Reviewed by J. David Holland, Biology Instructor, Benedictine University at Springfield College, 1500 North Fifth Street, Springfield, IL 62702.

Social Science

WHERE GOD AND SCIENCE MEET: How Brain and Evolutionary Studies Alter Our Understanding of Religion by Patrick McNamara, ed. Westport, CT: Praeger Publishers, 2006. Three volumes, 862 pages, indices. Hardcover; $275 set. ISBN: 0275987884.

The intersection of religion and spirituality with the human sciences has witnessed remarkable growth in research over the past century with marked acceleration in the later part of the twentieth century. While scholars like Sigmund Freud were determined to rid the world of religion through pioneering psychiatric research, others such as Carl Jung became convinced by their studies that psychology, religion, and spirituality are inextricably interwoven. This pioneering collection is part of a larger Praeger series on Psychology, Religion and Spirituality edited by J. Harold Ellens.

These particular volumes focus on the manner in which brain and evolutionary studies in the past decade have contributed to our understanding of three main areas—each of which is the subject matter of a single volume—evolution, genes, and the religious brain; the neurology of religious experience; and the psychology of religious experience. Over forty contributors from diverse disciplines such as cognitive psychology, theology, psychiatry, neurology, anthropology, radiology, philosophy, experimental psychology, social psychology, clinical psychology, religious studies, behavioral genetics, sociology, and pharmacology make for wide-ranging and informative reading. Authors are of varying religious persuasions or none and this provides some interesting ways for the perceptive reader to discern how belief systems influence interpretation of scientific or clinical findings. A variety of models, theories, systems, and methodologies are employed across the three volumes reflecting not only the diversity of disciplines but also the proclivities and interests of various researchers. Most of the authors are well published in their fields in elite peer-reviewed journals and this fact coupled with excellent editing provides high quality fare.

The majority of the contributors are sympathetic to spirituality and/or religious inclinations of human beings although not all would assert the transcendental nature of religious belief. The essays as a whole speak to the infancy of research in this area, the limitations of scientific methods to study matters that may go beyond the experiencing human subject, and the myriad variables that interrelate in complex psycho/social/spiritual phenomena. Some readers will object in principle to the idea that scientific methods and techniques should be employed in pursuit of deeper understanding of religious phenomena; others will adopt a cautiously optimistic view that some fruitful insights may emerge. Clearly the lure of reductionism is ever present as is the equal lure to declare something religious or spiritual and about which science can say nothing of any worth. Many of the contributors are well attuned to both of these dangers and most conclusions are appropriately couched in cautionary language. Most *PSCF* readers would benefit from these essays, especially those pertaining to their own expertise.

Reviewed by Dennis W. Cheek, Vice President of Education, Ewing Marion Kauffman Foundation, Kansas City, MO 64110.

THE MARKETPLACE OF CHRISTIANITY by Robert B. Ekelund, Jr., Robert F. Hébert, and Robert D. Tollison. Cambridge, MA: The MIT Press, 2006. 328 pages, index. Hardcover; $29.95. ISBN: 026205082X.

Adam Smith, founder of economics, recognized early in his work that religious movements could be productively viewed through the lens of economics. Max Weber is perhaps the most famous historical exponent of this view with his work on how Protestantism spurred the rise of capitalism in what is now known as the Weber-Tawney thesis. The authors of this book, all economists, build on

the insights of Nobelist Gary Becker who showed how use of a utility-maximizing strategy based on full-price notions of supply and demand could be applied to various aggregate human behaviors within populations, including topics in crime and justice, family relations, altruism, and religion. This work is a sequel to their *Sacred Trust* (1996) on indulgences in the medieval church.

The current book builds on the pioneering work of Ekelund and Tollison in *Mercantilism as a Rent-Seeking Society* (1981). Combining their economic analysis with inputs from history, anthropology, sociology, and religious studies, they provide a fascinating way to view religion and how individuals choose to participate in modern religious life.

The Protestant Reformation is seen in this light as the successful penetration of a religious market formerly dominated by a monopolistic firm—the Roman Catholic Church. From Martin Luther onwards, they argue, Christianity is pushed toward a competitive process where various offerers within this market differentiate themselves from their competitors in doctrinal, organizational, worship, and other ways. This includes an analysis of the Counter-Reformation and its attendant results in response to the challenges raised by the Reformers. Individuals respond to these various market differentiators in diverse ways and select from an ever-increasing menu of choices that serve to further differentiate and segment the market. The end result is the plethora of viewpoints and allegiances that one can find in contemporary Christianity. The authors consider a wide ranging collection of examples and mini-case studies as they explore the ways in which various market pressures and market reforms operate within Christendom, including some attention to contemporary concerns such as gay marriages, gay clergy, science vs. religion, and clerical celibacy. They also discuss the views and approaches of a large number of other economists and social scientists and how these views relate to their own. It will no doubt emerge that these fairly early but serious attempts to apply economic theory and analysis to the marketplace of Christianity will prove misplaced at points and overdone, but the reader cannot fail to think more deeply and thoughtfully about the contemporary Church within society in light of the pioneering work of these three economists.

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WHY THIS NEW RACE: Ethnic Reasoning in Early Christianity by Denise Kimber Buell. New York: Columbia University Press, 2005. 257 pages, bibliography, indices. Hardcover; $47.50. ISBN: 0231133340.

The twentieth century has witnessed several instances of science, ethnic reasoning, and religion intertwining with absolutely horrific results. The ethno-religious thinkers of the Third Reich, for example, defined the racial category of Jewish with a fixity that entailed the belief that Jews could not actually become Christians, that conversion to this religion—which had previously prided itself on its universality—was, for them, simply impossible. Bolstered by a supposedly scientifically rational way of defining race, and laden with centuries of a Christian ethnic reasoning that included the doctrine of supercessionism (the view that Christianity replaced Judaism as recipients of God's covenants), nearly a whole continent participated in the mass extermination of Jews.

Many books have been published examining the role that racialist thinking has played in Christian discourse, usually in connection with the colonial or anti-Semitic enterprises that Christians have engaged in, but Buell's *Why This New Race* stands out for tackling how early Christians formulated their ideas through discourses of ethnic reasoning. Through a study of Christianity's first few centuries, it proves applicable to our modern era precisely because much of what she covers remains part and parcel of Christian rhetoric. Readers of this journal should find her book invaluable for demonstrating how socially fluid concepts such as religion have played a major role in defining race—especially because "[w]e are used to thinking of science, especially the biological sciences, as the site for authoritative knowledge about race" (p. 21).

Buell begins by exploring how race/ethnicity and religious practices were already linked in the Roman world and how Christians followed this pattern. She notes how genealogical claims functioned to support the notion of ethnicity as fixed even as certain documents, such as Caracalla's edict calling for the expulsion of Egyptians from Alexandria, link ethnicity to social habits. In the biblical narratives upon which early Christians drew, a similar fixity/fluidity dynamic was at work, as illustrated by Achior's conversion in the deuterocanonical book of Judith; Paul likewise claims that gentiles acquire Abraham as an ancestor upon conversion. "Assent to religious teachings," Buell argues convincingly, "is imagined as the essence that constitutes a *genus*" (p. 46).

But more than that, early Christian appealed to history in order to stave off arguments against their supposed innovations, for such "innovation is particularly effective when framed as a restoration or reform by appeal to the past" (p. 67). Buell examines the writings of Clement of Alexandria, Origen, Justin Martyr, and more, uncovering how they identified Christianity as in continuity with the past. In some instances, it was by defining Christians as the true Israelites, and in others by claiming that Christianity restored the original universality of humankind. The latter bears particular relevance for the study of historical anti-Judaism in that Christians have often posited themselves as a universal, a non-people, in contrast to the supposed ethnic limits of Judaism, which is said to "define membership and salvation through flesh and blood lineages" (p. 95). Indeed, Christian rhetoric against other groups, be they Jews or Gnostics, often included the charges that said groups reckoned their identity in a fixed manner in contrast to Christianity's fluidity: "Ethnic reasoning is an effective rhetorical device for those seeking to gain authority for their visions of Christianness in part because they can use it to persuade readers to think of themselves and others using collective strategies" (p. 136). However, Christian collective self-definition that relied upon ethnic or racial terminology was made to serve a universalist purpose by positing Christianness "as the ideal or most authentic form of humanness" (p. 164).

Buell's book illuminates how early Christians used ethnic reasoning to develop the various binary discourses of Christian/Jew, orthodox/heretical, universal/particu-

lar, etc. At the end of her book, she writes that she hopes to encourage more studies of how modern interpretations of Christianity are racialized and how contemporary Christian claims to universality may encode racism or ethnocentrism. She has given us a worthy starting point. *Why This New Race* is set to challenge many of our assumptions about the intersection of race and religion, both in ancient and modern times. It is one of those books that serve to inform us, in clear and uncompromising language, just how it is that we arrived at this point in history; it will undoubtedly shape future studies of the subject for years to come.

Reviewed by Guy Lancaster, Assistant Editor, Encyclopedia of Arkansas History & Culture, *Little Rock, AR 72201.*

DARK AGES: The Case for a Science of Human Behavior by Lee McIntyre. Cambridge, MA: MIT Press, 2006. 121 pages, index. Hardcover; $24.95. ISBN: 0262134691.

I obtained this book with the hope that it would build on the themes I encountered in another book that I am reading (*Destructive Trends in Mental Health*). As a practicing experimental psychologist, I have observed firsthand the strengths and weaknesses of the field of psychology. Unfortunately, McIntyre is prone to overstatement. He argues that social scientists often answer questions without data, their attempts are biased by political and perhaps religious ideology, and the field is not adequately scientific because social scientists avoid reducing the human condition to deterministic relations. As much as I might agree with some of these points, he overstates them and caricatures social scientists as ignorant ideologues uninterested in data.

While he idealizes the natural sciences as the model child, he fails to recognize some of the best scientific analogies for the condition of the social sciences: weather prediction, earthquake prediction, fluid dynamics, or population growth. For example, our inability to make anything more than general predictions about the weather more than a week in advance parallels our inability to predict with any degree of accuracy the behavior of an individual or group, and trying to predict a rare phenomenon like an earthquake is like predicting another Columbine. To ascribe these failures to a resistance to knowledge, a disdain for the scientific method, or ideological bias is as unfair for social scientists as it is for natural scientists.

McIntyre underestimates the challenges that are unique to the social sciences. First, if I had as much control over humans as physicists and chemists have over their subject matter, the application of the scientific method would be much easier. Social scientists have to obtain approval by review boards to insure that their experiments are ethical. Second, many of the social sciences (especially sociology and psychology) are heavily biased by a liberal ideology (e.g., see Redding's March 2001 article in the *American Psychologist*). McIntyre was more likely to use religious ideology as the scapegoat and seems to idolize Galileo and Darwin, but liberal political ideology is much more likely to be the problem in certain social scientific fields (e.g., studies of gun control, sexual orientation, race, and immigration) but less so in ones that are not so value-laden (e.g., studies of perception, basic learning phenomena, or decision making). Third, I have encountered too much faddishness that results in the quick dispensing of old theories instead of building on them. These fads are often due to a lack of precision in theory development that makes it difficult to disprove the theory. The best theoretical "story," no matter how vague, is the one that wins out.

Despite McIntyre's diatribe against bias, he failed to recognize the log in his own eye. When he makes statements like "religion has been offered as a substitute for reason and has retreated only after suffering the most crushing defeats" (p. 52) and wonders how a rational person can "believe in a concept so patently implausible as God" (p. 53), his own ideological biases are manifest. In his concerns about a resistance to knowledge holding back the social sciences, I was left wondering whether the author would be willing to consider answers that would suggest that religious beliefs have positive consequences? McIntyre envisions a future utopia in which a properly conducted social science has eliminated poverty, crime, and war. This Heaven on Earth may or may not be possible, but he argues that we will never know until we try. I worry that McIntyre has not considered that this ideal may require that his utilitarian ethics would lead us to justify genocide (to eliminate war), parental licenses (to reduce poverty by preventing overpopulation), or a police state (to reduce crime) among other questionable solutions.

In sum, I believe that McIntyre failed to consider many of the real problems with the behavioral sciences, showed many of the biases that he fears might influence our judgment, demonstrated a disdain for the Christian worldview, and deified humankind. There are real problems in the social sciences, but the author provides caricatures that are of little practical utility. Unfortunately, despite its promising premise, I cannot recommend this book.

Reviewed by Michael Young, Associate Professor of Psychology, Southern Illinois University, Carbondale, IL 62901. ▣

Letters

Amplification on Two Evolutionary Claims: A Response to Pattle Pun

Some of the points made in Pattle Pun's article (*PSCF* 59, no. 2 [June 2007]: 102–9) are contentious and widely debated in the context of the debate over ID. Rather than deal with those, I would like to point out two claims that can also be found in sources from a conventional evolutionary perspective, yet are incorrect.

The first is the claim that "the fossil [record] shows unicellular organisms such as cyanobacteria around three and one-half billion years ago and then suddenly the Cambrian explosion 530 million years ago, with nothing much appearing in-between." Older rocks have generally suffered greater alteration and are less common than younger rocks, and bacteria often have few distinctive fossilizable features. Nevertheless, there seems to be an increase in the diversity of bacterial forms over time.

Eukaryotes are typically more complex in structure and thus are easier to study in the fossil record. The first eukaryotes appear about two billion years ago or so. Algae and other protistan eukaryotes diversified through the Precambrian; there are also fossils of uncertain taxonomic affinity that show appreciable evolutionary turnover through this time interval.

In the latest Precambrian, beginning about 570 million years ago, the earliest animals appear. These include such simple animals as sponges and cnidarians, as well as probable very primitive representatives of other phyla. Exact affinities of many of them are uncertain; this reflects the preservation (often relatively coarse) but may also indicate that the species have not yet differentiated into the familiar post-Cambrian phyla. Within the Cambrian itself (beginning about 544 million years ago), there are forms transitional between phyla as well as the earliest clear representatives of many phyla. Although assignable to modern phyla, these typically are relatively primitive, as expected evolutionarily. The Cambrian is neither as explosive nor as exceptional as commonly claimed, though there remains much to do in areas such as testing competing evolutionary hypotheses by better documenting the exact patterns.

Secondly, although "survival of the fittest" is a well-established popular description of evolution, often depicted (especially in nature TV shows) as fierce competition, in reality it only takes being fit enough to survive. Cooperation and competition both are possible paths to adequate fitness. Thus, symbioses such as that envisioned in the endosymbiosis model of organelle origination fit within a normal evolutionary paradigm. It does not increase one's fitness to kill a handy supply of food, shelter, transportation, etc.

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What the "Big Bang" Really Was!

The June 2005 issue of *Perspectives on Science and Christian Faith* contains an excellent article entitled "The Thrice Supported Big Bang" by Perry G. Phillips (*PSCF* 57, no. 2 [2005]: 82–96). It is a scholarly presentation covering fifteen pages, including references. In his opening paragraph, Phillips states: "One cannot dismiss ... the 'hot Big Bang' as the best model for the origin of the universe."

I found Phillip's article most interesting but his positive assumption that the universe came into being as the result of an unparalleled cosmic explosion troubled my finite mind. All explosions since then have been chaotic or destructive. How could anyone with any degree of intelligence come to a conclusion that this is the way the universe began? Yet the vast majority of scientists (astronomers, cosmologists, and astrophysicists) are in general agreement with this theory for its origin. I am one that does not accept it, although I do accept the theory that a "Big Bang" did occur—but not as the beginning or the origin of the universe. Being a Christian, amateur astronomer, biochemist, nutritionist, food technologist and logician, I just could not accept the event called the "Big Bang" as a plausible explanation for anything as awesome as the origin of our magnificent universe!

On my office wall I have a picture taken with the Hubble Telescope in 1995 entitled "Hubble Deep Field." The inscription at the bottom is:

> Nearly every object in this image is an entire galaxy, each composed of billions and billions of suns taken by the Hubble Space Telescope. It is a random patch of sky near the Big Dipper, less than 100th the area of the full moon. The telescope, above the blurring effects of the Earth's atmosphere, reveals colors, shapes and structures of galaxies to nearly 90% of the distance to the edge of the Universe.

I made a count of the galaxies within a one-inch width of several places on the picture and then computed from the average the number of galaxies on the picture and came up with 750. Thus, when extrapolated to cover the entire sky, the number of galaxies in existence at a relatively short time after the "Big Bang" was astronomical if I can choose a word to describe the number. How could this be? To me, a scientist who thinks scientifically, there is only one explanation—the universe was already in existence at the time of the "Big Bang" and that event was merely God's way of announcing that the work was finished and that now the curtain could be opened and the marvel of his creation could be viewed for the first time!

I am so excited about this revelation that was given to me just shortly after the turn of the year that I want to share it with other scientists, especially those who believe in God as the Creator, to see how they react to my theory which, to me, is far more plausible and believable than the one that is so widely accepted by the vast majority of scientists today.

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Errata

The cover of the June 2007 was inadvertently printed with the list of articles in the December 2006 issue. Replacement covers with the correct titles were mailed to everyone who received the June issue.

In the manuscript guidelines and on p. 167, the incoming editor's email address was published incorrectly. Please note Arie's correct email address below.

We apologize for the errors and confusion.

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Please submit all manuscripts (except book reviews) to:

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A closely affiliated organization, the Canadian Scientific and Christian Affiliation, was formed in 1973 with a distinctively Canadian orientation. The CSCA and the ASA share publications (*Perspectives on Science and Christian Faith* and the *ASA/CSCA Newsletter*). The CSCA subscribes to the same statement of faith as the ASA, and has the same general structure; however, it has its own governing body with a separate annual meeting in Canada. Contact CSCA by writing to: Canadian Scientific and Christian Affiliation, PO Box 40086, 75 King St. S., Waterloo, ON N2J 4V1 or visit their website at: www.csca.ca.

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Vol. 16–19 (1964–1967), *JASA* 19 (1967): 126–28
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Vol. 23–25 (1971–1973), *JASA* 25 (1973): 173–76
Vol. 26–28 (1974–1976), *JASA* 28 (1976): 189–92
Vol. 29–32 (1977–1980), *JASA* 32 (1980): 250–55
Vol. 33–35 (1981–1983), *JASA* 35 (1983): 252–55
Vol. 36–38 (1984–1986), *JASA* 38 (1986): 284–88
Vol. 39–41 (1987–1989), *PSCF* 42 (1990): 65–72
Vol. 42–44 (1990–1992), *PSCF* 44 (1992): 282–88
Vol. 45–47 (1993–1995), *PSCF* 47 (1995): 290–96
Vol. 48–50 (1996–1998), *PSCF* 50 (1998): 305–12
Vol. 51–53 (1999–2001), *PSCF* 54 (2002): 71–78
Vol. 54–56 (2002–2004), *PSCF* 56 (2004): 310–19

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Editorial

The Elusive Virtue, *Gelassenheit,* and Feet Washing 169 Roman Miller

Articles

Science-Fostering Belief—Then and Now 171 Christopher B. Kaiser
Early Humans, Adam, and Inspiration 182 Peter Rüst
Extended Humpty Dumpty Semantics and Genesis 1 194 David F. Siemens, Jr.
Thinking Critically and Christianly About Technology 201 Ken Funk

Art Eyes Science

I Think He Made Zebras by Hand 212 Dorothy M. Wedemeyer

Communications

From Scientific Method to Methodological Naturalism: The Evolution of an Idea 213 Harry Lee Poe and Chelsea Rose Mytyk
The Origin of Eukaryotic Cells 219 Michael Buratovich
Stewardship of an Aquatic Habitat on the Campus of Oral Roberts University, Tulsa, Oklahoma 224 John Korstad
Residual Radiocarbon in an Old-Earth Scenario 226 Robert Rogland

Book Reviews

God for the 21st Century 229 Russell Stannard, ed.
Jacob's Mirror: A Reconciliation of Science and Religion 229 Bill McKee
Eden's Garden: Rethinking Sin and Evil in an Era of Scientific Promise 230 Richard J. Coleman
Mysteries of the Middle Ages: The Rise of Feminism, Science, and the Arts from the Cults of Catholic Europe 231 Thomas Cahill
Oracles of Science: Celebrity Scientists Versus God and Religion 231 Karl Giberson and Mariano Artigas
A Meaningful World: How the Arts and Sciences Reveal the Genius of Nature 232 Benjamin Wicker and Jonathan Witt
Evolution: A Scientific American Reader 232 Scientific American
Darwin's Nemesis: Phillip Johnson and the Intelligent Design Movement 233 William Dembski, ed.
Understanding Genesis: Contemporary Adventist Perspectives 234 Brian Bull, Fritz Guy, and Ervin Taylor, eds.
Cosmic Jackpot: Why Our Universe Is Just Right for Life 234 Paul Davies
Living with Darwin: Evolution, Design, and the Future of Faith 235 Philip Kitcher
The Order of Things: Explorations in Scientific Theology 236 Alister E. McGrath
Uncertainty: Einstein, Heisenberg, Bohr, and the Struggle for the Soul of Science 236 David Lindley
Panentheism: The Other God of the Philosophers—From Plato to the Present 237 John W. Cooper
The Passionate Intellect: Incarnational Humanism and the Future of University Education 238 Norman Klassen and Jens Zimmerman
The Evolution of Rationality: Interdisciplinary Essays in Honor of J. Wentzel Van Huyssteen 239 F. LeRon Shults, ed.
Escape from Reason: A Penetrating Analysis of Trends in Modern Thought 239 Francis A. Schaeffer
Thy Kingdom Come: How the Religious Right Distorts the Faith and Threatens America 240 Randall Balmer
The Night Is Far Spent 241 Thomas Howard
Religion in Schools: Controversies around the World 241 R. Murray Thomas
The Well and the Shallows 242 G. K. Chesterton
The Age of Reason 242 Meic Pearse
Paul Meets Muhammad: A Christian-Muslim Debate on the Resurrection 243 Michael R. Licona
Doubting: Growing through the Uncertainties of Faith 243 Alister McGrath
Where God and Science Meet: How Brain and Evolutionary Studies Alter Our Understanding of Religion 244 Patrick McNamara, ed.
The Marketplace of Christianity 244 Robert B. Ekelund, Jr., Robert F. Hébert, and Robert D. Tollison
Why this New Race: Ethnic Reasoning in Early Christianity 245 Denise Kimber Buell
Dark Ages: The Case for a Science of Human Behavior 246 Lee McIntyre

Letters

Amplification on Two Evolutionary Claims: A Response to Pattle Pun 246 David Campbell
What the "Big Bang" Really Was! 247 Fred H. Hafner