PERSPECTIVES on Science and Christian Faith

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In this issue . . .

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

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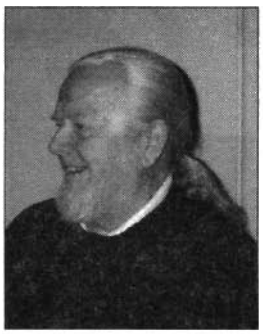

Walter R. Hearn

The **Good,** *the* **True,** *and the* **Beautiful**

The editor has announced that he will begin including in the journal samples of art work related in some way to the science/faith issues with which *PSCF* readers are already familiar. His proposal, made at the ASA annual meeting in Colorado, struck me as appropriate but possibly risky.

I thought immediately of how many times a speaker or an entire audience at that meeting responded to a projected image of a spiral galaxy or some other feature of God's astronomic universe with the words, "How beautiful!" or with a silent gasp expressing the same emotion. I thought of the magnificent harmony of great hymns of praise rising upward from our congregation of believers.

I also thought of the divine choreography taking place in the lives of some ASA members who shared their stories with me. The God whom we worship is Lord not only of What is True and What is Right but also of what is appropriate, satisfying, colorful, symmetrical, neat, patterned, refreshing, exciting, awe-inspiringly fit for enjoyment by his children: in short, of What is Beautiful.

Some ASA members think we best integrate scientific work and spiritual life by trying to approach those two aspects in basically the same way. Others see the methods required as distinct, with integration occurring only in the total life of individuals repeatedly having to choose between goals. If artistic appreciation is considered a third aspect, the conversation becomes more complicated. Do we approach all three in essentially the same way to unite the Good, the True, and the Beautiful? Or do we acknowledge our need for a third way of thinking, a third mode of response to our Creator and Redeemer?

It seems risky to introduce a new question before settling an old one. Consensus is notably hard to reach on questions of artistic taste. Never mind. Let's regard bringing art into *PSCF* as an experiment of sorts. We do not know how it will turn out, which is true of any experiment worth doing.

Let's face it: there is "high art" and "folk art," like real science and "folk-science," professional theology and "folk theology." Compare these expressions: "So what if I've had only one course in biology? I know what I think about evolution." "Who cares when theologians disagree? What counts is my faith in Jesus Christ as Savior." "I don't know much about art, but I know what I like."

The practice of making art differs from the theory of art (aesthetics) as much as experimentation differs from theorizing, or as practicing one's faith differs from theological disputation. I doubt that our editor wants to stir up a theoretical argument about art in relation to science or Christian faith. He may not have in mind a cerebral exercise of any kind. I think he wants ASA to get some practice at experiencing art to add to our hands-on participation in scientific work and our communal life as followers of Jesus Christ.

My own experience of artistic creativity has been primarily in the writing of poetry, from which one learns about symmetry and fitness and figures of speech. With almost a third of the Old Testament in poetic form, a better appreciation of that art form might clear up our understanding of many biblical passages.

So I, for one, welcome this new experiment in the pages of *PSCF*. But I have been thinking about these matters for a long time (as in my article, "The Meaning of Creation," *JASA* 18, no. 1 [1966]: 25–8). ★

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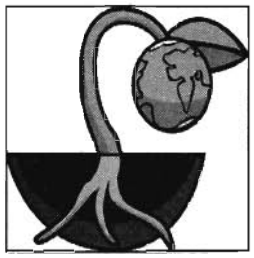
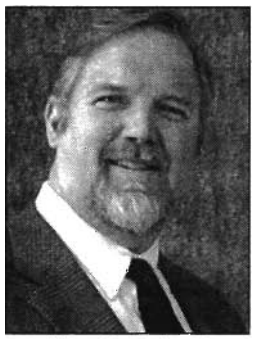


Article

The Roots of the Western Concept of the "Laws of Nature": From the Greeks to Newton

The Roots of the Western Concept of the "Laws of Nature": From the Greeks to Newton

Alan G. Padgett



Alan G. Padgett

As with many of the root ideas of Western culture, the notion of a "law of nature" can be traced back to both Greco-Roman culture and to biblical religion.

This article traces the historical origins of the traditional Western idea of the laws of nature, from the classical period and its biblical roots to the early modern period (Newton). The laws of nature, in this view, are regularities built and sustained by God into the natural world. They are secondary causes, sustained by the ordained power of God. The focus is upon developments in the Middle Ages, especially scientists influenced by Arabic learning and Aristotelian science. I conclude that the division between primary and secondary causes, and between God's ordained and absolute power, is still important for today's religion and science dialogue.

Hegel taught us that the history of an idea is an important part of understanding the nature of that concept. The first example of this kind of historical explanation, of course, comes not from Hegel but from Aristotle, whose *Metaphysics* (book A) is a historical *tour de force* of the concept of cause. In this article, my purpose is to lay out the historical developments of the idea of "laws of nature" in Western culture, from the earliest sources to the early modern period. I will demonstrate that there has been a common, dominant understanding of the laws of nature in the West, rooted in biblical theism. At the same time, this notion of a law of nature has been understood and developed in diverse ways by particular thinkers from the past. There is a unity of general understanding, and a diversity in the details of how this is worked out.

In this paper,[1] I will outline this unity and diversity and will argue that there is a "traditional" Western idea of the laws of nature. The general idea that a law of nature is a physical regularity built by God into the very fabric of the universe, by means of which (along with other things) he conserves the physical universe in existence throughout time.

As with many of the root ideas of Western culture, the notion of a "law of nature" can be traced back to both Greco-Roman culture and to biblical religion. The notion of a law of nature (Latin: *lex* or *regula naturae*; Greek: *nomos physeos*) has two sources in the classical period: Hellenistic natural philosophy, especially Stoicism; and the Christian patristic tradition.[2] In the Christian case, the God of the Bible is understood as Lawgiver (among other things), but also as Creator. Patristic authors such as Augustine and Basil of Caesarea used the term "laws of nature," and understood these as coming from God the Creator.[3] This was particularly true in those works of the patristic period that sought to harmonize the teachings of the Bible with the then-current science or natural philosophy.[4] For both Augustine and Basil, the natural world operated according to regularities ordained by the divine Creator and Lawgiver.[5] Basil taught, for example, that the various types of fish are assigned to their own watery habitats by "a law of nature."[6] Augustine, too, stated that "the ordinary course of nature in the whole of creation has certain natural laws."[7]

Turning from Christian to pagan sources for Stoic philosophy as well as Roman culture in general, law was an important

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cultural and religious concept (although arguably not as central as *torah* to Judaism). For the Stoics, God or Zeus is universal Reason (*logos*), the principle of order or law that is immanent in all things and gives structure to both the cosmos and human societies. As early as the third century BC, Cleanthes in his famous *Hymn to Zeus* could write of Zeus as "Universal Nature, piloting all things according to Law."[8] To the classical mind, the heavens seemed particularly good examples of natural bodies obeying the laws of nature. Indeed, the very word "astronomy" indicates this: the law (*nomos*) of the stars (*astros*).

In two other poems about nature influenced by Stoic thought, we also find poetic expression of the "laws of nature." In the famous *De Rerum Natura*, the Epicurean natural philosopher and poet Lucretius (ca. 99 BC–51 AD) tells us that he wished to "teach in my poem how all things are bound to abide in that law by which they were made."[9] Also during the first century AD, the last of the Roman didactic poets, Marcus Manilius, spoke of the laws of nature. Like Lucretius, his poem *Astronomica* is a natural philosophy, but with a specific focus on the heavens. Unlike the Epicurean philosopher, Manilius was more willing to speak of God (in a Stoic sense) as the source of the laws of nature, e.g., "For when God brought the whole universe under law ...," or in a more poetic vein, the planets "perform the dances of their orbits which nature's law diversifies."[10]

While poets and patristic writers, therefore, could use the term "law of nature" and mean thereby a principle of order governing natural bodies given by Nature or God, there was no developed conception of a law of nature in the classical period. Natural philosophy tended to be either Platonic or Aristotelian (or something of both), neither one of which gave any centrality to law of nature as we know of it in modern science.[11] We are wrong to think, however, that the bare concept of a "law of nature" cannot be found in the classical period.

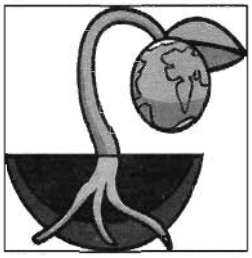
In the Middle Ages, the notion of a law of nature, especially the relationship between God and the world, was given further philosophical development by Christian thinkers. To take an early example, Peter Damian (eleventh century) is best remembered for his discussion of divine omnipotence. In that context, he discussed the laws of nature. Damian argued that the Almighty Creator was not limited by them, but rather was their author and sustainer. He specifically taught that God's absolute power rules over the laws of nature, and that the divine will conserves the laws of nature in being.[12] This philosophical position was later developed into medieval *voluntarism*, which has a long history.[13] As opposed to both Aristotelian and Platonic natural philosophy, voluntarism insisted that the structures of Nature were not deduced by logical necessity from first principles, nor were they fixed and eternal. For voluntarist natural philosophers, the order of nature stems from the will of almighty God, who is free to do things differently. God chose to create the laws of nature in this way, and he could have chosen differently. The laws of nature are not logically necessary, according to voluntarism, nor are they eternal. This belief meant that the structure of Nature was contingent. Logic alone would not discover them; we would have to look and see.

In the Middle Ages, the notion of a law of nature, especially the relationship between God and the world, was given further philosophical development among Christian thinkers.

This history of medieval natural philosophy reaches a high watermark with the re-introduction of Aristotle, and of Arabic learning based upon Greco-Roman and Hindu cultures (especially medicine and mathematics). In 1159, John of Salisbury could lament the lack of geometrical and astronomical science in Europe, as compared to Islamic countries.[14] Soon, however, the learning of the Arabs and Greeks was translated into Latin and became the backbone of the new University liberal arts curricula, especially at Paris and Oxford. This literature helped to create a separate faculty of philosophy, with an interest in natural philosophy and metaphysics as distinct from theology.

The gift of the Muslim philosophers to late medieval natural philosophy was their mathematics, based upon Greek and Hindu sources, that included several significant developments. The new mathematical learning could be used to describe the natural world, as especially the field of optics was making clear. This mathematical approach to metaphysics was upheld within a Christianized Platonic and Pythagorean tradition. The final combination of mathematics (Platonic-Pythagorean), observation and experience (Aristotelian) and voluntarism (biblical-theological) provided the vital philosophical milieu in which early modern science could develop.[15] Of course, this generalization is too simple. These philosophical currents did not exist in pure forms, nor was their combination a simple matter. Rather, they represent perspectives and trajectories of medieval thought found in various manifestations in the actual works of medieval philosophers.

Medieval natural science was based principally upon commentaries on Aristotle's natural philosophical books. As Edward Grant points out: "The translation of Greco-Arabic science, within which Aristotle's natural books formed the core, laid the foundation for the continuous development of science to the present."[16] As astronomy and natural philosophy became based upon Aristotle's works, there developed an important distinction between



Article

The Roots of the Western Concept of the "Laws of Nature": From the Greeks to Newton

The powerful combination of a mathematical and geometrical approach, combined with the work of natural philosophy, provides the historical background for early modern science.

astronomy and natural philosophy. This can be illustrated by Simplicius (sixth century), a late Neo-platonic commentator on Aristotle's *Physics*, whose work was translated into Latin by Grosseteste. Simplicius gives a very clear distinction (citing many authorities from the Aristotelian tradition) between astronomy, which is focused particularly on the stars and planets—their shape, size, and distances—and natural philosophy or physics. He writes:

> Astronomy does not seek to pronounce on any of these [substantial] questions, but reveals the ordered nature of the phenomena in the heavens (*taxin ton ouranion kosmon*) ... [S]ince astronomy touches on the study of quantity, magnitude, and quality of their shapes, it understandably has recourse to arithmetic and geometry.[17]

Copernicus, then, is an astronomer in this Aristotelian sense. Natural philosophy, on the other hand, examines the substance of the heavens and its most basic elements and properties. For this reason, the astronomer "must get his basic principles from the natural scientist (*physikes*)." Galileo, then, is no astronomer in this sense of the term, but rather a natural philosopher. This distinction is typical of Aristotelian science. The powerful combination of a mathematical and geometrical approach, combined with the work of natural philosophy, provides the historical background for early modern science.

The term "first principles" (*principia* in Latin) becomes the common word for things we might call the laws of nature. Aristotle did not use these words in our modern sense, as we have seen. As natural science becomes based upon his work, many natural philosophers begin to use the word "first principles" or just principles of natural philosophy. One is reminded immediately of Descartes' *Principles of Philosophy*, or Newton's *Principia* in this regard, where the word *principia* in the title means something like the rules or laws of nature. The terms *lex naturae* in Latin gradually became associated with moral law, as, for example, in Aquinas. But the use of these words for the laws of nature did not fully die out, as we shall see.

These generalizations need concrete investigation, which we cannot fully develop here. We can only briefly illustrate these points by examining the work of select medieval natural philosophers. While the stage of history was set for the powerful combination of voluntarism, empiricism, and a mathematical approach to natural philosophy, it was made in fits and starts. Part of this combination can be found, in early form, in the work of Robert Grosseteste (ca. 1170–1253), who was a natural philosopher, theologian, Bishop of Lincoln and the one of the first Chancellors of the University of Oxford.[18]

Early in his career, Grosseteste was interested in natural philosophy and mathematics, rather than the more typical scholastic methods which dominated Paris. Such natural philosophy was available through new translations from Arabic learning and a few other medieval sources. Grosseteste was an influential teacher at Oxford on these subjects. Until about 1225, he worked mostly on science and mathematics, producing an important commentary (the first in Latin that we know of) on Aristotle's *Posterior Analytics*. His interest in theology led him to the study of Greek, and he became one of the best Greek scholars in the West at that time. His theological work combines both biblical studies and natural philosophy, one example of which is his own *Hexaemeron*. Grosseteste lectured on theology to the Franciscans at Oxford and published a number of biblical-theological works. For all of his intellectual career, he was interested in the nature of light. In *De luce*, he developed a metaphysics of light as the first form of "prime matter" and the basic stuff of the human soul.[19]

While at Oxford, Grosseteste introduced the new Aristotelian philosophy as mediated by Arabic commentators. For our purposes, he represents the very early combination of interest in mathematics with natural philosophy, typical of Platonic-Pythagorean influence. R. W. Southern has placed Grosseteste in a twelfth-century tradition of English medieval science, which was distinct from the methods and aims of the great scholastic thinkers of the day in Paris or Bologna. But Grosseteste makes a decisive break with even these humble predecessors in the breadth of his learning and in the scope of his interests, as well as in his consistent emphasis on observation as a foundation for natural science (à la Aristotle). With his mathematical interests and his theistic and voluntarist world view, Grosseteste was an important contributor to medieval science.

Even as he translated and interpreted Aristotle, Grosseteste placed Aristotelian natural philosophy in a broader Christian and Neo-platonic world view. In addition to a theistic basis, which was ultimately voluntarist, he was committed to a natural philosophy based upon mathematics. This emphasis derived from Platonic and Pythagorean traditions, as mediated to him through Patristic authors like Augustine. A mathematical natural philosophy is demonstrated in a number of his works, particularly works on astronomy, light, and in his treatise on geometry, *De Lineis, Angulis et Figuris*. He defends his mathematical approach to natural philosophy in the latter book, stating:

> There is an immense usefulness in the consideration of lines, angles and figures, because without them natural philosophy cannot be understood. They are applicable in the universe as a whole and in its parts, without restriction, and their validity extends to related properties, such as circular and rectilinear motion ...[20]

Notice that Grosseteste wants to use geometry, which was long a key tool of astronomers, within natural philosophy. This is a decisive step in the history of Western science, although Grosseteste was not alone in making it. As John McEvoy notes in his careful exposition of Grosseteste's thought: "We can discover [in his works] an originality and an importance which in the long run did have a bearing on science, in so far as science came into being in dependence upon certain metaphysical beliefs."[21]

Grosseteste developed an experimental scientific method for the investigation of contingent, physical truths, which for him was part of the divine order and natural law. He understood the law of nature, stemming from the Word of God, to include the spiritual, moral, and physical ordering of creation. This is clear from his *Hexaemeron*, which like Basil's was a commentary on the first days of creation, as well as from his discussion of natural law in *De cessatione legalium*.[22] Like Basil, Ambrose, and Augustine, Grosseteste was concerned with the combination of biblical, metaphysical, and scientific thought in his theological works. But unlike them, he was doggedly interested in scientific explanations for natural phenomena when writing his natural philosophy. This is clear in his commentary on the *Posterior Analytics*, which is free of the spiritual allegorizing of the natural world typical of medieval natural histories. In his biblical commentaries, however, Grosseteste did engage fully in allegorical and symbolic speculation upon both the biblical text and natural phenomena.

Medieval thinkers had a more unified understanding of God, nature, and humanity than we do today. Both nature and Scripture alike were filled with spiritual lessons. And like others of his day, Grosseteste used the term "laws of nature" to refer to the spiritual and moral laws of God. But he also saw the term "laws of nature" as referring to physical regularities. In *Hexaemeron*, he writes: "Since the origin of nature is the word of God, it is God's right to give a law to nature (*legem dare naturae*), since he gave it its origin."[23]

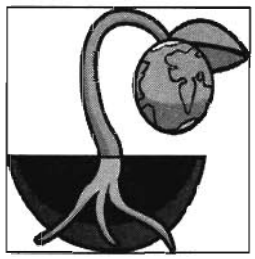
Grosseteste developed an experimental scientific method for the investigation of contingent, physical truths, which for him was part of the divine order and natural law.

The direct legacy of Grosseteste was not great in his own time. His only real theological heir was John Wycliffe, a century later. The theological tradition of his age (as represented, for example, by the great English theologian and philosopher John Duns Scotus) went decidedly into scholastic methods. He did have some important followers in science, however, such as Roger Bacon and John Pecham. Grosseteste was convinced that natural philosophy could only progress under geometrical analysis, but did not carry this forward very far. He was no great experimenter, yet his methods and examples provided a stimulus for later scientific developments.

The importance of Grosseteste, then, is not in his excellence as a scientist, but in his setting forth a new method, metaphysics, and epistemology for the discovery of physical reality. For example, in his most important work on scientific method (his commentary on the *Posterior Analytics*), he makes this remarkable comment:

> *Sollertia* ("insight," Greek *anchinoia*) is the penetrating power in virtue of which the mind's eye does not rest on the outer surface of an object, but penetrates to something below the visual image. For instance, when the mind's eye falls on a colored surface, it does not rest there, but descends to the physical structure of which the color is an effect. It then penetrates this structure until it detects the elemental qualities of which the structure is itself an effect.[24]

Such a method was quite distinct from that of Scholastic natural philosophy, based as it was upon textual analysis rather than physical observation. Grosseteste's mathematical and empirical approach to natural philosophy was to bear fruit in a few followers who would continue the development of medieval natural philosophy. When combined with Scholastic philosophical methods, Grosseteste's mathematical and observational methods would bear more fruit.



Article

The Roots of the Western Concept of the "Laws of Nature": From the Greeks to Newton

One of the most famous followers of Grosseteste was Roger Bacon ... Bacon applied his immense experimental and mathematical learning to the science of light, continuing the interests of Grosseteste.

One of the most famous followers of Grosseteste was Roger Bacon (ca. 1220–1292). Bacon was a Franciscan philosopher and scientist who studied and taught at Oxford and Paris.[25] He was even more accomplished than Grosseteste (whom he admired) in the areas of Greek and Arabic natural philosophy, mathematics, and optics. Bacon pressed even further for the application of mathematics to natural philosophy. He declared: "Nothing of supreme moment can be known in them [the sciences] without mathematics."[26]

Bacon was a true experimental scientist, one of the very first in Europe. This becomes clear in his major scientific work, *Opus Maius*.[27] He applied his immense experimental and mathematical learning to the science of light, continuing the interests of Grosseteste. Bacon also was interested in the reform of education and was quite critical of the Scholastic methods. He proposed that education should be scientific and mathematical and, even more importantly, based upon the study of original languages. These were, he argued, more valuable to theological research than the traditional medieval subjects.[28] These can be recognized as the fundamental studies that Grosseteste practiced in theology (languages) and natural philosophy (observation and geometry).[29]

Bacon was one of the earliest masters to lecture directly on Aristotle at Paris, and did so for many years. He never seems to have "advanced" to theological studies, as many other medieval thinkers did. While modern historians of science find Bacon fascinating and significant, his own contemporaries misunderstood him, and his own Order eventually condemned him. He seems to have been imprisoned for two years around 1277.

Bacon could use the term "natural law," as most medieval thinkers did, i.e., to refer to the moral law of God.[30] But he also, like Grosseteste, could use the term to describe the mathematical order of the natural world, which, of course, also comes from God the Creator. For example, he held the principle that "nature works more effectively in a straight line than a curve" to be one of the laws or rules of nature.[31] He notes in passing that all corporeal bodies are also material bodies (rather than spiritual) and so "they must obey the laws of material and corporeal things."[32]

For Bacon, the laws of nature (or the rules, principles, or truths of nature) were often mathematical and imposed upon creation by an almighty Creator.[33] They could, however, just as well be metaphysical. For example, he held that there was, "by divine ordination and a universal law of nature" (*lege nature*), a limit to what spiritual and celestial substances could bring about.[34] The rules or laws of nature, though ordained by God, could be discovered through careful observation, analysis, and mathematical formulation. An example of this would be Book II of his work on force and agency, *De multiplicatione specierum*, which is devoted to the geometric analysis of the subject.[35] After explaining some of the geometry of refraction, he writes: "This refraction occurs according to the law (*lege*) that governs passage from the subtler to the denser substance."[36] So Bacon used the terms "law" and "law of nature" to refer to the natural order, often mathematical, which the divine Ruler created into the world.

In Bacon, we find the flowering of the methods advocated by Grosseteste. Unfortunately, Bacon found almost no followers, and his work lay in obscurity until the seventeenth century rediscovered him. But his example demonstrates the power of late medieval natural philosophy to generate scientific inquiry of a mathematical kind.

Less well known in our day, but more respected than Bacon in their own day, was a group of mathematical philosophers associated with Merton College, Oxford, who continued the emphasis on mathematical and logical analysis of physical problems.[37] Known as the "Merton School" or the "Oxford Calculators," these logicians were influenced by Grosseteste, and to some extent by Bacon. Grosseteste and Bacon were hardly the only voices in this tradition; Gerard of Brussels wrote an important *Book on Motion*, utilizing mathematical analysis of kinematics.[38] But the Merton School carried this analysis to new heights of excellence. They had a large influence (within a narrow range of topic) upon later Continental natural philosophy and early modern scientists like Galileo who studied motion.

The most influential man in this group in his own day and nation was doubtless Thomas Bradwardine (ca. 1295–1349), who became Archbishop of Canterbury and was

known as the *doctor profundus*.[39] In medieval science, his greatest contribution was his *Tractatus de proportionibus* (1328), which was studied by scientists into the seventeenth century. H. L. Crosby, the translator of this work into English, declares that it is "the first [scientific work] to announce a general law of physics whose expression calls for anything more than the most rudimentary mathematics."[40] Bradwardine was just as distinguished a theologian, and entered into the debate concerning voluntarism with his treatise *De causa dei* (1344).[41] Bradwardine, following Augustine, denied free will in a libertarian sense to human beings. However, he did insist upon the full freedom of God's will over all creation, including the laws of nature. Because of God's absolute power, he can do things that are contrary to the laws of nature.

Bradwardine and the Merton school had a long history of influence within the narrow topic of kinematics.

There was a common medieval distinction between God's absolute power (*potentia absolutis*) and God's ordained or disposing power (*potentia ordinatus*).[42] In terms of the geometry of motion, for example, Aristotelian natural philosophy would argue that all motion must of necessity be upward, downward, or circular, that is, away from the center, toward the center, or around the center. But if this is so, God cannot move the world. Bradwardine denied this, allowing that God can do this because of his absolute omnipotence.[43] At that time, science, following Aristotle, thought a vacuum was impossible. Bradwardine denied this in God's case (but not in the normal course of nature). He wrote:

> Indeed, by means of His absolute power, God could make a void anywhere that he truly wishes, inside or outside the world.[44]

While Bradwardine analyzed the laws of nature in terms of geometry and mathematics, like Grosseteste he insisted that God was the source of these laws, and was not himself bound by them.[45]

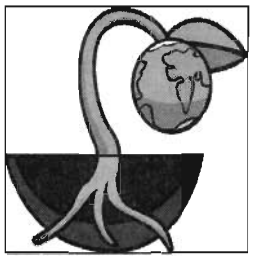
The determinism of Bradwardine should give us caution in using the term "voluntarism." In this article, we are talking about the freedom of the divine will, something most medieval theologians and scientists (like Bradwardine) would simply assume. This we are calling "voluntarism." There is also a voluntarism of the human will, which Bradwardine argued against. This issue does not enter into our topic. So our argument is that *divine* (not human) voluntarism was historically effective in helping to develop the traditional Western notion of a law of nature.

Bradwardine and the Merton school had a long history of influence within the narrow topic of kinematics. Jean Buridan, one of the most distinguished natural philosophers at Paris in the fourteenth century, was influenced by their works and, in general, by the Oxford "school" of natural philosophy in the thirteenth and fourteenth centuries (which would include Grosseteste). Buridan (ca. 1292–1358) was one of the most prestigious intellectuals in Europe in his day and continued to develop medieval natural science. Like Bacon, Buridan flourished wholly in the Arts faculty (philosophy), not taking the normal route of continuing "upward" to theological studies.[46] As the work of these two scholars illustrates (and more could be added to their number), the conceptual division between the disciplines of theology and natural science began during this time, especially after the social impact of the condemnation of certain Aristotelian philosophical teachings in Paris in 1277.[47] Buridan wrote, for example, that "in natural philosophy we ought to accept actions and dependencies as if they always proceed in a natural way."[48]

The distinction between natural science and theology is not, as is sometimes thought, a product of the Renaissance (which, of course, did much to enlarge the division!). Buridan in particular made significant headway in setting forth scientific methodology that was distinct from theological methods and conclusions. We should note, however, that Buridan was devoutly Christian, and his natural philosophy was framed within a Christian world view. For example, after the quotation given above, Buridan went on to state: "Nevertheless God is the cause of this world." He argued in the same question that the motion of the heavens, and other effects, depend upon God as their First Cause.

Buridan was famous as a logician, natural philosopher, and commentator on Aristotle. He was twice elected rector of the University of Paris. As a commentator and scientist, he knew of the work of Grosseteste (especially his commentary on the *Prior Analytics*), and may have known something of Bacon, who also lectured for many years in Paris on Aristotle. But unlike Grosseteste, who was a realist and much influenced by Platonic thought, Buridan was a nominalist.

Buridan's philosophy of science was much influenced by a philosophical movement whose most brilliant defender was William of Ockham. Nominalists held that universal properties are mere words (*nomen* in Latin) rather than real things, as Platonic philosophers (realists) argued. This debate was centuries old, but in the fourteenth century, it became particularly acute. There developed, following Ockham, a kind of skeptical nominalist epistemology, which undercut any knowledge of the real causes of things. This would also undercut any natural theology, as indeed Ockham argued. To his credit, Buridan, though a nominalist, argued against such skeptical conclusions in the realm of natural philosophy.[49] True science, according



to Aristotle, was deductive. Buridan accepted this, but noted that such demonstrative knowledge was limited in scope. There are principles that are only conditionally necessary (that is, physically necessary if God does not change his action) and cannot be known with logical rigor (*certitudine*),[50] but they indeed can be known. He wrote:

> These principles are not immediately evident; indeed we may doubt concerning them for a long time. But they are called principles because they are indemonstrable, and cannot be deducted from other premises nor proved by any formal procedure; they are accepted because they have been observed to be true in many instances and to be false in none.[51]

Examples of what we can know physically are the modes of being, such as height, width, and depth, which are natural and distinct. These can be known through geometry and arithmetic.[52] Buridan followed the typical late medieval practice of using "law of nature" to refer to the moral law, not to the "principles" of natural philosophy nor the natural "modes" of physical objects. But for Buridan, these principles and modes (or properties) are not known through logic alone, but by experience and analysis.

So against the extreme form of skeptical nominalism (as personified by his opponent Nicholas of Autrecourt), Buridan insisted that we can know the natural causes of physical phenomena, what we might call the laws of nature.

So against the extreme form of skeptical nominalism (as personified by his opponent Nicholas of Autrecourt), Buridan insisted that we can know the natural causes of physical phenomena, what we might call the laws of nature. He wrote:

> It has hereby been shown that very evil things are being said by certain ones who seek to undermine the natural and moral sciences because absolute evidence is not possessed by most of their principles and conclusions, it being supernaturally possible for them to be rendered false. For in these sciences absolutely unconditional evidence is not required, and it is enough if we have conditional or hypothetical evidence.[53]

Against skeptical nominalist theology and philosophy, Buridan accepted the less-than-logically-pure principles of natural science as being sufficient for its aim, i.e., to discover the principles of natural philosophy and the mathematical properties of physical things.

Buridan was not simply a logician and metaphysician. He was a distinguished medieval scientist as well, whose major contributions come in commentaries on Aristotle's *Physics* and *On the Heavens*. Perhaps his most important scientific discovery was his impetus theory of local motion.[54] He could use this theory to talk about God's relationship to the principles of natural science. Impetus (his special term for inertial force) also comes from God. Buridan wrote:

> God, when He created the world, moved each of the celestial orbs as He pleased, and in moving them He impressed in them impetuses which moved them without his having to move them any more except by the method of general influence whereby he concurs as a co-agent in all things which take place.[55]

God was not only the "prime mover," but the source of the principles of natural order and motion (First Cause), which Buridan studied in a scientific (as well as metaphysical) manner.

This distinction which Buridan develops between natural philosophy and theology is an important one, even for our own day. By his absolute power, God can do anything that is logically impossible, including creating matter from nothing or moving the entire universe. But such miracles are not the subject of natural science. Instead, natural science investigates the ordinary activity of God, by which he sustains the universe, his "method of general influence." A sixteenth-century, collaborative Jesuit scientific commentary on Aristotle from Coimbra, Portugal, notes that God conserves the universe throughout time (*in perpetuum durare*) in the common and ordinary concourse (*communi et ordinario concursu*) of nature.[56]

This, I think, is a key distinction, even for our own day. Natural science investigates the common and well-ordered (*ordinatus*) activity of God, his ordained power by which he conserves the world. That is the reason miracles are not part of natural philosophy, as far as first principles are concerned. In our own time, we would say that the natural sciences aim to explain the activity of God in sustaining the physical universe through his ordained power, including matter, energy, and the laws of nature. Buridan, and the late medieval tradition with him, accepted mira-

cles, which God does by means of his absolute power, but did not use them to explain physical phenomena within the domain of natural philosophy.

In his reflections upon God as the source of the laws of nature, Oresme allowed that God could create many worlds by his infinite power. ... Laws of place and motion would apply to any world created by God ...

The mathematical tradition of natural philosophy was carried on by a number of Buridan's students and followers, including Nicole Oresme (ca. 1320–1382). He was a theologian, scientist, and philosopher of wide-ranging interests.[57] Unlike Bacon and Buridan, Oresme became a theologian, as well as a mathematician and natural philosopher. He was also a more extreme nominalist than either of them, and his speculations in natural philosophy were just that—speculations. He was not as famous as Buridan, whom he knew and whose works he studied. Nevertheless Oresme's work in natural philosophy and mathematics was significant, especially in Paris. A tutor and friend of Charles V, the king of France, Oresme was commanded to translate some of Aristotle's texts into French for the further edification of the nobility. As well as works on ethics and politics, Oresme completed a translation and commentary on Aristotle's *On the Heavens*, which is the first important scientific work in the French language and Oresme's last publication. This book, which was quite influential in its own way, is an early example of the use of a clock metaphor to discuss the regular motions of the physical universe.[58]

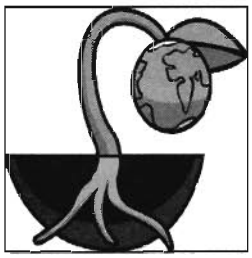
With respect to his views on the laws of nature, Oresme used the term "law of nature" always in the sense of the moral law or natural law.[59] When writing about what we now call the laws of nature, he consistently used "principles" of nature. While Oresme accepted the general idea of the laws or principles of nature from earlier philosophers, he extended the idea to speculation about other possible worlds. In his reflections upon God as the source of the laws of nature, Oresme allowed that God could create many worlds by his infinite power. God is not only creator, but governor of any and all worlds that could possibly exist. So if God made another world, it would have physical principles or laws of nature (in this case, of place and motion toward a center) the same as our world does. Oresme wrote: "If God [in His infinite power] created another world like our own, the earth and the other elements of this other world would be present there just as they are in our own world"[60] Laws of place and motion would apply to any world created by God, he argued. "[I]f several worlds existed, no one of them would be outside Him nor outside His power."[61] This universal character of the laws of nature will have great influence on Descartes and other scientific minds in the early modern period.

Western natural science continued its basis upon the natural books of Aristotle, through a gradual transition until the end of the seventeenth century and Isaac Newton (1642–1727). Since space is limited here, I will focus on Newton as one example for all of early modern science.

Newton opens the Preface to his famous *Mathematical Principles of Natural Philosophy* with the statement: "The moderns ... have undertaken to reduce the phenomena of nature to mathematical laws."[62] The Axioms at the beginning of the work are entitled *Axiomata, sive Leges Motu*. Newton used the word "principle" for gravity or for law of nature. "[T]hey [material particles] are moved by certain active Principles, such as is that of Gravity ... These Principles I consider ... general Laws of Nature."[63] And God is the source of the laws of nature. Newton's God is the absolute Lord of the universe. "He rules all things, not as the world soul but as the lord of all, the Pantokrator."[64]

In his work on optics, Newton notes that "God is able ... to vary the Laws of Nature and make Worlds of several sorts in several Parts of the Universe."[65] Against Descartes, Newton returns to the traditional theory of God's absolute power, which is able to alter the laws of nature at will. The basic theological concepts in Newton's natural philosophy were already part of his scientific inheritance from the past. In fact, in a recent work on Newton, Ted Davis and John Henry have clarified some of the confusing things Newton wrote concerning God and gravity, by utilizing the distinction between God's ordained and absolute power.[66] But Newton's brilliant transformation of natural philosophy soon overturned the larger Aristotelian paradigm in which these concepts were developed.

Copernicus, Galileo, Kepler, Descartes, Newton, and the other great early scientists were both arguing against, but also using and continuing in some respects, the late medieval and renaissance tradition of natural science. One area where there is continuity is the notion of the laws of nature, and the role of God in natural philosophy. But after Newton, the decisive break with the past is too great, and this tradition gradually becomes less marked in the writings of natural scientists. Nevertheless, the Christian tradition of natural philosophy handed on a distinctively theistic notion of the laws of nature, that is, as stemming from the ordained power of God by which he concurs with the normal course of nature. This view is so common throughout the history of Western science before 1700 that we should call it the traditional Western view. A law of nature, in this view, is a physical regularity built by God



Article

The Roots of the Western Concept of the "Laws of Nature": From the Greeks to Newton

into the very fabric of the universe by means of which (along with other things) he conserves the physical universe in existence throughout time.

I believe that a return to this traditional concept of a law of nature, grounded in the ordained power of God, could help solve several contemporary issues and confusions in the philosophy of science and in the ongoing dialogue between religion and science. The purpose of this essay, however, has been primarily historical. I have sought simply to demonstrate that, in the midst of diversity, there was a common Western conception of "law of nature" based upon belief in the ordained power of God. ✯

The Christian tradition of natural philosophy handed on a distinctively theistic notion of the laws of nature, that is, as stemming from the ordained power of God by which he concurs with the normal course of nature.

Notes

[1]Research funding for this article was provided by the John Templeton Foundation, through the Oxford Templeton Seminars in Science and Christianity (1999–2001).

[2]For secondary literature on this topic see, G. Frey, "Naturgesetz," *Historisches Wörterbuch der Philosophie*, 6:528–31; Jane Ruby, "The Origins of Scientific Law," *Journal of the History of Ideas* 47 (1986): 341–59; J. R. Milton, "The Origin and Development of the Concept of the 'Laws of Nature,'" *European Journal of Sociology* 22 (1981): 173–95; F. Oakley, "The Rise of the Concept 'Laws of Nature,'" *Church History* 30 (1961): 433–57; E. Zilsel, "The Genesis of the Concept of Physical Law," *Philosophical Review* 51 (1942): 245–79.

[3]There are even earlier Jewish and Christian authors, such as Philo, who use the idea. See Christoper Kaiser, *Creational Theology and the History of Physical Science* (Leiden: E. J. Brill, 1997), 35–6.

[4]In particular, these would be Augustine's *Literal Commentary on Genesis* and Basil's *Hexaemeron* (*On the Six Days of Creation*) as well as the Latin version of the *Hexaemeron* from the pen of Ambrose.

[5]See Basil, *Hexaemeron*, vii.3–5 and viii.4; English translation in *Nicene and Post-Nicene Fathers, Second Series* (Oxford: J. Parker, 1895), 8:91–3, 97. For the Greek text, see J. P. Migne, ed., *Patrologiae Graeca* 29: 156–8. Augustine, *The Literal Meaning of Genesis* 2, trans. J. H. Taylor (New York: Paulist Press, 1983), 41. See the Latin text of *De Genesi ad litteram*, ed. J. Zycha in *Corpus Scriptorum Ecclesiasticorum Latinorum* 28/1 (1894; reprint, New York: Johnson Reprint, 1970).

[6]*Hexaemeron*, vii.3 (p. 92).

[7]*De Gen.*, ix.17 (*Literal Meaning*, 2:92).

[8]Line 2 of the Greek text, for which see Gilbert Murray, et al., eds., *The Oxford Book of Greek Verse* (Oxford: Clarendon Press, 1931), #483. There are several English translations, including the rather good one in F. H. Sandbach, *The Stoics*, 2d ed. (Indianapolis: Hackett, 1994), 110–1.

[9]Lucretius, *De Rerum Natura*, ed. M. F. Smith (LCL; Cambridge, MA: Harvard, 1924), 5:58. See also 2:714 and 719 for his use of the term law of nature.

[10]Manilius, *Astronomica*, ed. G. P. Goold (LCL; Cambridge, MA: Harvard, 1977), 2:475 and 1:670–1.

[11]Aristotle uses the bare form of words "law" of nature in only one place, in the opening of *On the Heavens* (*De Caelo*, 268A, 14). Interestingly the context is, again, that of astronomy. However, his meaning here is quite different from our interests in this paper.

[12]For the Latin text, see Pierre Damien, *Lettre sur la toute-puissance divine*, ed. A. Cantin (SC 191; Paris: Ed. Du Cerf, 1972), §13, 448–50, which also has an excellent introduction to Damian. For an English translation, see letter 119 in the Fathers of the Church edition of his *Letters*, trans. O. J. Blum, 5 vols. (Washington, DC: Catholic University of America Press, 1989–1999).

[13]For a discussion of medieval voluntarism, see N. Kretzmann, A. Kenny and J. Pinborg, eds., *The Cambridge History of Later Medieval Philosophy* (Cambridge: Cambridge University Press, 1982), 537–9, 638–40; and William Wallace, "The Philosophical Setting of Medieval Science," in *Science in the Middle Ages*, ed. David Lindberg (Chicago: University of Chicago Press, 1978).

[14]John of Salisbury, *Metalogicon*, IV.6, trans. D. D. McGarry (Berkeley: University of California Press, 1962), 212.

[15]See Edward Grant, *The Foundations of Modern Science in the Middle Ages* (Cambridge: Cambridge University Press, 1996). Pierre Duhem and A. C. Crombie are particularly remembered for advocating this thesis, among twentieth century historians of science. See Duhem, *Le systém du monde*, 10 vols. (Paris: Hermann, 1913–1959) and Crombie, *Medieval and Early Modern Science*, 2 vols. (New York: Anchor Books, 1959).

[16]Edward Grant, *Planets, Stars, and Orbs: The Medieval Cosmos, 1200–1687* (Cambridge: Cambridge University Press, 1996), 13.

[17]Simplicius, *On Aristotle Physics* 2, trans. Barrie Fleet (London: Duckworth, 1997), 47 (on Aristotle, *Physics*, 193b23). Greek text in *Symplicii In Aristotelis Physicorum*, ed. H. Diels, 2 vols. (Berlin: Reimer, 1882), 2:291.

[18]Southern argues that he was not confirmed as Chancellor by the Bishop (p. xxx). For more on Grosseteste, see A. C. Crombie, *Robert Grosseteste and the Origins of Experimental Science, 1100–1700*, 2d. ed. (Oxford: Oxford University Press, 1962), John McEvoy, *The Philosophy of Robert Grosseteste* (Oxford: Oxford University Press, 1982); and R. W. Southern, *Robert Grosseteste*, 2d ed. (Oxford: Oxford University Press, 1992).

[19]Robert Grosseteste, *On Light*, trans. C. C. Riedl (Milwaukee: Marquette University Press, 1942).

[20]Cited from McEvoy, 168; for the original text, see Ludwig Baur, ed., *Die philosophischen Werke des Robert Grosseteste*, BGPM 9 (Munster: Aschendorff, 1912), 59; for a modern English translation, see E. Grant, ed., *A Source Book in Medieval Science* (Cambridge, MA: Harvard University Press, 1974), 384–8.

[21]McEnvoy, 169.

[22]Robert Grosseteste, *Hexaemeron*, ed. R. C. Dales and S. Gieben (London: British Academy, 1982); English translation, *On the Six Days of Creation*, by C. F. J. Martin (London: British Academy, 1996). This text will be cited by section number, which is uniform in both the Latin and English editions.

Natural law is used in the moral sense in Robert Grosseteste, *De Cessatione Legalium*, ed. R. C. Dales and E. B. King (London: British Academy, 1986), I.v.2,6, I.vi.8.

[23]Grosseteste, *Hexaemeron*, 3.iii.5.

[24]Cited from Southern, 168; original text in Robert Grosseteste, *Commentarius in Posteriorum Analyticorum Libros*, ed. P. Rossi (Florence: L. S. Olschki, 1981), 281.

[25]For the life and work of Bacon, see A. C. Crombie and J. D. North, *Dictionary of Scientific Biography*, s.v. "Bacon, Roger"; T. Crowley, *Roger Bacon* (Louvain: *Ed. Institute Superior de Philosophie*, 1950); Stewart Easton, *Roger Bacon and his Search for a Universal Science* (New York: Columbia University Press, 1952); and the first chapter of *Roger Bacon and the Sciences*, ed. J. Hackett (Leiden: Brill, 1997).

[26]*Opus Maius*, part IV, d. 1, chap. 3 (p. 127, Burke ed.)

[27]Roger Bacon, *The "Opus Maius" of Roger Bacon*, ed. J. H. Bridges, 3 vols. (London: Williams & Norgate, 1879–1900); and in English, *The Opus Majus of Roger Bacon*, trans. R. B. Burke, 2 vols. (1928; reprint, New York: Russell & Russell, 1962). Part V is given a modern critical edition and translation by David Lindberg, *Roger Bacon and the Origins of Perspectiva in the Middle Ages* (Oxford: Oxford University Press, 1996).

[28]*Opus Maius*, parts III and IV.

[29]Crombie and North, 377f.

[30]*Opus Maius*, part II, chap. 2 (pp. 37–8, Burke ed.).

[31]*Opus Maius*, part IV, d.3, chap. 1 (p. 139, Burke ed.)

[32]*Opus Maius*, part V, part 1, d 6, chap. 4 (p. 87, Lindberg ed.)

[33]For example, "Just as the wisdom of God is provided for the ordering (regimen) of the universe, so too is this science of vision – powerfully, usefully, and by its agreeable beauty" (*Opus Maius*, part V, d. 3, chap. 3; p. 330, Lindberg ed.). At one point Bacon even uses the word *canon* for a law of nature (*Opus Maius*, part V, part 3, d. 2, chap. 4, pp. 310, 316, Lindberg ed.).

[34]*De multiplicatione specierum*, I.6, ed. David Lindberg in *Roger Bacon's Philosophy of Nature* (Oxford: Oxford University Press, 1983), 84. See also pp. 85, 87 and IV.1, p. 209 for his use of "law of nature."

[35]Op. cit., 91–177.

[36]Op. cit., II.4, p. 127.

[37]See Christopher Lewis, *The Merton School and Kinematics in Late Sixteenth and Early Seventeenth Century Italy* (Padua: Antnore, 1980); Edith Sylla, "The Oxford Calculators," in *The Cambridge History of Later Medieval Philosophy*, 540–63; and M. Clagett, *The Science of Mechanics in the Middle Ages* (Madison, WI: University of Wisconsin Press, 1959), 199–239.

[38]See Grant, *Source Book*, 234–7 and Clagett, 185–95.

[39]For his life, see John E. Murdock, "Bradwardine, Thomas," *Dictionary of Scientific Biography* 2:390–6; Gordon Leff, *Bradwardine and the Pelagians* (Cambridge: Cambridge University Press, 1957); and Edith Dolnikowski, *Thomas of Bradwardine* (Leiden: Brill, 1995).

[40]See H. L. Crosby, *Thomas of Bradwardine* (Madison, WI: University of Wisconsin Press, 1955) which contains an English translation of the work.

[41]See Leff, *Bradwardine* and Grant, *Source Book*, 555–60.

[42]See, e.g., William of Ockham, *Quodlibetal Questions*, IV, q.1, trans. A. J. Freddoso and F. E. Kelley, 2 vols. (New Haven: Yale University Press, 1991), 491–2. See further, William J. Courtenay, *Covenant and Causality in Medieval Thought* (London: Variorum, 1984).

[43]*De causa Dei*, Bk. I, chap. 5; in Grant, *Source Book*, 557, 560.

[44]Ibid.

[45]See, e.g., the doxology at the conclusion of his *Tractatus de proportionibus*, p. 140 (Crosby ed.).

[46]On Buridan, see E. A. Moody, *Dictionary of Scientific Biography*, s.v. "Buridan, Jean"; Alessandro Ghisalberti, *Giovanni Buridano dalla Metafisica alla Fisica* (Milan: Vita e Pensiero, 1975); and Benoit Patar, ed., *Ioannis Buridani Expositio et Quaestiones in Aristotelis De Caelo* (Louvain: Peeters, 1996).

[47]For more on the condemnations of 1277, see E. Grant, "The Condemnation of 1277, God's Absolute Power, and Physical Thought in the Late Middle Ages," *Viator* 10 (1979): 211–44, reprinted in his *Studies in Medieval Science and Natural Philosophy* (London: Variorum, 1981); see also David Lindberg, *The Beginnings of Western Science* (Chicago: University of Chicago, 1992), 234–44.

[48]*Quest. de caelo*, book 2, q.9 (p. 423f., Patar ed.).

[49]See, e.g., Joannis Buridanus, *In Metaphysicen Aristotelis* (Lyon, 1518), II, q. 1, fol. 8.

[50]Ibid.

[51]Cited from Moody, 604; original text, *In Metaph.*, II, q.2, fol. 9v.

[52]See *Quest. de Caelo*, I, q. 2 (p. 234, Patar ed.).

[53]Cited from Moody, 605; original text in *Quest. Meta.* II, q. 1, fol. 9r.

[54]Clagett, *Science*, 505–30 for discussion and a brief translation.

[55]Cited from Clagett, 536; original text, *Questiones super octo physicorum libros Aristotelis*, VII, q. 12 (Paris, 1509), fol. 121r.

[56]Conimbricenses [College of Arts at Coimbra], *Commentarii Collegii Conimbricenses S. J. in quatuor libros De Coelo* (Lyon, 1598), book 1, chap. 2, q. 1, art. 2. Also in Grant, *Planets*, 77n.

[57]On Oresme, see Marshall Clagett, *Dictionary of Scientific Biography*, s.v. "Orseme, Nicole"; ____, *Nicole Oresme and the Geometry of Qualities and Motions* (Madison, WI: University of Wisconsin Press, 1968), G. W. Coopland, *Nicole Oresme and the Astrologers* (Liverpool: Liverpool University Press, 1952), and E. Grant, *Nicole Oresme and the Kinematics of Circular Motion* (Madison, WI: University of Wisconsin Press, 1971).

[58]Oresme, *Le Livre du ciel et du monde*, ed. A. D. Menut and A. J. Denomy (Madison, WI: University of Wisconsin Press, 1968), 70d–71a, 73d.

[59]*De configurationibus qualitatum et motuum*, II.38 (in Clagett, *Nicole Oreme*, 381).

[60]Grant, *Source Book*, 551, from *Livre de Ceil*, bk. I, chap. 24.

[61]Grant, *Source Book*, 552, from *Livre de Ceil*, I.24.

[62]Issac Newton, *Principia*, trans. I. B. Cohen and A. Whitman (Berkeley: University of California Press, 1999), 381.

[63]Issac Newton, *Optikcs*, 4th ed. (1730; reprint, London: Bell, 1931), 401.

[64]General Scholium to the *Principia*, 940.

[65]*Opticks*, 405.

[66]John Henry, "'Pray do not Ascribe that Notion to Me': God and Newton's Gravity," in *The Books of Nature and Scripture*, ed. J. Force and R. H. Popkin (Boston: Kluwer, 1994), 123–48; Edward Davis, "Newton's Rejection of the 'Newtonian Worldview,'" *Science and Christian Belief* 3 (1991): 103–17, reprinted from *Fides et Historia* 22 (1990): 6–20.

Upcoming ASA Conferences

July 23–26, 2004:

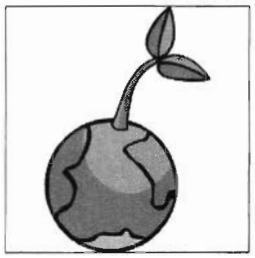
Location: Trinity Western University, Langley, British Columbia Canada
Topic: Neuroscience and the Image of God
Program Co-Chairs: Judith Toronchuk, CSCA; Kenneth Dormer, ASA; and Hugh Reynolds, CiS
Local Arrangements Chair: David Clements

Aug. 5–8, 2005:

Location: Messiah College, Grantham, PA
Theme: "Energy, Conservation and the Environment"
Program Chair: Kenell Touryan
Local Arrangements Co-Chairs: Ted Davis and Jerry Hess

July 28–31, 2006:

Location: Calvin College, Grand Rapids, MI
Local Arrangements Chair: Hessel Bouma III



Young-Earth Creationism: A Literal Mistake

Dick Fischer

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"Biblical literalism" often is blamed when conservative Christians find themselves unable to cope with certain realities of this world and its encompassing universe, specifically, in respect to the great age of our surroundings – around 15 billion years for the universe and about 4.6 billion years for our global habitat. This article endeavors to shift the blame away from the written Scriptures, and place it squarely on the shoulders of those who to this point have been unable to comprehend them. Scribal errors and translation mistakes have led to flawed interpretations, and some of the problem can be traced to those who wrote Bible commentary centuries ago. But the Bible itself can rise above these difficulties. All we have to do is read it, and except in obvious instances, take it literally!

"Young-earth creationism" attempts to blend a little scientific learning with a curious style of [biblical] literalism.

"A little learning is a dangerous thing" is a time-honored expression my high school geometry teacher would use when one of us misapplied an axiom, postulate, or corollary in an attempt to prove a particular geometric theorem. "Biblical literalism" is a term to describe a movement among conservative Christians who demonstrate a certain lack of acumen in the basic tenets of earth science. "Young-earth creationism" (YEC in the vernacular) attempts to blend a little scientific learning with a curious style of literalism. YECs, who purport to be biblical literalists, actually are not! We will see that a little learning combined with a lack of understanding can still to this day be a dangerous thing.

What YECs assert can be summarized as follows: The earth and the universe were created recently, about six to ten thousand years ago. From the beginning of the cosmos, the little hand of a clock would sweep its face fewer than twelve times before the first human beings were there to enjoy the warmth of a two-day old sun, and could view a nighttime sky complete with two-day old galaxies and stars created on the fourth 24-hour day. The earth on that sixth 24-hour day would be filled with trilobites, brachiopods, dinosaurs, wooly mammoths, and all of the forms of animals that ever lived, dwelling in peaceful cohabitation with Adam and Eve, the first human beings.

There are no biological links between species in young-earth doctrine, and no death of any kind occurred prior to Adam's fall. All of the animals, and presumably insects, too, would have multiplied and filled the earth without dying had it not been for Original Sin.[1] Representatives of every animal species, including dinosaurs, were loaded on Noah's ark. A worldwide flood distributed neat layers of incongruous sedimentary materials, gouged out the Grand Canyon over a mile deep, synthesized ice ages, and even moved continents around the globe. The fossil record with complex fossils overlying simple varieties is due to an indescribable sorting action, according to YEC belief.

These beliefs derive directly from Scripture, according to young-earth creationists. It is the unerring, infallible Word of God, they believe, that leads them to advocate a farce of divine deception, disregarding sensible scientific explanation. As Duane Gish put it:

> It is this author's belief that a sound Biblical exegesis requires the acceptance of the catastrophist-recent creation interpretation of earth history.[2]

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Is it possible that the Bible is an unwilling accomplice in a charade of implausibility promoted by unwitting Christians? We have only to read it to see.

The Days of Creation

Did the days of creation in Genesis 1 last only twenty-four hours, or could these days be long times of indefinite length, such as a few billion years between days one and two, for example? "Evening and morning cannot be construed to mean an age, but only a day," Bible scholar Charles Caldwell Ryrie says, "everywhere in the Pentateuch the word 'day,' when used with a numerical adjective, means a solar day (now calibrated as 24 hours)."[3]

We who are bound to a specific place at any given time perceive "evening" and "morning" as synonymous with sunset and sunrise, but God does not see the world from a single vantage point. From God's perspective, the earth is always half in daylight and half in darkness perennially.

Yet Moses stated in Ps. 90:4: *"For a thousand years in Thy sight are like yesterday when it passes by, or as a watch in the night* [three to four hours]." That sentiment is echoed in 2 Peter 3:8: *"But, beloved, be not ignorant of this one thing, that one day is with the Lord as a thousand years and a thousand years as one day."*

In other words, God's time and humans' time are dissimilar. The timetable of any moving object in the universe is dictated by the speed of that object according to the Theory of Relativity. Here on earth we enjoy earth time. For astronauts traveling aboard the International Space Station, time compresses slightly such that when they return to earth they are a tiny bit younger than if they had not ventured in space. By the same token, a God of the universe would not be on the same timetable as one of its moving bodies.

Further, God does not live at any particular location. We who are bound to a specific place at any given time perceive "evening" and "morning" as synonymous with sunset and sunrise, but God does not see the world from a single vantage point. From God's perspective, the earth is always half in daylight and half in darkness perennially. We could say God never sees "evening" or "morning," or we could say that God sees an infinite number of "evenings" and "mornings" every single day.

To human and animal observers on the sixth day, *"morning"* could be thought of as sunrise. But from day one to day four, God's timing alone applied, eliminating the possibility of a 24-hour day. So who should we trust, Bible scholar Ryrie, or Bible writers Moses and Peter? Or Augustine who said that they were "God-divided days," not "sun-divided days"?[4]

Evening and Morning Defined

"Evening" and "morning" should not be troublesome; these words are clarified in the Old Testament. In Psalm 90, humans are likened to grass. *"In the morning it flourisheth, and groweth up; in the evening it is cut down, and withereth"* (Ps. 90:6). Perry Phillips comments:

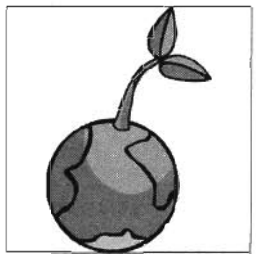
> I know of no grass that literally springs up in the morning and then is dead by the same evening. Rather, the psalmist has in mind the life cycle of grass in the Levant, which begins its growth with the November rains and dies with the hot, dry, March, desert winds. In this psalm, therefore, "morning" stands for the period of growth and "evening" stands for the period of death.[5]

Vegetation Without Sun?

Vegetation appears on the third day. The sun, moon, and stars were created on the fourth day according to YEC doctrine from what they consider to be a literal interpretation of Gen. 1:14–19. They maintain this belief even though on both the third and fourth day, the Hebrew word for create (*bara*) is absent. On the fourth day, the word is *asah*, often translated as "made." In this case, "ordained," "commissioned," or "permitted to function" would aptly translate *asah*. Gleason Archer comments:

> Genesis 1:14–19 reveals that in the fourth creative stage God parted the cloud cover enough for direct sunlight to fall on the earth and for accurate observation of the movements of the sun, moon, and stars to take place. Verse 16 should not be understood as indicating the creation of the heavenly bodies for the first time on the fourth creative day; rather it informs us that the sun, moon, and stars created on Day One as the source of light had been placed in their appointed places by God with a view to their eventually functioning as indicators of time ("signs, seasons, days, years") to terrestrial observers.[6]

On day one, God created heaven and earth, including the sun, moon, and stars. The sun's energy enabled the growth of vegetation on the third day. On the fourth day, God appointed the sun, moon, and stars as timekeepers for the sighted creatures that began to appear on the fifth day. If the sun's appearance is not until the fourth day, it could not have been used to measure the length of that day or any of the previous days. Taken literally, not one of the first four days of creation can be a 24-hour period.



Article

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The word of importance in Genesis 2:4 ... is toledah, translated as "generations." According to Hebrew lexicons, this word always pertains to a long time period. Plus, the word is plural. Therefore "generations" refers to numerous time periods, each of which would be longer than one calendar week.

The Seventh Day of Rest

Even if a 24-hour period could be construed for any one of the first six days of creation, it is impossible for the seventh. God's seventh day of rest says nothing of "evening" or "morning" and continues as in Heb. 4:3: *"For we which have believed do enter into rest, as He said, As I have sworn in my wrath, if they shall enter into my rest: although the works were finished from the foundation of the world."*

According to Archer: "... that seventh day, that 'Sabbath rest,' in a very definite sense has continued on right into the church age."[7] If the seventh day is a long period of time encompassing thousands of years, then consistency demands that the first six days be given similar treatment – that is, ages or eons, but not 24-hour periods.[8]

Can One Day Equal Six Days?

Following the six days of creation and God's sanctification of the seventh day of rest, a shift of focus begins at Gen. 2:4: *"These are the generations of the heavens and of the earth when they were created, in the day that the Lord God made the earth and the heavens."*

Here the word *"day"* is used as a coverall to apply to the previous six days of creation. But how can one 24-hour day equal six 24-hour days? This is not a semantics problem, this is a math problem. If a day of creation is a time of indefinite length, then one large time of indefinite length could equal six smaller times of indefinite length. But one 24-hour day cannot equal six 24-hour days.

The word of importance in Gen. 2:4, however, is *toledah*, translated as *"generations."* According to Hebrew lexicons, this word always pertains to a long time period. Plus, the word is plural. Therefore *"generations"* refers to numerous time periods, each of which would be longer than one calendar week.[9] If we take Genesis literally, that effectively eliminates the 24-hour day definition from the list of possibilities.

Planting the Garden

In Gen. 2:8–9: *"... the LORD God planted a garden eastward in Eden; and there he put the man whom he had formed. And out of the ground made the LORD God to grow every tree that is pleasant to the sight, and good for food."*

To read this straightforwardly (the only way YECs say is valid), we would conclude that on the sixth day when Adam was created, the garden of Eden was planted by God. Then Adam was charged to *"dress it and to keep it"* (Gen. 2:15). The garden grew and matured to the extent that the seedlings which God planted became trees bearing edible fruit whereupon God could command Adam in Gen. 2:16–17: *"Of every tree of the garden thou mayest freely eat: but of the tree of the knowledge of good and evil, thou shalt not eat of it ..."* Fruit has now grown on the trees God planted, and this is still the sixth day. And Eve is yet to be created, on the same sixth day!

To insist that day six is a 24-hour day is to argue against the straightforward method of interpretation that YECs claim they follow.

A Word from Adam

On that sixth day of creation, YECs believe, Adam named all the world's thousands and thousands of animal species, tended the garden a little, and had an operation resulting in Eve – all within a small part of a 24-hour day.

Yet Adam exclaims excitedly in Gen. 2:23, *"This is now bone of my bones, and flesh of my flesh ..."* The word *"now"* is the Hebrew *happa'am* usually translated "now at length" or "at last." This Hebrew word is appropriate after a long wait or a lengthy search, but it would be entirely inappropriate had Eve been presented to him only a few hours after he was created. Should we trust YEC doctrine, or take Adam at his word?

Death Before Sin?

Young-earth creationists maintain the Bible prohibits death, even in the animal world, until Adam commits Original Sin. Gen. 3:17b and Rom. 8:22 are summoned for oblique support, but essentially this idea of no death in the animal kingdom before Adam hinges on their interpretation of about one- half of one verse in Romans.

Citing Rom. 5:12, Henry Morris explains that death "entered into the world" only when sin came by humankind. He continues:

> ... it is as obvious as anything could be that the fossil record now found in the

sedimentary rocks of the earth's crust could only have been formed sometime *after* man sinned.[10]

What did Paul say in Romans? *"Wherefore, as by one man sin entered into the world, and death by sin ..."* (Rom. 5:12a). Does this mean Adam's sin caused death in the animal world too, and there was no physical death before then?

Notice that Morris did not quote the entire verse. He stopped in mid-sentence, in fact. This is what follows the semi-colon. Rom. 5:12b: *"and so death passed upon all men, for that all have sinned."* So the Bible tells us, "as obvious as anything could be," who or what is affected by Adam's sin—humans, not animals. Additional clarification can be found in verse thirteen: *"For until the law sin was in the world: but sin is not imputed when there is no law."* Who was under the law, humans or animals? Did animals tithe, fast, celebrate feasts, honor the Sabbath, keep the commandments, or offer up unblemished sacrifices?

Romans 4:13 says: *"For the promise, that he should be the heir of the world, was not to Abraham, or to his seed, through the law, but through the righteousness of faith."* Were animals "through the righteousness of faith" to be joint heirs of the world along with the descendants of Abraham? Who is right on this issue, creationist Henry Morris or the Apostle Paul?

The Appearance of Age

When they come under a reasoned attack, there is another rationalization young-earth advocates will employ. Flinching under the weight of old-earth evidence, they offer an alternate explanation. The world is young, they claim, but was created to look old.

In 1857, Phillip Gosse wrote *Omphalos* (navel), a book advocating that God created false records in nature to date his recent creation artificially. Just as Adam seems to have been created an adult, Gosse argued, the Creator designed the earth to look old. The earth would be young, but would have the "appearance of age."

The appearance of age argument is similarly flawed. Had Adam been aged artificially in the same sense that the universe and earth bear the undeniable stamp of antiquity, a physical exam would have revealed worn teeth, liver spots, scar tissue, calluses, blood cholesterol, wrinkles, and all the other physical signs of an aging adult.

The notion that the universe was created with an apparent age, or that it looks old but is really young, crumbles under its own weight. How ironic it would have been for God to have commanded in Exod. 20:16, *"Thou shalt not bear false witness,"* and have expected his children to adhere to a criterion that God himself would have violated from the beginning. From Romans, we are held accountable by the evidence of nature. *"For the invisible things of Him from the creation of the world are clearly seen, being understood by the things that are made, even his eternal power and Godhead; so that they are without excuse"* (Rom. 1:20). Had an artificially-dated planet been palmed off on us by a clever sleight-of-hand artist we would not be without excuse, we would have a great excuse!

Flinching under the weight of old-earth evidence, [young-earth advocates] offer an alternate explanation. The world is young, they claim, but was created to look old.

Inherent with the appearance of age argument is a classic "Catch-22."[11] If the world is old, as it looks, then why would God give us a book saying it is young? And if the world is young, then it had to be manufactured deliberately to look old. Thus, YEC orthodoxy poses an insane dilemma: If the world is old, then God would be a fibber, and if young, he would be a counterfeiter! Taking young-earth dogma to its conclusion, we ask: "If we cannot trust God to give us a true history of the world, how can we trust him to give us true history and true prophecy in his Book?" A god who could falsify nature might falsify a resurrection!

Ironically, these implied allegations raised by those who profess to be believers, call God's credibility into question. True words demand true works. *"For the word of the Lord is right and all his works are done in truth"* (Ps. 33:4).

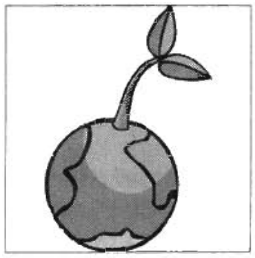
Scripture Evidence for an Old Earth

Is the earth young or old? Let us thumb through the Bible and see. In Job 15:1, Eliphaz asked Job, *"Wast thou made before the hills?"* Does it seem reasonable that Eliphaz would have used this question of digging sarcasm had he thought the age of the hills and the age of humans were virtually the same, varying by a scant five days?

The intent of Eliphaz in Job is confirmed by Hab. 3:6. The mountains are described as *"everlasting"*; the hills are *"perpetual."* The Hebrew words *'ad* and *'owlam* mean "long duration," "ancient," "forever," and "continuous existence."

Does the Bible comment on the earth-age dispute? Consider Eccles. 1:10: *"Is there any thing whereof it may be said, See, this is new? it hath been already of old time, which was before us."* Could *"any thing"* include an earth, for example?

After Peter declares that false prophets and false teachers will come in the last days, he warns in 2 Pet. 3:5, *"For this they willingly are ignorant of, that by the word of God the*



Because YECs believe that the flood was universal, ... [they] claim that the Euphrates [and Hidekkel were] two different rivers with the same name! ... And though the Hiddekel and Euphrates join together today just as described in the pre-flood era, they have to be unrelated rivers or the entire YEC scenario unravels.

heavens were of old ..." Who says the earth and heavens are young? Those who are "willingly ignorant."

Where Did the Rivers Go?

Because YECs believe the flood was universal and necessarily sequenced what otherwise appears to be a chronologically-sequenced fossil record laid down over millions of years, none of the features of the antediluvian world would be found today. Whatever remnants of the rivers Euphrates and Hidekkel (Tigris) mentioned in Gen. 2:14 that might exist would be buried beneath layers of flood-laid sedimentary rock. The flood would have scrubbed the earth's landscape. Yet we find the Euphrates thirteen chapters later. When Abraham receives his covenant from God, the Lord himself cites the *"great river, the river Euphrates"* (Gen. 15:18).

Those who purport to take the Bible literally claim that the Euphrates was two different rivers with the same name! Also, if YEC explanations were true, the Hiddekel in Gen. 2:14 could not be the *"great river"* Daniel stood beside in Dan. 10:4. But wait, the Tigris today still arises out of what was once ancient Assyria just as described in Gen. 2:14. "Sorry, different rivers," according to those who call themselves biblical literalists. And though the Hiddekel and Euphrates join together today just as described in the pre-flood era, they have to be unrelated rivers or the entire YEC scenario unravels. Here is the key. The "straightforward reading" YECs call for is simply cast aside whenever it does not fit their young-earth motif.

The Great Flood

According to YEC theory, about 5,000 years ago, all of the world's animals trekked their way from Noah's Ark and the mountains of Ararat—or maybe even Mount Ararat—to their final destinations in North and South America, and islands like Australia, and Madagascar leaving no traces of ancestors along their courses of migration.

All human life, YECs believe, emanates from Noah and his three sons who must have found ways to alter their skin color, physical features, and even their underlying skeletal morphology in an extremely short period of time. Why do YECs believe this? The Bible affirms it, they say. Or as we shall see, maybe it does not.

There was no rain on the early earth, YECs will say. A "vapor canopy" surrounded the globe for over 1600 years, and fell as rain during the flood. That is their reading of Gen. 2:5–6: *"And every plant of the field before it was in the earth, and every herb of the field before it grew: for the Lord God had not caused it to rain upon the earth, and there was not a man to till the ground. But there went up a mist from the earth, and watered the whole face of the ground."*

Henry Morris argues for a vapor canopy over the early earth, and reasons:

> In the original world, however, there was no rainfall on the earth. As originally created, the earth's daily water supply came primarily from local evaporation and condensation.[12]

Morris reaches this conclusion based solely on his reading of the biblical text, deducing that rain does not come until the flood, notwithstanding that no one has discovered any place in the world where mist or fog oozes naturally out of the ground in sufficient volume to water humans, livestock, and crops. We would also be left to wonder what furnished the rivers in Gen. 2:10–14 with water. Were the Tigris and Euphrates not supplied by snow melt and rainfall as they are today?

In their *Commentary on the Old Testament*, Keil and Delitzsch explain Gen. 2:5 as follows: "The creation of the plants is not alluded to here at all, but simply the planting of the garden in Eden."[13]

The following is taken from the *Cambridge Encyclopedia of Archaeology* pertaining to ancient Mesopotamia, the land of the Tigris and Euphrates:

> This area was characterized by the very great fertility of its alluvial soil and—outside local areas of marsh and lagoon where a specialized fishing, hunting and collecting economy could have been practised—an extremely arid environment that necessitated the use of irrigation for successful agriculture.[14]

Could "an extremely arid environment" be described as a place where the *"Lord God had not caused it to rain"*? Could a *"mist from the earth"* that *"watered the whole face of the ground"* refer to a land "that necessitated the use of irrigation for successful agriculture"?

Driver suggests Gen. 2:5–6 is about irrigation. He says: "Provision made for the irrigation of the garden. The reference is implicitly to a system of canals, such as existed in Babylonia ..."[15]

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The Septuagint version of the Old Testament offers further assistance. In the Greek text, the word is not *"mist,"* but *"fountain."* The RSV uses "stream." Could part of an irrigation system be called a *"fountain"*? Could a canal be called a "stream"? At least could we agree that the words "fountain" and "stream" better describe an irrigation system than a vapor canopy? It seems *"there was not a man to till the ground"* for an uncomplicated reason. No one had irrigated the desert soil. Thus no plowing had been done, so no crops could be grown.

Mist, the Hebrew *'ed*, derives from the Accadian *edu*. *Theological Wordbook of the Old Testament* comments on this word as it appears in Gen. 2:6:

> The Akkadian *edu* refers to the annual inundation of Babylon by the Euphrates as well as to irrigation. If Eden was watered by floods and irrigation rather than rain, it may have been located in an area like southern Mesopotamia where it does not rain. Such a location would suggest that the paradisiacal situation was not worldwide but peculiar to Eden's immediate environs.[16]

The Great Flood, Global or Local?

If the flood was a Mesopotamian event, what causes YECs to believe that the flood was worldwide? It stems primarily from the King James translators who thought the same thing, and translated Hebrew into English with an erroneous preconception. Note the word "earth" in this passage:

> *And, behold, I, even I, do bring a flood of waters upon the* ***earth****, to destroy all flesh, wherein is the breath of life, from under heaven; and every thing that is in the* ***earth*** *shall die* (Gen. 6:17).

The following comes from Old Testament scholar Gleason Archer:

> ... it needs to be pointed out that the Hebrew *'eres*, translated consistently as "earth" in our English Bibles, is also the word for "land" (e.g., the *land* of Israel, the *land* of Egypt). There is another term, *tebel*, which means the whole expanse of the earth, or the earth as a whole. Nowhere does *tebel* occur in this account, but only *'eres*, in all the statements which sound quite universal in the English Bible (e.g., Gen. 7:4, 10, 17, 18, 19). Thus, Genesis 6:17c can be rendered: "Everything that is in the land shall die" – that is, in whatever geographical region is involved in the context and situation.[17]

The King James Version dates to 1611. This translation was performed without the benefit of scientific and historical knowledge gleaned over the last 390 years, and unfortunately has provoked this common misunderstanding. What the writer of Genesis understood by the word "earth" is an open question.

For us, "earth" could be thought of as synonymous with "globe" or "planet," from Gen. 1:1 to 2:4, even though this last verse is transitional and shifts focus to the immediate area where Adam was created, and the flood took place. With the possible exception of Gen. 8:22 and 9:13, from Gen. 2:5 to Gen. 12, words such as "land," "region," or "territory" fit the context better than the word *"earth."* Cain was not driven off *"the face of the earth"* (Gen. 4:14), just out of the vicinity of Eden. Clouds never cover the globe completely (Gen. 9:14), only a segment of land. The planet was not divided in Peleg's days (Gen. 10:25), simply the immediate region.

Fountains of the Deep

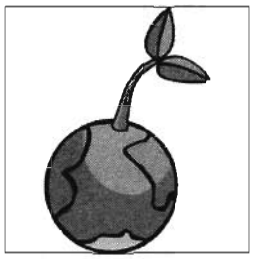
There are key words and phrases contained in the Genesis text that, properly understood, place the entire text in proper context. Gen. 7:11 says: *"In the six hundredth year of Noah's life, in the second month, the seventeenth day of the month, the same day were all the* ***fountains of the great deep*** *broken up ..."*

The phrase *"fountains of the deep"* has been a major contributor to the global flood concept. Visions of great, oceanic, water-spewing volcanoes have been conjured up to rationalize this phrase, and to account for the enormous amount of water needed for a universal deluge.

Earlier in this article, we looked at the Septuagint version where the word *"fountain"* appears rather than *"mist"* in Gen. 2:6. We saw this referred to an irrigation system in all likelihood. Here *"fountains of the great deep"* again points to irrigation. The Hebrew word for *"deep"* can mean the sea, it can refer to subterranean waters, or it can mean the depths of a river.

In the Atrahasis epic (an Assyrian flood account that parallels the Genesis flood narrative), the phrases "fountains of the deep" or "fountain of the deep" appear four times. In all instances, fountain(s) pertain to "fields," as in this example:

> *Be[low] the fountain of the deep was stopped,*
> *[that the flood rose not at the source].*
> *The field diminished [its fertility].*[18]



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The phrase "fountains of the deep" is defined by Semites, even before it appeared in the Genesis flood narrative, as overflowing rivers that caused the dams, dikes, and irrigation canals to burst open, flooding the land. [Thus] we can interpret "fountains of the deep" as a reference to the irrigation systems constructed in southern Mesopotamia ...

From the consistency in usage, we can see these were canals or levies used for irrigation. In the eleventh chapter of Gilgamesh (an Accadian flood account), the name "Ninurta" appears. He was the "lord of the wells and irrigation works."[19] So, the phrase *"fountains of the deep"* is defined by Semites, even before it appeared in the Genesis flood narrative, as overflowing rivers that caused the dams, dikes, and irrigation canals to burst open, flooding the land. With the assistance of this historical information, we can interpret *"fountains of the deep"* as a reference to the irrigation systems constructed in southern Mesopotamia, which clearly mandates a local flood.

Making Mountains out of Hills

"And the waters prevailed exceedingly upon the earth; and all the high hills, that were under the whole heaven, were covered. Fifteen cubits upward did the waters prevail; and the mountains were covered" (Gen. 7:19, 20).

Some Genesis commentators have seized on these passages to assert that the high mountains were covered to a depth of fifteen cubits (about twenty-two feet). Where the water would have come from is problematical, as well as what became of it.

As with the Hebrew word common for both earth and land, the word for "mountains" and "hills" is the same. If the flooding was restricted to the Mesopotamian plain, then the "mountains" submerged by the flood could have been the lower mountains of the surrounding region, or it may signify the lower foothills at the beginning of a mountain range.

If one is tempted to believe that the flood encompassed more than just Mesopotamia, the last phrase, *"of all that was in the dry land, died"* should provide perspective. Mesopotamia, present-day Iraq, is a desert, and a desert is a "dry land."

All and Every

"Bring forth with thee every thing that is with thee, of all flesh, both of fowl, and of cattle, and of every creeping thing that creepeth upon the earth ..." (Gen. 8:17).

It is a great temptation to take ancient Hebrew words, translate them directly into English, and then make an interpretation based upon what modern English-speaking peoples might have meant had they used such words. There are many instances where this technique will generate an erroneous result.

In Gen. 41:41,47, Pharaoh set Joseph *"over all the land of Egypt,"* and there were seven plentiful years. *"And he gathered up all the food of the seven years, which were in the land of Egypt ..."* (Gen. 41:48). All the food? The resident Egyptians ate none of it in seven years?

"And the famine was over all the face of the earth ..." (Gen. 41:56). Were the Americas similarly affected? Australia? China? *"And all countries came into Egypt to Joseph for to buy corn ..."* (Gen. 41:57). That would be a long trip for someone living in Scandinavia.

Let us use sense interpreting these verses. There were seven years of bountiful harvest followed by seven lean years. Food was stored up during the first seven years so that enough would be available for the following seven. They were so efficient that even surrounding countries could draw on their stores. It would be unreasonable to suggest that the Egyptians ate not a morsel for seven years because, *"he gathered up all the food of the seven years."* It would be senseless to think the rainfall in Peru was deficient because *"famine was all over the face of the earth,"* or that Aztec Indians lined up behind Australian Aborigines at the gates of Memphis because *"all countries came into Egypt to Joseph for to buy corn ..."* By the same token, the Genesis flood narrative does not require a worldwide catastrophe because *"all flesh died"* in it.

Another example of Hebrew terminology is found in Psalm 22. This is a psalm of David, yet a prophecy of the crucifixion: *"... they pierced my hands and my feet"* (Ps. 22:16). Matthew harkens back to David, *"the prophet,"* and quotes Ps. 22:18 in his account of the Roman soldiers casting lots for Jesus' garments (Matt. 27:35). Yet, David also wrote: *"... and all my bones are out of joint"* (Ps. 22:14).

For those who think that *"all"* in the flood narrative demands that every human and every animal died in the flood, let them explain how 206 bones can get out of joint! The word *"all"* in the flood account is entirely consistent in Hebrew usage.

Scope of the Flood

A local flood with unaffected animal survivors throughout the world gives rise as to whether there were human survivors. Realizing there were animal survivors is one more basis for acknowledging human survivors as well. It may not be as evident, but when we focus on what the Bible says, and not on what we have been told it means, we can see there were human populations living outside the flood zone.

Bernard Ramm emphasized this point:

> The flood was local to the Mesopotamian valley. The animals that came, prompted by divine instinct, were the animals of that region; they were preserved for the good of man after the flood. Man was destroyed within the boundaries of the flood; the record is mute about man in America or Africa or China.[20]

In ignorance, we could think all animals and all humans perished in the flood. In light of general revelation, we can say that some animals and some humans perished in the flood. It would be entirely inconsistent, however, to assert that only some animals died in the flood, but all humans perished.

When we focus on what the Bible says, and not on what we have been told it means, we can see there were human populations living outside the flood zone.

On the question, did Noah's flood cover the entire world? Donald Boardman answered "no," and concluded:

> There is little evidence from the Scriptures concerning how God was dealing with people in other parts of the earth. It seems logical in the light of these evidences that, in the case of the Noahic society, God was dealing with a local society and that his punishment was upon a limited number of persons at the time.[21]

Reflection on an Olive Leaf

Those who argue for a worldwide flood not only have disregarded geological evidence, they have ignored the Bible's evidence. Had the entire earth been submerged in salt water for over nine months, plant life would have perished.

Seven days after the dove returned to the ark without finding land, Noah *"sent forth the dove out of the ark,"* and when it returned, *"in her mouth was an olive leaf ..."* (Gen. 8:10-11). Could an olive tree survive over nine months covered with salt water? If one did, could it sprout leaves in a week? Or is it more sensible to believe that most of the world, including parts of Armenia from where the leaf was taken was spared the flood?

Flood Survivors

From *The Cambridge Ancient History*:

> Although the Flood was not the universal phenomenon that it has often been claimed to be, there is no doubt that it was exceptional among the long series of recorded Mesopotamian floods and that it overwhelmed parts of various cities in southern Babylonia.[22]

In *The Biblical Flood*, Davis Young concluded:

> ... archaeological investigations have established the presence of human beings in the Americas, Australia, and southeastern Asia long before the advent of the sort of Near Eastern civilization described in the Bible and thus long before the biblical deluge could have taken place. In the light of a wealth of mutually supportive evidence from a variety of disciplines and sources, it is simply no longer tenable to insist that a deluge drowned every human on the face of the globe except Noah's family.[23]

The Gen. 6:4 "giants" (*Nephilim* in Hebrew) were some manner of men with ancient origins who apparently were in residence prior to Noah, and maybe, Adam. Furthermore, they appear in later chapters. In Num. 13:33, the post-flood "sons of Anak who come of the giants" reflects back to the pre-flood period.

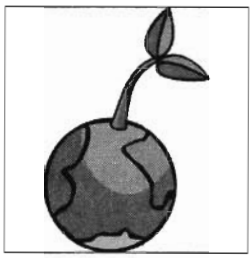
This is from *The Expositor's Bible Commentary*:

> On the face of it, the remark presents a problem to the view that only Noah and his sons survived the Flood, since it suggests that the "sons of Anak" were descendants of the "Nephilim" (*min hannepilim*, lit. "from the Nephilim") who lived before the Flood.[24]

How could Nephilim be on both sides of the flood? Because in the post-flood period they were living in what became Canaanite country, the region of Palestine, outside the flood zone.

Noah's Flood, recent in occurrence and confined to the Mesopotamian valley and its inhabitants, was retribution for sin, but as Paul states: *"Sin is not imputed when there is no law"* (Rom. 5:13b). Those civilizations outside the Adamic covenant and outside the immediate area were unaccountable and unaffected by the flood.

Bible translators had a penchant for choosing "earth" over "land," "heaven" rather than "sky," and "mountains" versus "hills." This coupled with the Hebrew usage of "all" and "every" in instances we would say "much" or "many," should give even staunch biblical literalists pause



Article

Young-Earth Creationism: A Literal Mistake

to consider that a Mesopotamian flood has been misunderstood unfortunately as a global flood.

Christians Caught in the Web

In light of the Scripture passages herein discussed, coupled with voluminous scientific data which is totally one sided, the question is: Why have so many conservative Christians adopted young-earth creationism? The answer lies in this: while YECs can be criticized for using flawed logic in this particular area, in other areas of Christian doctrine, in general, their theology is quite sound.

This is the tragic legacy of young-earth creationism: The non-Christian is handed what can appear to be a valid reason to reject the good news of Jesus Christ. And when the fallacies of young-earth creationism are finally discovered, disillusioned Christians may relinquish their faith.

This makes the poisoned pill easier to swallow for eager evangelicals, hungry for the Word, and angered by the popularity of Darwinism. The fallacy of young-earth doctrine would be easier to detect if it was not encapsulated in what is otherwise commonly accepted hermeneutics. If evangelicals cannot get a simple matter right such as the age of the earth, which can be established through an enormous amount of independent scientific discoveries and methods, then how could evangelicals be trusted on the doctrine of shed blood for the remission of sin, for example, where the corroborative, extra-biblical evidence is sparse to say the least?

Therein is the crying shame. The unbeliever remains in unbelief because the Bible is presented as unbelievable from the first chapter. This is the tragic legacy of young-earth creationism: The non-Christian is handed what can appear to be a valid reason to reject the good news of Jesus Christ. And when the fallacies of young-earth creationism are finally discovered, disillusioned Christians may relinquish their faith.

Conclusion

Essentially, YECs do violence to the clear intentions of Scripture. Their insistence on a disharmonious interpretation of Genesis with its bizarre theological and scientific consequences is damaging not only to intellectual and scientific integrity, but even to the Christian faith they claim to be defending.

On the other side of the coin, it has been argued that Genesis was not intended to be taken literally. But perhaps we have mistaken what was a telling of Semitic history (Gen. 2–11) as a narrative of human history. If that is the case, then YECs are not the only ones to have fallen into that trap. They believe it is true human history, while other Christians consider it a poetic rendition of human history, whereas it may very well be true Jewish history, and can be taken as literally as any other history book.

A Course of Action

Those of us who revere the Bible must work together to exonerate it. Labels themselves can have power and influence, and the label, "biblical literalists" for proponents of young-earth creationism is entirely inappropriate. Distortion is their game in reality, and if the term "biblical distortionism" gains popularity, it might serve as a warning label to conservative Christians.

When we encounter well-intentioned Christians attracted to the young-earth creationist movement, what should we tell them? Should we marshal up an overwhelming mountain of scientific data and evidence, and heap it on them?

We could talk about the rate at which coral can grow found on coral atolls thousands of feet in depth; overlapping tree rings showing continuous forests that are many thousands of years old; radiometric decay rates that are unique to each element, yet correlating to the same age in the billions of years; sedimentary rock miles in thickness containing not a single fossil bone indicating a long period of earth history devoid of animal life; galaxies that can be seen today billions of light years away; billions upon billions of tons of petroleum and coal in the earth's surface taking hundreds of millions of years of vegetation to produce; and much more. But YEC advocates teach their gullible followers to distrust science and the scientists who use it.

We need something better. We must show them the Book they revere. "It is good you take the Bible literally," we can say. "Let's search it together." If they wish to argue, let them argue against prophets and apostles. We have a wonderful tool to reach them, and they probably have it already in their hands. ★

Notes

[1]Dick Fischer, "The Bible Proves That Creationism Is Wrong," *The Washington Post* (August 17, 1986): C1.
[2]Duane Gish, *Evolution: The Challenge of the Fossil Record* (El Cajon: Creation-Life Publishers, 1985), 52.
[3]Charles C. Ryrie, *The Ryrie Study Bible* (Chicago: Moody Press, 1976), 7.
[4]Dick Fischer, *The Origins Solution* (Lima: Fairway Press, 1996), 161.
[5]Perry G. Phillips, "Are the Days of Genesis Longer than 24 hours? The Bible Says `Yes'!" *IBRI Research Report*, no. 40 (1991): 3.
[6]Gleason Archer, *Encyclopedia of Bible Difficulties* (Grand Rapids: The Zondervan Corporation, 1982), 61.
[7]Archer, *Encyclopedia of Bible Difficulties*, 62.
[8]Fischer, *The Origins Solution*, 160.
[9]Hugh Ross, *The Fingerprint of God* (Orange: Promise Publishing Co., 1989), 151.
[10]Henry Morris, *The Genesis Record* (San Diego: Creation-Life Publishers, 1976), 79.
[11]*Catch-22* was a classic book and film about an Army Air Corps navigator named Yossarian who sought to get out of World War II by claiming insanity. Army doctors explained that since war itself was insane, his wanting to escape it showed he was sane. Those who were truly insane were those who preferred to fight the war, but they stayed in. The only way he could prove himself insane was to stay in the war which thwarted what he was trying to do—namely get out. Thus the "catch 22."
[12]Henry Morris, *The Genesis Record* (San Diego: Creation-Life Publishers, 1976), 84.
[13]C. F. Keil, and F. Delitzsch, *Commentary on the Old Testament* (Peabody, MA: Hendrickson Publishers, 1989), 77–8.
[14]Andrew Sherratt, ed., *The Cambridge Encyclopedia of Archaeology* (New York: Crown Publishers, Inc., 1980), 113.
[15]S. R. Driver, *The Book of Genesis* (London: Methuen & Co. Ltd., 1938), 39.
[16]R. Laird Harris, Gleason J. Archer, Jr., and Bruce K. Waltke, *Theological Wordbook of the Old Testament* (Chicago: Moody Press, 1980), 38.
[17]Gleason Archer, *A Survey of Old Testament Introduction* (Chicago: Moody Press, 1974), 210.
[18]Albert T. Clay, *A Hebrew Deluge Story in Cuneiform* (New Haven: Yale University Press, 1922), 63.
[19]Knut Tallquist, *Addadische Gotterepitheta* (Helsinki: 1938), 424–6.
[20]Bernard Ramm, *The Christian View of Science and Scripture* (Grand Rapids: Wm. B. Eerdmans Publishing Co., 1954), 169.
[21]Donald Boardman, "Did Noah's Flood Cover the Entire World?" *The Genesis Debate*, ed. Ronald Youngblood (Grand Rapids: Baker Book House, 1990), 227.
[22]I. E. S. Edwards, C. J. Gadd and N. G. L. Hammond, eds., *The Cambridge Ancient History* vol. I, part 2 (Cambridge: Cambridge University Press, 1971), 243.
[23]Davis A. Young, *The Biblical Flood* (Grand Rapids: William B. Eerdmans Publishing Company, 1995), 242.
[24]Walter C. Kaiser Jr., Bruce K. Waltke and Ralph H. Alexander, eds., *The Expositor's Bible Commentary* (Grand Rapids: Zondervan Publishing House, 1990), 79.

A Call for ...

Works *in the Arts!*

Behold something new! Beginning with the 2004 issues, *Perspectives on Science and Christian Faith* is planning a new section to publish submissions that integrate art, science, and faith. Submissions must be original, previously unpublished, and can be in the form of poetry, musical score, drawings, cartoons, photography, short prose or meditative thoughts. The submissions must show some relationship between science and Christian faith.

Guidelines for submissions. Submissions must be sent to the editor with a cover letter indicating that the submission is intended for the "Art, Science, and Faith" section of the journal. All submissions must have a title. Submissions with text must be less than 200 words. Photographs and artwork must be black-and-white or grayscale. Colored artwork, photographs, or slides cannot be accepted. Three copies of each submission must be on single sheets of plain white paper; one copy must be in digital file form (Word document for text, JPG or TIFF for artwork) sent on a PC-formatted floppy disk or as an electronic mail attachment. Submissions will be peer-reviewed prior to publication.

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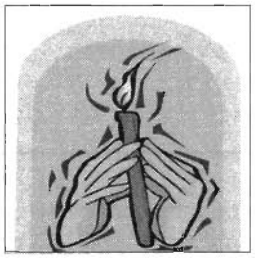
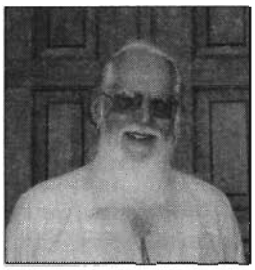


Life: An Analogy Between Views of Its Creation and Eternal Life

David F. Siemens, Jr.



David F. Siemens, Jr.

Scripture declares that eternal life is God's gift, a new creation. By analogy, one may consider primordial life and human life as his gift by act of creation. The resulting view is compared with Van Till's Robust Formational Economy and Mills' sequential insertion of new genetic information. The compatibility and connection of these three views with science and theology are analyzed. They are compared with such popular views as Intelligent Design and episodic creationion.

A vital part of Christianity is the insistence that human beings may have a new kind of life.

Life, *zoē*, which applied to animals and human beings in ancient thought, extends in scientific usage to microbes and plants. *Bios*, which commonly refers to the course of life or means of living, is basic to the broader term designating the life sciences, but does not deny the unity of life across kingdoms and phyla. *Zoē* is used in the New Testament to designate a new kind of life, eternal life. Scientific and theological views of several kinds concerning the origins and development of life may be compared and contrasted in order to evaluate various commitments current among Christians.

Eternal Life

A vital part of Christianity is the insistence that human beings may have a new kind of life. Christ stated this repeatedly: *"I tell you the truth, whoever hears my word and believes him who sent me has eternal life and will not be condemned; he has crossed over from death to life"* (John 5:24).[1]

This new life comes to us through faith, but at incomprehensible cost.[2] That the Creator should humble himself to enter his creation has been a problem for philosophers. That he should suffer death on a cross is, as Tertullian noted, beyond human invention.[3] The transformation of the believer is so great that in two of his letters, Paul calls it a new creation: *"Therefore, if anyone is in Christ, he is a new creation; the old has gone, the new has come!"* (2 Cor. 5:17).[4]

Some want to insist that the new birth or birth from above[5] is a miracle. I view it as "natural"[6] in this new creation, just as the birth of a child is natural in the creation described in the first chapters of Genesis. This transformation is a consequence of God doing something creative in the natural world, transforming the human beings who are descended from Adam into something different, having a different kind of life, yet retaining at the same time all of the old characteristics—at least for the present. There is the promise of transformation: *"Dear friends, now we are children of God, and what we will be has not yet been made known. But we know that when he appears, we shall be like him, for we shall see him as he is"* (1 John 3:2).

Human life

Now let's back up to an earlier creation, that of man and woman. What we have learned is that we possess many of the same genes as the rest of the mammals: more than 98% identity with *Pan troglodytes* (chimpanzee);

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70% with *Mus musculus* (house mouse). Indeed, many of our genes are essentially the same as those of insects and worms. Some are like those in yeast. What, then, makes us different?

We have speech, though this requires that our throats be more susceptible to choking. Other creatures can signal vocally, but cannot produce novel locutions. They also lack the conjoined time-binding and space-binding abilities we have. In other words, some can cleverly solve problems when confronted with them, but none anticipate and prepare for eventualities. But there is something even more special about human beings: they worship. Nowhere have we found any tribe that lacks some sort of religion.

Why is there this difference between Homo sapiens *and all other mammals? It may well be because God transformed a hominoid by creating in it a mind that is totally unanticipated elsewhere.*

Why is there this difference between *Homo sapiens* and all other mammals? It may well be because God transformed a hominoid by creating in it a mind[7] that is totally unanticipated elsewhere. In other words, the initiation of human life, like the initiation of eternal life, involved the direct action of God.

If one accepts this view, there is a likely parallel to the life of the new birth in the primordial pair. If we assume a baldly literal interpretation of Genesis 3, had Adam and Eve resisted temptation, at a minimum, they would not have been cut off from the tree of life. Scripture does not discuss what life and continued communion with God would have produced.

On the other hand, however one interprets the early chapters of the Bible, there is no empirical evidence for God's giving to human beings a spirit or soul or mind.[8] As one consequence of this, secular psychology views the activities traditionally ascribed to such entities as merely products of the complex organization of matter in the human brain, as well as in the simpler nervous systems of other creatures. There is disagreement about whether these activities can be described in purely physical terms, or if one needs a different set of categories for emergent properties.[9] This latter view has been described as nonreductive materialism.[10] It has also been presented in a Christian context.[11]

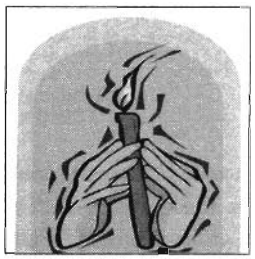
An additional difference has been noted between *Homo sapiens* and the rest of the mammals: the number of proteins produced by the set of human genes is greater than that of the others.[12] Why this should be and how it came about remains unexplained.

Life and Before Life

If we go back to another beginning, we seem to see something similar to the start of human life and of eternal life. Thus far we have not found any natural mechanism by which the nonliving can give rise to life, though various persons have speculated on possible means and others have declared the matter impossible. There is the natural synthesis of organic compounds in the terrestrial atmosphere, on the surfaces of clay and rocks, and at mid-ocean ridges with their black smokers, as well as in the nebulae from which planetary systems condense. But there seems to be a problem getting from amino acids and other compounds to self-replicating entities. I will not predict that scientists will not find the transforming event, for there are continually unexpected discoveries, like the abiotic generation of complex organic compounds and the catalytic power of RNA. Still, it appears that there may have been divine intervention to produce these effects—God may have taken the matter which had developed through physical causes and transformed it into a living creature.

The first step in this direction came with the creation of the universe. Although it is not provable, it looks to many as though the Big Bang matches *"In the beginning God created the heavens and the earth"* (Gen. 1:1) and *"By faith we understand that the universe was formed at God's command, so that what is seen was not made out of what was visible"* (Heb. 11:3). The beginning developed gradually over about 10 billion years until one small corner was ready for the introduction of life. The living things in turn, so far as we can determine scientifically, developed naturally until the vast array of plants, animals, fungi, bacteria, and viruses came into existence. God may have transformed part of the result to have a creature who could love and worship him. Then later, according to evangelical theology, he clearly transformed some of these into beings who would fellowship with him forever. At both these levels, assuming the relevance of this interpretation, what is inherent in them by God's gift developed according to their nature.

There is a peril in saying that the universe, living things, human beings, and the redeemed proceed naturally. This is liable to be understood as their having an inherent power within them so that they are independent of the deity, as the deists thought.[13] This is not my intent. As a committed theist, I contend that all that we think of as nature and natural is Providence and providential, God's maintenance of their order according to his will.[14]



The four-intervention view [specifying divine intervention to create the universe, to initiate life in the universe, to alter natural life to produce human life, and finally to transform human life] is one possibility among several that are compatible with orthodox theology and what we can learn from science.

Between the Origin of Life and Human Life

The four-intervention view just presented is one possibility among several that are compatible with orthodox theology and what we can learn from science. Howard Van Till pushes the envelope when he argues that God originally endued creation with every power needed to develop under his providential control into what we have today.[15] This Robust Formational Economy is theologically and scientifically sound. The most serious problem seems to be the origin of life, claimed by many to be too complex to have been built into the Big Bang. But that is ultimately no problem for an omniscient and omnipotent Creator without later miraculous intervention. This has been much misunderstood.[16] He has been accused of adopting a deistic view, which he explicitly rejects. But in his later thought, he seems not to recognize that God's actions are not restricted by the categories of our understanding. An omnipotent and omniscient deity can act without coercion, though many philosophers think such action requires strict determination of all human actions. This confusion, I believe, is what leads him to a flirtation with process theology.[17]

In contrast to part of the claims of a Robust Formational Economy, Gordon Mills argues that living things developed from originally created life, which was too simple to provide all of the information necessary to produce the variety found in the fossil record and today's biome. Hence, God from time to time introduced new genes into the genomes of various life forms.[18] Thus we have both the persistence of the original genome of the species plus the divine endowment which produced new species, or even higher taxa. This view provides both for the continuity of some genes from bacteria and fungi in some contemporary plants and animals, along with their modification over time, as well as for novel developments over past ages. This contrasts with Van Till's view, in which essentially no new structures are introduced from outside the genome.

I do not know of any way for science to prove from the fossil record whether a specific gene is a product of natural development or came about by divine insertion of new genetic material into an earlier genome. However, the sequencing of genomes of many species should eventually allow a determination. If Van Till is correct, then there will be a trail from bacterial genes to those of higher animals and plants. The greater number and variety of genes in the latter will have to be accounted for by mutation, duplication with later mutation, recombination, and such other processes as fit into scientifically describable processes. Such processes also account for the "junk" DNA that is not transcribed.[19] Mills' approach accounts for all of such developments as may be found, but requires further that there be some genes which could not have arisen by these processes, although they could have been modified subsequent to their introduction. Not until many more genomes have been sequenced can there be a decision between these two views.

In contrast to the possibility of a scientific resolution between Van Till and Mills, the four-intervention view is not so easily evaluated. Granted, if Mills is correct, then there are more interventions than the four. If Van Till is correct, then the creation of life is excluded, but the introduction of human and spiritual life is probably not—unless a distinct derivable gene is found only in human beings. Theoretically, a unique concatenation of such genes might also signal that human life was not a direct spiritual gift from God, but would be less obvious, more difficult to establish.

All three of these views are compatible with intelligent design in the traditional sense, the claim that divine wisdom guided the processes which began with the origin of the universe and continue today, whether explained or unexplained. However, only Mills' view is compatible with the Intelligent Design (ID) of Behe, Dembski, Johnson, Meyer, and others, which posits that what counts as designed is only that which is unexplainable apart from what would be a miracle if God is involved.[20]

Two More Popular Views

There is a yet more radical view, episodic or old earth creationism, which better fits the version of ID circulated among Christians. Common forms of old earth creationism accept the great age of the universe but hold that every new family or genus was miracu-

lously introduced into the world by divine action.[21] This view provides for geologic time but gives no explanation of genetic continuity. For example, chromosomes in *Homo sapiens* and *Mus musculus* have homologous genes and "junk" in the same order.[22] Indeed, I hold that what we observe makes God, on this view, seriously lacking in imagination. There is evidently more than one way to catalyze the reactions needed by living creatures. An intelligent designer would surely have adopted different means in order to demonstrate both his ingenuity and the discontinuity between separately created entities. Indeed, one of the problems in trying to determine what a gene does by knocking it out is that there are sometimes alternative pathways that take over. The old earth creationism approach also makes the Creator careless or sloppy, inserting silent duplications and other irrelevant DNA into genomes. There are creatures which function very well with less "junk." Additionally, this view is almost always committed to a concordist interpretation of Genesis 1 and 2 that does violence to the text, to the fossil record, and to scientific cosmology.[23] But, while I dismiss it, it appears to be the second most popular view among evangelical Christians, following young earth creationism, though the latter is incompatible with science as currently practiced.

Common forms of old earth creationism accept the great age of the universe but hold that every new family or genus was miraculously introduced into the world by divine action.[21] This view provides for geologic time but gives no explanation of genetic continuity.

Young earth creationism, also known as creation science, encompasses flood geology, for it is part of a pattern of literalistic interpretation of the first chapters of Genesis.[24] It should be obvious that the Almighty is able to produce a universe instantaneously, though on this view the question remains why he stretched the process out for 144 hours. However, any universe produced recently without deception does not look like what careful observation and theory construction finds in ours. If the universe is no more than six, or ten, or twenty thousand years old, the deity must have constructed it to mislead sincere and careful students of his handiwork. Such a lying deity is closer to Satan than one we can worship.[25]

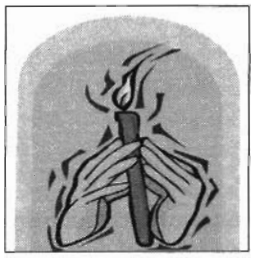
A Further Analysis

Since old earth creationism and young earth creationism, the more popular views, face grave exegetical and scientific problems,[26] we are left with three major views. Van Till's one-shot creationism speaks to the scientific matters, with the deity the unseen Creator and Sustainer of all. It does not account for the incarnation and its consequences, leaving such matters to the theologians. The four-intervention view, specifying divine intervention to create the universe, to initiate life in the universe, to alter natural life to produce human life, and finally to transform human life, attempts to cover both scientific and theological matters, though with emphasis on the latter. One or both of the middle two interventions (the production first of life and then of human life) may be omitted to produce a view of empirical matters similar to Van Till's. However, I hold that the human race has been endowed with a soul or spirit which cannot be detected scientifically, for this is required by careful exegesis. Finally, there is Mills' multiple gene intervention. It may be supplemented with the immaterial gifts of God. This is the option most likely to be falsifiable on the basis of a comprehensive knowledge of the genomes of many living things. If it is not falsified, both Van Till's Robust Formational Economy and the four-intervention interpretation become less likely.

This broad characterization of these three views allows for various subsidiary additions, such as the date of the first fully human entity and the time and location of the Flood, which have been debated in this journal. All three are currently compatible, so far as I can tell, with scientific evidence and orthodox theology, though some additions may be problematic.

More on Agreement and Difference

A further look at the context of these three views plus old earth creationism notes an area of agreement with scientific theory: the cosmological development of the Big Bang. All agree that the universe began with a singularity over ten billion years ago and that the unfolding of this original state is according to physical principles rather than direct divine intervention. They further agree that the fundamental characteristics of the universe, down to the kind of star the sun is and the distance of the earth from the sun, have to fit very narrow parameters.[27] All of this intelligent pattern, designed so that life could inhabit one small planet, is assumed to proceed under God's providential care without the need for miraculous manipulation. Yet how all this order could be inherent in the ylem, the minute undifferentiated clump from which the ordered universe sprang, is surely puzzling to any who raise the issue. There seems to be no contradiction in the atheistic claims that there may be an infinite number of other universes with different parameters. At least most of these would be incompatible with life. So the anthropic nature of a



While recognizing that the strictly natural origin of life is not impossible, though difficult, the four-intervention view argues that it did not happen, based on the analogy with a kind of life that cannot be introduced naturally. But an analogy cannot be presented as proof.

single universe, that is, the view that God specifically endued the creation with everything needed for intelligent life, seems problematic.

If God—in the act of original creation—could include that which would minutely order the universe, the galaxy, the solar system and the earth, surely he could include whatever was needed to originate life. This is the point of the Robust Formational Economy. Mills, old earth creationism, and the four-intervention view reject this possibility. Proponents of various views have argued that it is impossible for large molecules to form, certainly in the number and variety needed for life. Such arguments usually begin from the assumption of random concatenation of atoms or simple molecules. However, this assumption does not necessarily hold in all situations. Additionally, a low probability is not equivalent to impossibility. Any five-card hand in poker has a probability of one in 2,598,960. But this does not indicate that the player does not have the hand he holds.

Another tacit assumption is that primordial life must have been about as complex as the simplest life forms that have survived. One difficulty with this is that some organisms do not grow in culture with current techniques and so may not be detected. The determination of the minimum complexity of life forms may thus be problematical. Beyond this, what could have lived and reproduced in what is arguably the absence of any predation could hardly survive under current conditions.

Another obvious problem with the abiosynthesis of large molecules is that the heat or radiation which can provide energy for synthesis is more likely to break them down. This tacitly assumes that the newly synthesized molecules will remain exposed to these forces. However, one may imagine circumstances in which the new molecules would be shunted to places less inimical to their continued existence. Finally, that we have not envisioned conditions that could produce the simplest form of life does not prove that it could not have existed. In other words, we do not have proof that life could not have originated without miraculous intervention. On the other hand, we do not have proof that it could have originated through natural processes.

While recognizing that the strictly natural origin of life is not impossible, though difficult, the four-intervention view argues that it did not happen, based on the analogy with a kind of life that cannot be introduced naturally. But an analogy cannot be presented as proof.

Similar difficulties and options apply to the origin of human life. But here, if the traditional orthodox understanding is correct, an immaterial soul was given which produced human life. In Gen. 2:7, the breath of God made what he had shaped from dust alive.[28] This life was not always differentiated from the life of animals in remote antiquity.[29] Not until the intertestament period was the soul recognized as surviving death. This view permeates the New Testament. So I hold as most probable that this unification of an immaterial substance, a spirit or soul, with the organized physical substance of a body produced life. But I can understand that the very first life may have been a natural product, for the divine command was, *"Let the land produce vegetation"* (Gen. 1:11).[30] In marked contrast to this, human life was created in God's image and likeness (Gen. 1:27). Since, as noted earlier, humans share genes and chromosomal patterns with other creatures, it is reasonable to believe that God transformed a creature similar in appearance to us into a human being by a spiritual endowment. This is not something that would make a major difference in any physical structure. The change would be in behavior.[31] The claim that a soul transformed a pre-human animal into a human being is strengthened by the theological claim that the life of human beings is transformed into eternal life because God acted in history. The discovery of a human-causing gene would falsify it.

To the extent that this argument is relevant, it weakens Van Till's claim that everything from creation on proceeded naturally.[32] But the support for this argument is theological, not scientific. A disproof of Van Till on a scientific basis verges on an impossibility proof, itself close to impossible. In contrast, Mills' approach requiring more divine interventions looks more to scientific advances than to theological considerations. While he has not explicitly dealt with the origin of natural life, human life or spiritual life in the sources cited, his approach is open to theological modification.

Summary

Those who are impatient for a clear resolution will be frustrated. We do not have the evidence required to reject outright any of the three views. Indeed, though I consider the evidence against old earth creationism telling, one may still rationally hold the view by divorcing it from the concordant interpretation of the first chapters of Genesis. However, I see no benefit to this modification of old earth creationism over Mills' view, which has the clear advantage of fitting the genetic continuity which has been observed.

Some things may be said concerning potential decisions among the three views which have been the focus of this discussion. (1) The four-intervention view would be falsified by the discovery of a single gene or unique set of genes which both caused the complex of human characteristics and could be derived by normal genetic means from the genome of less-developed creatures. (2) Since it shares the notion of natural development of living things with Van Till's approach, the discovery of genes which cannot be accounted for by natural processes would falsify both. Such novel genes would instead support Mills' view. (3) In contrast, Mills' view would be rendered at least highly improbable if all genetic material were found to be interconnected across kingdoms and phyla. While this determination is in principle possible, a large number of species or genera across all higher taxa would need to be sequenced. Hence a scientific decision among these views is not yet possible. (4) Whatever future scientific work may show, two items within the four-intervention view will remain outside its scope: the substantial soul of human beings (though, as noted, this could become problematic) and the new nature granted by faith.[33] ★

Notes

[1]All Scripture is from the NIV. See also John 1:4, 12f; 3:14-18, 36; 4:14, 36; 5:40; 6:27, 40, 47, 57; 10:10, 28; 11:25 *f.*

[2]This is the clear point of the reformers *sola fide*. Whether eternal life is mediated by Word and sacraments, as Luther insisted; is granted directly, as Zwingli and moderate Anabaptists held; or comes through an intermediate or more extreme method, will not be soon settled. These and similar differences of interpretation are the basis for contemporary denominations.

[3]Tertullian, *De Carne Christi*, chap. 5; in Alexander Roberts and James Donaldson, eds., *Ante-Nicene Christian Library* (Edinburgh: T. & T. Clark, 1870), XV, 173 *f*; (Grand Rapids, MI: Wm. B. Eerdmans Publishing Company, 1961), III, 325.

[4]See Eph. 2:4-10.

[5]The term in John 3:3, 7 is *anōthen*, which is translated either "new" or "from above." I think our Lord used the ambiguous term because it is both.

[6]This must not be confused with the kind of nature studied scientifically, for it belongs to the realm of the spiritual rather than the material. There is no connection in the special use here with either metaphysical or methodological naturalism.

[7]Traditional theology argues that the soul, which is the seat of mind, is something that survives death and will be reunited with a body in the resurrection. Since the physical cannot produce an immaterial substance, the soul must be a gift from God.

[8]"Spirit" (*pneuma*) and "soul" (*psychē*) are the biblical terms. "Mind" is the philosophical term since the time of Descartes.

[9]This is argued by Walter R. Thorson, "Legitimacy and Scope of 'Naturalism' in Science: Part II: Scope for New Scientific Paradigms," *Perspectives on Science and Christian Faith* 54 (March 2002): 12-21.

[10]Non-reductive materialism is the combination of naturalism for everything physical, including the human body and soul or mind, while positing a spiritual deity. Mental phenomena, though they may require different categories of explanation, are construed as produced by cerebral activity.

[11]The most comprehensive treatment is Warren S. Brown, Nancey Murphy and H. Newton Maloney, eds., *Whatever Happened to the Soul: Scientific and Theological Portraits of Human Nature* (Minneapolis: Fortress Press, 1998). Objections have been raised by Robert A. Larmer, "Christian Anthropology: Saving the Soul?" *Philosophia Christi*, ser. 2, 2 (2000): 211-26; William Hasker, "Reply to My Friendly Critics," ibid., 200; Robert K. Garcia, "Minds sans Miracles," ibid., 239; David F. Siemens, Jr., "Thoughts on Non-Reductive Materialism: A New Heresy?" *Philosophia Christi* 4 (2002): 519-23.

[12]Francis S. Collins, "Faith and the Human Genome," *Perspectives on Science and Christian Faith* 55 (September 2003): 146.

[13]This view, without a deity, obviously characterizes philosophical materialists. It seems also to be a tendency, if not a necessity, for those accepting creation science.

[14]I have no doubt that the view presented to this point has been discussed previously, but I do not recall encountering a source.

[15]Howard J. Van Till, "4. Partnership: Science and Christian Theology as Partners in Theorizing," [and his responses to the other views] in Richard F. Carlson, ed., *Science and Christianity: Four Views* (Downers Grove, IL: InterVarsity Press, 2000), 195-234.

[16]Note his clear statement on the possibility of miracles on page 233 of "Is the Creation a 'Right Stuff' Universe?" *Perspectives on Science and Christian Faith* 54 (December 2002): 232-9. But making the introduction of life miraculous does not fit his Robust Formational Economy.

[17]While Van Till has not adopted David Ray Griffin's process theology, he said he had taken Griffin's criticism of him in *Reenchantment Without Supernaturalism: A Process Philosophy of Religion* (Ithaca, NY: Cornell University Press, 2001) seriously. Howard Van Till, "Do We Live in a Right Stuff Universe? The Roots of Design Vs. Naturalism Debate," Lecture, Grand Canyon University (November 21, 2002). In the abridgment published in *Bulletin of Canyon Institute for Advanced Study* II, no. 2 (Spring 2003), see p. 6.

[18]Gordon C. Mills, "A Theory of Theistic Evolution as an Alternative to Naturalistic Theory," *Perspectives on Science and Christian Faith* 47 (June 1995): 112-22; ——, "Possible Role of Protein Molecules in a Theory of Theistic Evolution," *Perspectives on Science and Christian Faith* 50 (June 1998): 136-9; and ——, "The Origin of Antibody Diversity," *Perspectives on Science and Christian Faith* 51 (December 1999): 254-6.

[19]I use the traditional term, "junk," even though some of these untranscribed sequences are now known to be functional.

[20]The notion of "irreducible complexity" (Michael J. Behe, *Darwin's Black Box: The Biochemical Challenge to Evolution* [New York: The Free Press, 1996], 39 *f*; 110-3 passim; William A Dembski, *Intelligent Design: The Bridge Between Science & Theology* [Downers Grove, IL: InterVarsity Press, 1999], 14 *f*, 17, 99, passim) is fundamental to ID. That the designer is usually unspecified in ID (Dembski, *Intelligent Design*, p. 109) and may be no more than a representative of a more advanced civilization makes one wonder about the theistic bona fides of this view.

[21]See, for example, Hugh Ross, *The Genesis Question: Scientific Advances and the Accuracy of Genesis* (Colorado Springs: Navpress, 1998), esp. pp. 39-43, 49, 52.

[22]Collins, "Faith and the Human Genome," Annual Meeting of the American Scientific Affiliation, August 4, 2002, responding to a question about the evidence for evolution.

[23]Paul H. Seely, "The First Four Days of Genesis in Concordist Theory and in Biblical Context," *Perspectives in Science and Christian Faith* 49 (June 1997): 85–95.

[24]Those holding young earth creationism views may extend Ussher's dates, but often present the age of the universe in terms of the biblical chronology. See, e.g., Henry Morris, ed., *Scientific Creationism*, 2d ed. (El Cajon, CA: Master Books, 1985), 227. Indeed, Morris produced a proof from population statistics that humans cannot have been reproducing for much longer than the time back to the Flood, about 4,300 years ago. See "World Population and Bible Chronology," *Creation Research Society Quarterly* 3, no. 3 (1966): 7–10. It is cited in William W. Boardman, Jr., Robert F. Koontz and Henry M. Morris, *Science and Creation* (San Diego: Creation Science Research Center, 1973), 154, 179. His formula provides a world population of about 45 during Abraham's lifetime. But he calculates it as "at least 300 million people" in Henry M. Morris, *The Genesis Record: A Scientific and Devotional Commentary on the Book of Beginnings* (San Diego: Creation-Life Publishers, 1976), 284. A similar flexibility with data is found on pages 642 *f.*

[25]Flood geology is an integral part of young earth creationism. Glenn R. Morton presents the history of one part of this view, canopy theory, at http://home.entouch.net/dmd/canopy.htm. The waters for the Flood have also been posited to come from "the great deep" (Gen. 1:7; 7:11; cf. 8:2), with the primordial surface dropping into subterranean caverns. This totally neglects the subterranean temperature. Another view has ocean water driven over the land by massive tsunamis caused by multiple comet and asteroid impacts over a brief period. Morton's home page has connections to many of the young earth creationism claims.

[26]There is another view which is essentially identical with young earth creationism in its interpretation of the first few chapters of Genesis, but without the connection to flood geology. The gap theory holds that most fossils and geological strata belong to a primordial creation which was destroyed. Genesis 1:3 *ff* records its reconstruction a few thousand years ago. Widely accepted at one time, gap theory is no longer often encountered.

[27]See, for example, Hugh Ross, *The Creator and the Cosmos: How the Greatest Scientific Discoveries of the Century Reveal God* (Colorado Springs, CO: NavPress, 1993), 111–25, 129–35.

[28]In Gen. 2:19, all the beasts and birds were also formed from dust, the same term (*aphar*) used in verse 7 for man. All living things are endowed with *ruach* (breath, spirit, wind). See Gen. 6:17; 7:15, 22. *Ruach* gave life in Ezek. 37:5–10.

[29]See Eccles. 3:19.

[30]Whether fish and birds (Gen. 1:21) involve a different level of divine involvement than terrestrial creatures (1:24 *f*) and plants may be argued on the basis of the specific language used. Claims and counterclaims cannot be resolved here.

[31]See http://home.entouch.net/dmd/mankind.htm and http://home.entouch.net/dmd/anth.htm. Morton notes that the crania will show changes over Broca's area, for example, with speech. He also documents evidence for religion in remote antiquity.

[32]This must not be pressed too strongly, though it fits his published statements, for Van Till is a theist. One may surmise that he does not explicitly refer to God's activity, except in the original creation, to avoid confusion with some variety of old earth creationism. For that matter, theistic scientists very seldom refer to divine providence in their work, though committed to Col. 1:16 *f.*

[33]My thanks to editor Roman Miller and the anonymous referees whose comments helped me sharpen and clarify this study.

Books Received and Available for Review

Contact the book review editor if you would like to review one of these books. Please choose alternate selections. Richard Ruble, Book Review Editor, *Perspectives on Science and Christian Faith*, 212 Western Hills Drive, Siloam Springs, AR 72761. ruble@tcainternet.com

Jason Bivins, *The Fracture of Good Order: Christian Antiliberalism and the Challenge to American Politics*, Univ. of NC Press, 220 pages, 2003

John Collins, *Science and Faith: Friends or Foes?* Crossway, 433 pages, 2003

George A. Erickson, *Time Traveling With Science and the Saints*, Prometheus Books, 177 pages, 2003

Wayne Grady, *The Bone Museum: Travels in the Lost Worlds of Dinosaurs and Birds*, Four Walls Eight Windows Publishers, 291 pages, 2003

Susan Haack, *Defending Science Within Reason*, Prometheus Books, 410 pages, 2003

Philip Hefner, *Technology and Human Becoming*, Fortress Press, 97 pages, 2003

D. J. Lococo, *Towards a Theology of Science*, Novalis, 80 pages, 2002

Dorothy McDougall, *The Cosmos as the Primary Sacrament: The Horizon for an Ecological Sacramental Theology*, Peter Lang, 190 pages, 2003

M. Heller, *Creative Tension: Essays on Science and Religion*, Templeton, 182 pages, 2003

Keith Miller, ed., *Perspectives on an Evolving Creation*, Eerdmans, 526 pages, 2003

Conrad Ostwalt, *Secular Steeples: Popular Culture and the Religious Imagination*, Trinity Press International, 230 pages, 2003

Ted Peters, *Science, Theology, and Ethics*, Ashgate, 350 pages, 2003

S. G. Post, *Human Nature and the Freedom of Public Religious Expression*, Notre Dame Press, 2003

S. G. Post, *Unlimited Love: Altruism, Compassion, and Service*, Templeton Foundation Press, 232 pages, 2003

Samuel Powell, *Participating in God: Creation and Trinity*, Fortress Press, 238 pages, 2003

Stuart Posenbaum, ed., *Pragmatism and Religion*, University of Illinois Press, 325 pages, 2003

Anne Primavesi, *Gaia's Gift: Earth, Ourselves and God after Copernicus*, Routledge, 150 pages, 2003

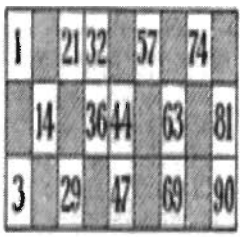
Jeffrey Pugh, *Entertaining the Triune Mystery: God, Science, and the Space Between*, Trinity Press International, 194 pages, 2003

Victor Shane, *Book of Life: God, Cosmos and Man: A New Understanding of Human Nature*, Para-Anchors International, 300 pages, 2003

Cletus Wessels, *Jesus in the New Universe Story*, Orbis Press, 240 pages, 2003

David Wilson, *Darwin's Cathedral: Evolution, Religion, and the Nature of Society*, Chicago University, 140 pages, 2002

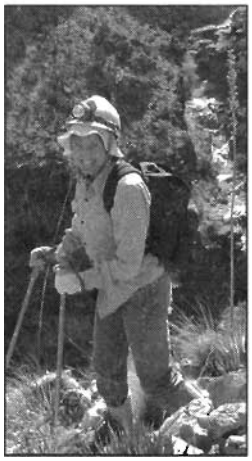
Todd Wood, *Understanding the Pattern of Life: Origin and Organization of the Species*, Broadman & Holman Publishers, 225 pages, 2003



Making Sense of the Numbers of Genesis

Carol A. Hill

Among the greatest stumbling blocks to faith in the Bible are the incredibly long ages of the patriarchs and the chronologies of Genesis 5 and 11 that seem to place the age of the Earth at about 6,000 years ago. The key to understanding the numbers in Genesis is that, in the Mesopotamian world view, numbers could have both real (numerical) and sacred (numerological or symbolic) meaning. The Mesopotamians used a sexagesimal (base 60) system of numbers, and the patriarchal ages in Genesis revolve around the sacred numbers 60 and 7. In addition to Mesopotamian sacred numbers, the preferred numbers 3, 7, 12, and 40 are used in both the Old and New Testaments. To take numbers figuratively does not mean that the Bible is not to be taken literally. It just means that the biblical writer was trying to impart a spiritual or historical truth to the text – one that surpassed the meaning of purely rational numbers.


Carol A. Hill

One of the greatest stumbling blocks to faith in the Bible has been, and is, the numbers found in Genesis—both the incredibly long ages of the patriarchs and the chronologies of Genesis 5 and 11 that seem to place the age of the Earth at about 6,000 years before present. As stated by Hugh Ross in the *Genesis Question*: "When readers encounter the long life spans in Genesis, they become convinced that the book is fictional, or legendary at best, whether in part or in whole."[1]

Apologists have attempted to explain the long ages in Genesis in various ways.

1. *Year-month-season explanation.* This theory proposes that perhaps a "year" to the people of the ancient Near East had a different meaning than it does today. Instead of being marked by the orbit of the sun, a "year" then marked the orbit of the moon (a month) or a season (three months). Among the Greeks, years were sometimes called "seasons" ("*horoi*"), and this explanation of possible one-month or three-month equivalents of a year was mentioned by the ancient authors Pliny and Augustine, among others.[2]

However, this theory is nonsensical if one looks at the "begotting" ages of the patriarchs. If the ages for Adam and Enoch are divided by twelve (1 year = 1 month), then Adam would have fathered Seth at age eleven and Enoch would have been only five when he fathered Methuselah.[3] Enoch's age (65; Gen. 5:21) divided by four (1 year = 1 season) would result in an age of sixteen, which is biologically possible. But if the same number four is divided into 500—Noah's age when his first son(s) were born (Gen. 5:32)—then the age of "begetting" would have been 125 years old, another unlikely possibility.

2. *Astronomical explanations.* Astronomical explanations also have been proposed to explain the incredibly long patriarchal ages. Perhaps the rotation period of the Earth has changed, so that the days then were not equivalent to those we have now. Or, perhaps a supernova could have damaged the Earth's ozone layer, thus increasing ultra-

Numbers [in Genesis] could have both real (numerical) and sacred (numerological or symbolic) meaning.

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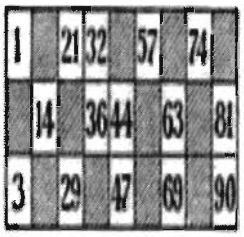


Apologists have attempted to explain the long ages in Genesis in various ways: (1) Year-month-season explanation; (2) Astronomical explanations; (3) Tribal, dynasty, or "clan" explanation; and (4) Canopy theory explanation.

violet radiation and systematically decreasing the age of humans.[4] A problem with such astronomical explanations is that there is no concrete evidence for them. Some scientists have speculated that the transfer of angular momentum from the Earth to the moon over time has resulted in an appreciable increase in the length of a day.[5] But this happened very early in Earth's history—not within the last 10,000 years or less when the patriarchs lived. Similarly, there have been no known supernova explosions within the last 10,000 years that can account for the long ages of the patriarchs and a supposed decrease in the age of humans over time.

3. *Tribal, dynasty, or "clan" explanation.* Another explanation is that, when the Bible makes a statement like "Adam was the 'father' of Seth," it means that the Adam "clan" had exercised dominion for 130 years (the age of Adam when Seth was born). In this view, Seth would be a direct-line descendent of Adam (grandson, great-grandson, etc.), but not the immediate son of Adam.[6] Then, Seth's "son" descendants would become part of the Seth dynasty or tribe. While this theory might have some merit, as will be described later in the Chronology section (p. 247), it is not in accord with the personal encounters that the "fathers" supposedly had with their "sons"; e.g., Noah was 500 years when his son(s) were born (Gen. 5:32), yet he coexisted with them on the ark (Gen. 7:13).

4. *Canopy theory explanation.* Other people have tried to explain the long ages of the patriarchs by creating a "different world" for pre-Flood humans. Whitcomb and Morris' explanation of these long ages fits with their idea of a vapor canopy.[7] Before Noah's Flood this canopy supposedly shielded Earth from harmful radiation so that people could live to a very old age. After the Flood, harmful radiation slowly increased so that the patriarchs' ages exhibit a slow and steady decline to the biblical life span of 70 years mentioned in Ps. 90:10.

The problem with the canopy theory is that there is not one shred of geologic or physical evidence to support it. In addition, there is no archaeological evidence that substantiates incredibly long ages for people in the past—either in Mesopotamia or anywhere else. It is known that humans living in the Bronze Age (which time span includes most of the patriarchs) had an average life span of about forty years, based on human skeletons and legal documents of the time.[8] If infants and children are included in this life-span average, it would be even lower. Examination of skeletons in a number of graves at al'Ubaid (one of the oldest known archaeological sites in Mesopotamia) has indicated that some people lived to be over sixty—a great age at that time.[9] A wisdom text from Emar describes the stages of a man's life as follows: forty as prime, fifty as a short time (in which case he died young), sixty as "wool" (that is, gray hair), seventy as a long time, eighty as old age, and ninety as extreme old age.[10]

How then can the great ages of the patriarchs and other problematic numbers of Genesis be explained? Does one have to construct a fantastical world based on fantastical ages in order to come up with an adequate explanation? The answer is quite simple—*if* one considers the "world view" or "mind-set" of the people living in the age of the patriarchs; that is, the Mesopotamians (the people who lived in what is now mostly Iraq) and the Hebrews in Palestine descended from the Mesopotamians. This world view includes both the religious ideas of these people and the numerical system used by them.

The Mesopotamian System of Numbers

The Mesopotamians were the first to develop writing, astronomy, mathematics (algebra and geometry), a calendar, and a system of weights and measures, accounting, and money.[11] Even as early as the Ubaid Period (~3800- 5500 BC), Mesopotamian architects were familiar with numerous geometric principles such as 1:2, 1:4, 3:5, 3:4:5 and 5:12:13 triangles for laying out buildings,[12] and by ~3000 BC scribes were working with unrealistically large and small numbers.[13] The Mesopotamians were the first to arrive at logarithms and exponents from their calculations of compound interest,[14] they knew how to solve systems of linear and quadratic equations in two or more unknowns,[15] and they calculated the value of pi (π) to an accuracy of 0.6%.[16] The so-called Pythagorean Theorem was invented by the Mesopotamians more than 1,000 years before Pythagoras lived, and was known not only for special cases, but in full generality.[17]

Sexagesimal Numbers

The mathematical texts of the Sumerians or Babylonians (people who lived in southern Mesopotamia) show that these people were regularly using a *sexagesimal* numbering system at least by Uruk time (~3100 BC). Along with the numbers sixty and ten on which their combined sexagesimal-decimal system was based, the number six was also used in a special "bi-sexagesimal system."[18] Examples of the Mesopotamian sexagesimal system are still with us today in the form of the 360° circle, with 60-minute degrees and 60-second minutes, and with respect to time, the 60-minute hour and 60-second minute. The Mesopotamians' sexagesimal basis for time is also reflected in their 360-day (60 x 6) year, where a "13th month" (called *iti dirig*) was added every sixth year to make up for the days in an actual 365-day solar year.[19] A sexagesimal (base 60) system made it possible for the Sumerians to construct a family of nicely interrelated measurement systems, with sequences of naturally occurring standard units that were easy to deal with in computation.[20]

One disadvantage of the Sumerian numbering system was ambiguity. The Sumerians wrote their system of numbers in cuneiform—a series of wedged marks impressed onto clay tablets. Although the Babylonians had developed the important principle of "position" (place-value notation) in writing numbers, the absolute value of the digits impressed on cuneiform tablets remained a matter of intelligent guesswork.[21] Another uncertainty was introduced through the fact that a blank space in a cuneiform text could sometimes mean zero (the Mesopotamians had no symbol for zero).[22] In practice, these types of ambiguities were not that serious for Mesopotamian scribes because the order of magnitude and position of the numbers could be realized from the context of the tablet (e.g., whether one was denoting rations of barley, rings of silver, or whatever). However, such contextual ambiguities could have created confusion for later Hebrew biblical scribes who were not familiar with the sexagesimal system and its peculiarities.

Despite the inherent difficulties in the Mesopotamians' sexagesimal numbering system, these are not considered to be the major problem when it comes to understanding the ages of the patriarchs. The most important consideration in this regard is the Mesopotamians' concept of sacred numbers.

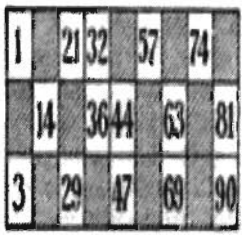
Sacred Numbers

The Mesopotamians incorporated two concepts of numbers into their world view: (1) numbers could have real values, and (2) numbers could be symbolic descriptions of the sacred. "Real" numbers were used in the everyday administrative and economic matters of accounting and commerce (receipts, loans, allotment of goods, weights and measures, etc.), construction (architecture), military affairs, and taxation. But certain numbers of the sexagesimal system, such as *sossos* (60), *neros* (600), and *saros* (3600) occupied a special place in Babylonian mathematics and astronomy.[23] In religion, the major gods of Mesopotamia were assigned numbers according to their position in the divine hierarchy. For example, Anu, the head of the Mesopotamians' pantheon of gods, was assigned sixty, the most perfect number in the hierarchy. In addition, the Mesopotamians sometimes used numbers cryptographically; e.g., names could have a corresponding numerical value. For example, during the construction of his palace at Khorsubad, Sargon II stated: "I built the circumference of the city wall 16,283 cubits, the number of my name."[24]

The sacred numbers used by the Mesopotamians gave a type of religious dignity or respect to important persons or to a literary text ... [and] fit into [their] world view of symmetry and harmony.

At least from the late third millennium BC onward, "sacred numbers" were used in religious affairs for gods, kings, or persons of high standing. Just as a name held a special significance to the ancients (e.g., Noah, Gen. 5:29)—beyond its merely being a name—a number could also have meaning in and of itself. That is, the purpose of numbers in ancient religious texts could be *numerological* rather than *numerical*.[25] Numerologically, a number's *symbolic* value was the basis and purpose for its use, not its secular value in a system of counting. One of the religious considerations of the ancients involved in numbers was to make certain that any numbering scheme worked out numerologically; i.e., that it used, and added up to, the right numbers symbolically. This is distinctively different from a secular use of numbers in which the overriding concern is that numbers add up to the correct total arithmetically. Another way of looking at it is that the sacred numbers used by the Mesopotamians gave a type of religious dignity or respect to important persons or to a literary text.

Sacred numbers also fit into the Mesopotamians' world view of symmetry and harmony, which was at the core of their meaning of life. It was important to associate one's life with the right numbers and to avoid wrong numbers that might bring disharmony (kind of like the Chinese concept of Yin and Yang). Symbolic numbers were of highest value in religious texts because they were considered to be the carriers of ultimate truth and reality. And what was



The concept of numbers has changed over time. While the Mesopotamians used a sexagesimal-based system, the Hebrews centuries later were using only a decimal-based system.

the "really big" unit to the Mesopotamians—the number around which their whole mathematical system revolved? It was the number sixty (and to a lesser degree the number ten), or some combination of these two numbers (e.g., 60÷10 = 6; 60 x 10 = 600).[26] Because sixty was considered to be the fundamental unit of the sexagesimal system, it is not surprising that it came to be thought of as sacred.

The Mesopotamian-Biblical Connection

Scholars in biblical and Mesopotamian studies have tried over the years to show the common traditions of both cultures, including the creation and flood stories and the numbers contained in Genesis. Stories from the ancient Akkadian (northern Mesopotamia) and Sumerian (southern Mesopotamia) cultures also tell of extraordinarily long life spans of important persons. This is not proof of long life spans, only that the two cultures were connected in their dual concept of sacred and secular numbers, and that people from both cultures were educated in essentially the same mathematical curriculum.[27] Similar to the Mesopotamians, the Egyptians had exaggerated "long reigns" for their gods and kings,[28] and this seems to have been a common religious tradition for peoples of the ancient Near East. A number of scholars have specifically attempted to mathematically determine a numerical connection between the long time spans in the Sumerian king lists and the long ages of the patriarchs in Genesis,[29] but despite these attempts, there still remains no absolute demonstrable relationship between the two besides a superficial similarity.[30]

What has emerged from such comparative studies, however, is that the concept of numbers has changed over time (Table 1). While the Mesopotamians used a sexagesimal-based system, the Hebrews centuries later were using only a decimal-based system.

A possible scenario for this noted change is: When Abraham left Mesopotamia (Ur) for Palestine, he and his descendants came in contact with other Semitic peoples and the Egyptians who were using the decimal system.[31] Thus, gradually the decimal system replaced the sexagesimal system in the Hebrews' numerical world view as they moved from Mesopotamia to Palestine to Egypt and back to Palestine. Certainly Moses, the author of Genesis, would have used the decimal system, having been raised and educated in Egypt, but perhaps some of the numerological elements of the Mesopotamians' world view remained in the Hebrew culture even at this time. It seems certain that a sound and really historical chronology had become established in Israel by the time of David (~900 BC), as two hundred or so chronological dates in the books of Samuel, Kings, and Chronicles are, with a few exceptions, of remarkable consistency.[32] But even then, and long after, preferred or figurative numbers continued to be used throughout both the Old and New Testaments. During the Middle Ages, the concept of "sacred" numbers was lost, and it was not until the discovery and publication of the Babylonian mathematical texts in the second quarter of the twentieth century that the numerological nature of the patriarchal ages was rediscovered.[33]

This change in the conception of numbers may be the reason for the overall general decrease of patriarchal "begetting" ages and life-spans over time (from 930 years for Adam down to 175 years for Abraham; Table 2). The tendency to use exaggerated sacred numbers decreased after the Hebrews left Mesopotamia and slowly acquired a different numerical world view in Palestine and Egypt. However, in the generally decreasing age trend, there is an enormous jump in the "begetting" age of Noah (Table 2). This may signify an attempt by the biblical writer to favor the more righteous, or those who "stand out" from the rest due to their promi-

TABLE 1: How the Concept of Numbers May Have Changed over Time

>2000 BC	~1500 BC	~1000 BC	1st Century AD	Middle Ages	2000 AD
Mesopotamia	Egypt	Palestine	Palestine	Europe	Western World
Sexagesimal, exaggerated, *sacred* numbers (60, 7); Genesis (to Abraham)	Decimal numbers Joseph-Joshua-Moses; preferred and figurative numbers (40, 12, 7, 3)	Decimal numbers Solomon-David; real numbers, but religious use of preferred numbers	Time of Christ; real numbers, use of preferred numbers waning	Real numbers only; concept of Mesopotamian sacred numbers completely lost	Cuneiform tablets found; concept of sacred numbers rediscovered

nence in the unfolding story (i.e., Noah, the hero of the Flood). Nahor, a relatively non-essential person to the story, quickly begets children and quickly leaves the world. His son Terah, however, since he is privileged to raise up so eminent a son as Abraham, is vouchsafed to rise from the low-ebb to which life-expectancy had sunk and to live much longer than his father.[34]

Preferred or Figurative Numbers

Besides the "sacred" Mesopotamian numbers in the early chapters of Genesis, the rest of the Bible uses "preferred" numbers consistent with the Hebrews' changing numerical world view. Even a cursory reading of the Bible will reveal that certain numbers are used over and over again. Among these preferred numbers are three, seven, twelve, and forty.

Three. Three is the number of emphasis in the Bible; e.g., "holy, holy, holy" signified that God was being especially hallowed. Jesus often repeated himself three times to emphasize a point, or things were done three times for emphasis. Three as a number also symbolized completeness; e.g., as when Jesus rose from the dead in 3 days, his mission was complete. Jonah was in the whale 3 days and 3 nights, in 3 days the temple will be raised, etc.

Seven. The number seven was especially sacred to the Jews because of the Sabbath, the seventh day of their week. As the last day of the week it signified wholeness, contentment, and peace.[35] It is a recurrent biblical symbol of fullness and perfection: 7 golden candlesticks, 7 spirits, 7 words of praise, 7 churches, 70 (7 x 10) nations, 70 (7 x 10) elders, forgive 70 x 7 times, Terah's age of 70 (7 x 10), Lamech's age of 777, etc.

The addition of seven to round numbers of the sexagesimal system is typical of some of the patriarchal life spans recorded in Genesis (Table 2). In the sexagesimal system, 120 (60 x 2) meant a large number or a long time; 127 (120 + 7) meant an even greater number, as in the years of Sarah's life (Gen. 23:1) or in the number of provinces ruled over by Xerxes (Ahasuerus) the king of Persia (Esther 1:1). The number seventy (7 x 10) also may not represent an exact number, but this was unimportant to the traditional way of thinking.[36] The number seventy symbolized a numerical *ideal*, not a numerical reality. Thus, in chapter 10 of Genesis seventy nations are mentioned—which number was symbolic among the Israelites for any family blessed with fertility (e.g., the 70 "sons" of Jacob who went down to Egypt in Gen. 46:27 and Exod. 1:5).

Twelve. Another number that is repeated over and over in the Bible is twelve (6 x 2). There are 12 pillars, 12 wells, 12 springs, 12 precious stones, 12 silver bowls, 12 golden spoons, 12 bullocks, rams, lambs, and goats, 12 cakes, 12 fruits, 12 pearls, 12 tribes of Israel, 12 tribes of Ishmael, 12 districts of Solomon, 12 gates of the New Jerusalem, 12 disciples of Jesus, 12,000 horsemen, 144,000 (12 x 12 x 1000) remnant of Israel, etc. Twelve was the symbol of wholeness and totality.[37]

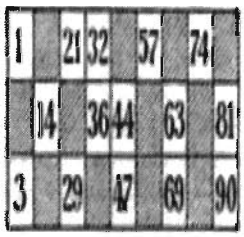
Forty. The number 40 also occurs many times in the Bible in different contexts, and it can be taken either literally or figuratively (for a long period of time). The Flood lasted 40 days and 40 nights, Moses fasted 40 days and 40 nights, Jesus fasted 40 days and 40 nights. The Israelites were in the wilderness for 40 years, Jesus was seen by his disciples after his resurrection for 40 days, Jonah preached to Nineveh for 40 days, Solomon, David, and Saul are each credited with a reign of 40 years, Goliath presented himself 40 days, etc.

Besides the "sacred" Mesopotamian numbers in the early chapters of Genesis, the rest of the Bible uses "preferred" numbers consistent with the Hebrews' changing numerical world view. ... Among these preferred numbers are three, seven, twelve, and forty.

In the case of all of these preferred numbers, which are to be considered literal and which figurative? How such symbolic numbers were meant at the time of writing is something that we may only guess at today, and if a specific principle ever underlay such figurative numbers, it is no longer readily apparent.[38] Unless we assume that God prefers certain numbers over other numbers, and somehow passed that preference down to the Hebrews, we must acknowledge that in many cases where preferred numbers are used in the Bible, they are to be taken symbolically or figuratively. Furthermore, we must acknowledge that the Jews (including Jesus) sometimes *purposely* used preferred numbers just because of their historical and/or spiritual meaning. To take a number symbolically or figuratively does not mean that the Bible is not to be taken literally. It just means that the biblical writer was trying to impart a spiritual or historical truth to the text—one that surpassed the meaning of purely rational numbers.

Long Ages of the Patriarchs

Having discussed the Mesopotamians' concept of sacred and secular numbers, with their dual numerological and numerical meanings, we can now tackle the difficult problem of the long ages of the patriarchs. By the word "patriarch," it is meant any of the biblical personages regarded as the



Article

Making Sense of the Numbers of Genesis

From Adam to Noah, all of the ages end in 0, 5, 7, 2 (5 + 7 = 12), or 9 (5 + 7 + 7 = 19) – a chance probability of one in a billion!

fathers of the human race or Israelites; that is, from Adam down to Abraham, or "the book of the history of Adam" specifically outlined in chapters 5 and 11 of Genesis. In other words, the term will be used in this paper in its general sense, not in the specific sense of Abraham, Isaac, Jacob, and Joseph.

A list of the patriarchs from Adam to Abraham, containing their ages when their first son was born, their remaining years of life, and total years, is shown in Table 2. These ages are then "deciphered" into their common components with respect to the sexagesimal (sacred) numbers of the Mesopotamians or preferred numbers of the Hebrews.

The first thing that is immediately apparent in Table 2 is that the numbers listed in the Genesis chronologies are based on the sexagesimal (60) system and can be placed into one of two groups: (1) multiples of *five*; that is, numbers exactly divisible by five, whose last digit is 5 or 0; and (2) multiples of *five* with the addition of *seven* (or two sevens).[39] The significance of the number five is that 5 years = 60 months, and combinations or multiples of 60 years + 5 years (60 months) are basic to Table 2. Note that for the 30 numbers listed for the antediluvial patriarchs up to the Flood (from Adam to Noah), *all* of the ages end in 0, 5, 7, 2 (5 + 7 = 12), or 9 (5 + 7 + 7 = 19)—*a chance probability of one in a billion!* For the entire 60-number list (antediluvial and postdiluvial), none of the ages end in 1 or 6—a chance probability of one in about one-half million. Surely, if the ages of the patriarchs in Genesis are random numbers, as would be expected for real ages, this could not be the case. *It is inconceivable that all of this should be accidental!* Undoubtedly these numbers have a special significance. What is it? Are some of these ages (that end in zero) round numbers? Are sacred ages somehow mathematically connected to the real ages of the patriarchs? Were these numbers "assigned" to the patriarchs on the basis of their character, accomplishments, or relationship with God? Or, could the ages be cryptographic (*gematria*) numbers, where numerical values were assigned to different letters of the patriarchs' names? Whatever the specific intent of the biblical writer for each of these patriarchal ages, it does seem apparent that the overall purpose of the text was to preserve the harmony of numbers.[40]

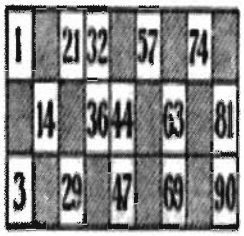
Further evidence that the patriarchal ages in Genesis are not real numbers is the "overlap" of the patriarchs' life spans. If the genealogies in Genesis 5 and 11 are both literal and complete, then the death of Adam has to be dated to the generation of Noah's father Lamech.[41] Shem, Arphaxad, Shelah, and Eber would have outlived all of the generations following as far and including Terah. Noah would have been the contemporary of Abraham for 58 years and Shem (Noah's son) would have survived Abraham by 35 years. But where does the Bible indicate that any of these men were coeval? They are spoken of as respected ancestors, not as contemporaries that interacted with them or who were to be cared for in their old age. The whole impression of the biblical narrative in Abraham's day is that the Flood was an event long since past, and that the actors in it had long passed away. Concluding that the ages for the patriarchs are literal is contrary to the spirit of the record that presupposes gaps between the lines of Adam and Noah and between Noah and Abraham.[42]

There is another problem with assuming absolute literal ages for the patriarchs in Genesis: these ages differ significantly in the Masoretic (MT), Septuagint (LXX), and Samaritan Pentateuch (SP) texts.[43] The antediluvial ages before the birth of the first son from Adam to Noah is 1,656 years in the Masoretic text, 1,307 in the Samaritan text, and 2,262 years in the Septuagint text. The postdiluvian ages before the birth of the first son in the interval between the Flood and Abraham is 292 years in the Masoretic text, 942 years in the Samaritan text, and 1,072 years in the Septuagint text. If the Bible is literally correct with respect to patriarchal ages, *which* Bible is correct? Cassuto argued that the Masoretic text was the autograph copy of the Old Testament (from which the others were modified) and thus the most reliable, and since this is the version that has made it into our Bible, it is the one that has been used in this discussion and in Table 2.[44] But this discrepancy should point out that the ages in Genesis may not have been reliably handled or transmitted over time, and thus cannot be considered inviolate from an absolutely literal point of view.

TABLE 2. Ages of Patriarchs and Corresponding Sexagesimal and Preferred Numbers

Patriarch	Age (yrs) when first son born	Sexagesimal and Preferred Numbers	Re-main-ing years of life	Sexagesimal and Preferred Numbers	Total years	Sexagesimal and Preferred Numbers
Adam	130	60x2yrs + 60x2mos	800	60x10x10mos + 60x60mos	930	60x3x5yrs(60mos) + 6x5yrs(60mos)
Seth	105	60x10x2mos + 60mos	807	60x10x10mos + 60x60mos + 7yrs	912	60x3x5yrs(60mos) + 5yrs(60mos) + 7yrs
Enosh	90	(6+6+6) x 60mos	815	60x10x10mos + 60x60mos + 60x3mos	905	60x3x5yrs(60mos) + 5yrs(60mos)
Kenan	70	7x2x5yrs(60mos)	840	60x10x10mos + 60x60mos + 60x8mos	910	60x3x5yrs(60mos) + 2x5yrs(60mos)
Mahalalel	65	60yrs + 5yrs(60mos)	830	60x10x10mos + 60x60mos + 60x6mos	895	60x3x5yrs(60mos) – 5yrs(60mos)
Jared	162	60x6x5mos + 5yrs(60mos) + 7yrs	800	60x10x10mos + 60x60mos	962	(60+60+60+6+6)x60mos – 5yrs(60mos) + 7yrs
Enoch	65	60yrs + 5yrs(60mos)	300	60x5yrs(60mos)	365	60x6yrs + 5yrs(60mos) = 1 solar year
Methuselah	187	60x3yrs + 7yrs	782	60x10x10mos + 60x60mos – 6x3yrs	969	(60+60+60+6+6)x60mos – 5yrs(60mos) + 7yrs + 7yrs
Lamech	182	60x7x5mos + 7yrs	595	60x10yrs – 5yrs(60mos)	777	7x10x10 + 7x10 +7yrs
Noah	500	60x10x10mos	450	40x2x5yrs(60mos) + 10x5yrs(60mos)	950	60x3x5yrs(60mos) + 10x5yrs(60mos)
Flood						
Shem	100	60x10x2mos	500	60x10x10mos	600	60x10yrs
Arphaxad	35	7x5yrs(60mos)	403	40x2x5yrs(60mos) + 3yrs (6x6mos)	438	40x2x5yrs(60mos) + 60x6 + 60 + 6x6mos
Shelah	30	60x6mos	403	40x2x5yrs(60mos) + 3yrs (6x6mos)	433	40x2x5yrs(60mos) + 6x(60+6)mos
Eber	34	60x6mos + 6x8mos	430	40x2x5yrs(60mos) + 6x60mos	464	40x2x5yrs(60mos) + 60yrs + 6x8mos
Peleg	30	60x6mos	209	40x5yrs(60mos) + 5yrs(60mos) + 6x8mos	239	40x5yrs(60mos) + 6x6yrs + 6x6mos
Reu	32	60x6mos + 6x4mos	207	40x5yrs(60mos) + 5yrs(60mos) + 6x4mos	239	40x5yrs(60mos) + 6x6yrs + 6x6mos
Serug	30	60x6mos	200	40x5yrs (60mos)	230	40x5yrs(60mos) + 60x6mos
Nahor	29	60x6mos – 6x2mos	119	60x2yrs – 6x2mos	148	60x10x2mos + 6x8yrs
Terah	70	7x2x5yrs(60mos)	135	60x2yrs + 60x2mos + 5yrs(60mos)	205	40x5yrs(60mos) + 5yrs(60mos)
Abraham	100	60x10x2mos	75	5yrs(60mos) x 3x5yrs(60mos)	175	60x10x2mos + 15x5yrs(60mos)

All age-numbers (30 in all) from Adam to Noah are a combination of the sacred numbers 60 (years and months) and 7. No numbers end in 1, 3, 4, 6, or 8—a chance probability of one in a billion. Thirteen numbers end in 0 (some multiple or combination of 60), 8 numbers end in 5 (5 years = 60 months), 3 numbers end in 7, 5 numbers end in 2 (5yrs + 7 yrs = 12), and 1 number ends in 9 (5yrs + 7yrs + 7yrs = 19). All of this cannot be coincidental. The Mesopotamians were using sacred numbers, not real numbers. Therefore, these numbers were not meant to be (and should not be) interpreted as real numbers.



There seems to have been an intentional attempt to impart religious harmony and prosaic beauty to [Genesis], commensurate with the style of literature and numerological concepts of that time.

Other Scripture Besides Genesis

Genesis is not the only book of the Bible where symbolic or figurative numbers are used. Figurative numbers are used throughout the Old Testament, and also (but less frequently) in the New Testament. An example of Scripture outside of Genesis where a symbolic number is used is the description of Moses when he died: *And Moses was a hundred and twenty years old when he died; his eye was not dim, nor his natural force abated* (Deut. 34:7). The number 120 (60 x 2) is first mentioned in Gen. 6:3: *yet his days shall be a hundred and twenty years*. This number has also been mentioned in a similar context in a cuneiform text found at Emar: "One hundred twenty years (are) the years of mankind – verily it is their bane." This is the only known extra-biblical parallel to Gen. 6:3. The figure 120, shared by Gen. 6:3 and the Emar text, is to be regarded as a maximal and *ideal* figure, which in the world view of that time could be reached only by extremely virtuous individuals.[45] Indeed, in the Bible there is only one person to whom this life-span was attributed – namely Moses.

Similarly, Joseph and Joshua were each recorded as dying at age 110 – a number considered "perfect" by the Egyptians. In ancient Egyptian doctrine, the phrase "he died aged 110" was actually an epitaph commemorating a life that had been lived selflessly and had resulted in outstanding social and moral benefit for others.[46] And so for both Joseph and Joshua, who came out of the Egyptian culture, quoting this age was actually a tribute to their character. But, to be described as "dying at age 110" bore no necessary relationship to the actual time of an individual's life span.

Numerical Symmetry of Scripture

There is a symmetry and regularity to Genesis that also cannot be accidental. Rather, there seems to have been an intentional attempt to impart religious harmony and prosaic beauty to the text, commensurate with the style of literature and numerological concepts of that time. For example, each genealogy presented in chapters 5 and 11 of Genesis includes ten names. Adam to Noah contains ten names and Shem to Abraham contains ten names (Table 2). To break a text into a ten-generational pattern was common for many Near Eastern people-groups of that time,[47] and reflected an overall sense of numerical importance and harmony (ten was the base of the decimal numbering system for most of these peoples, including the Egyptians and Hebrews). In addition, the description of each of these ten generations ends with a father having three sons; e.g., in Gen. 5:32, Noah begot Shem, Ham, and Japeth, and in Gen. 11:26, Terah begot Abram, Nahor, and Haran. This is likewise the case for the Cainite genealogy with Jabal, Jubal, and Zillah (Gen. 4:20–22). By ending each of these sections with three sons, an overall symmetry was established in Genesis using the preferred number three for emphasis. Thus, it appears that the symmetry of these primitive genealogies is *artificial* rather than natural.[48] This is not to say that Noah or Terah or Cain did not have three (or more) sons, or that these sons were not real historical people. It is to say that the biblical writer mentioned only these sons so that the text was made numerically symmetrical and harmonious within the overall framework of religious intent.

Numerical symmetry is contained in all of Genesis. A prime example is chapter 1, on which the Hebrew scholar Cassuto expounded in detail.[49] First, the whole chapter is based on a system of numerical harmony. Not only is the number *seven* fundamental to its main theme (God created the world in six days and rested on the seventh), but it also serves to determine many of its details. The number seven was the number of *perfection*, and thus the basis of ordered arrangement; also, particular importance was attached to it in the symbolism of numbers. It was considered a perfect period (unit of time) in which to develop an important work, the action lasting six days, and reaching its conclusion and outcome on the seventh day. It was also customary to divide the six days of work into three pairs; i.e., into two series of three days each. So, a completely harmonious account of creation, in accord with other ancient examples of similar schemes in the literature of that time, and using the rules of style in ancient epic poetry and prose of the ancient Near East, would be the parallel form of symmetry found in Genesis 1, where the first set of three days represents a general account of creation, while the second set

TABLE 3: A "Literary" Interpretation of Genesis One

Day 1. Light	**Day 2**. "Waters"; sea and heaven	**Day 3**. Earth or land; vegetation
Day 4. Luminaries (sun, moon, stars)	**Day 5**. Fish (whales) and fowl	**Day 6**. Land creatures that eat vegetation; man

Day 7. Rest

of three days is a more specific account of the first three days (Table 3).

Much debate has revolved around the Genesis 1 topics: (1) Are the days of Genesis long epochs of time or 24-hour periods? (2) How could the sun have been created on the fourth day after plants? (3) Does "each according to its kind" refer to the fixity of species? and (4) Is modern science in concordance or discordance with the "days" of Genesis 1? But if taken in the proper and intended context of literature written in the ancient Near East, there is no conflict in any of these topics. The Genesis writer was simply writing in the "politically-correct" cosmogenic and prose style of that day.[50] Does this negate the importance or truth of God's revelation in Genesis 1 to humankind? Not at all. If you were given a revelation from God, you would write it down in a style prevalent today and from your world view and cultural perspective. That is what the Hebrews did. They tried to show the highest respect for God by using the most sacred language they knew how to create—where every word and phrase was weighed scrupulously and woven together to present the most harmonious text possible. If one takes into account the literary style and numerological conceptions of the ancient Mesopotamians, then the dilemmas that arise from a literalist (literally a 24-hour day creation) or concordist (each day represents a geologic age or epoch) view disappear.

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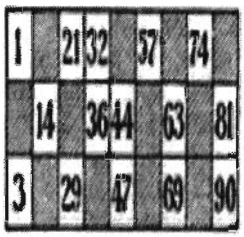
An even closer look at Genesis 1 reveals the carefully constructed and intricate harmony of the *original Masoretic Hebrew text*.[51] After the introductory verse (v. 1), the section is divided into *seven* paragraphs, each of which pertains to one of the *seven* days. Each of the *three* nouns that occur in the first verse ("God," "heavens," and "earth") are repeated throughout the chapter a multiple of *seven* times: "God" occurs 35 times (7 x 5), "earth" is found 21 (7 x 3) times, and "heavens" appears 21 (7 x 3) times. Each verse after the first contains *three* pronouncements that emphasize God's concern for humankind's welfare (*three* being the number of emphasis), namely the type phrases "Let us make man," "be fruitful and multiply," and "Behold I have given you every plant yielding seed." Thus, there is a series of *seven* corresponding dicta of triads (*threes*). The terms "light" and "day" are found *seven* times in the first paragraph, and there are *seven* references to "light" in the fourth (parallel) passage. "Water" is mentioned *seven* times in paragraphs two and three; "beasts" *seven* times in parallel paragraphs five and six; the expression "it was good" appears *seven* times—the seventh time "very good" for emphasis, etc. To suppose that all of this is a mere coincidence is not possible—the text was *purposely* constructed this way using preferred numbers and prosaic symmetry.

We find the same kind of symmetry and symbolism in other chapters of Genesis in the original Masoretic Hebrew text. Some examples that show the numerical "tightness" and regularity of the text are: in Gen. 2, Adam is mentioned 28 (7 x 4) times; in Gen. 4:15, vengeance shall be taken on him (Cain) *sevenfold*; in Gen. 4:24, Lamech shall be avenged *seventy and sevenfold*; the names listed in Cain's family, counting from Adam to Naamah are 14 (7 x 2); and Cain's name is mentioned 14 (7 x 2) times. In the story of Noah and the Flood in chapters 6–9, there is also a numerical symmetry and parallelism to the text.[52] The number *seven* is used repeatedly; *seven* days (Gen. 7:4, 10; 8:10, 12), *seven* pairs of clean animals and birds (Gen. 7:2–3); the number of times that God spoke to Noah was exactly *seven*. Repetitions (such as the "waters prevailed and increased"; Gen. 7:17, 18, 19, 20, 24) are included for the sake of parallelism in accordance with the customary stylistic convention of the time. Noah's age of 600 (60 x 10) was considered to be a perfect number in the sexagesimal system, and was symbolic of Noah's perfection as a person (Gen. 6:9). The size of the ark was 300 (60 x 5) cubits by 50 (10 x 5) cubits by 30 (6 x 5) cubits—numbers that also probably should be taken symbolically (numerologically) rather than literally.

Biblical Genealogies and Chronology

Can the biblical genealogies in Genesis chapters 5 and 11 be used as a chronological time scale to determine the date for Adam and Eve and thus the creation of the world? There have been a number of attempts to do just this. One of the first attempts was that of Jose Ben Halafta in the second century AD, who calculated that Adam was created in 3761 BC.[53] This date of ~3760 BC has become part of ortho-



Article

Making Sense of the Numbers of Genesis

Since a number of names are known to have been omitted from biblical genealogies, it is logical to conclude that these genealogies should be used in a wide sense to indicate overall descent ("X fathered the line culminating in Y") rather than a direct father-to-son relationship ("X fathered Y").

dox Jewish tradition and is the basis for the Jewish calendar. Most famous of these "literal" chronologies, and the one most cited, is Bishop Ussher's 1654 date for the creation of the world in 4004 BC. The results of these (and other) dates vary partly because the data itself is not consistent, partly because the three earliest manuscripts of the Old Testament (Masoretic, Samaritan, and Septuagint) contain different numbers for the patriarchal ages, and partly because the historical benchmarks chosen to relate the dates to the Christian era differ.[54]

Condensed Genealogies

The matter of obtaining creation dates from the patriarchal ages is not that simple if one looks carefully at the whole genealogical record of the Bible. Genealogies in the Bible are frequently abbreviated by the omission of unimportant names.[55] In fact, abridgment was the general rule for biblical writers who did not want to encumber their texts with more names than necessary for their intended purpose. Numerous examples of abridgment exist, the most notable example being the genealogy of our Lord in Matthew 1; e.g., in verse 8, three names are dropped since Uzziah was not the son but the great-great grandson of Joram. Another example is Exod. 6:16–24, where it seems that Moses (and Aaron) are the grandsons of Kohath, son of Levi. Kohath was born before the descent into Egypt (Gen. 46:11), and the abode of the children of Israel in Egypt continued 430 years (Exod. 12:40, 41). Now, as Moses was 80 years old at the time of the Exodus (Exod. 7:7), he must have been born more than 350 years after Kohath, who consequently could not have been his grandfather. The tradition of breaking down genealogical lists into a ten-generational pattern also suggests that only the most important persons in longer lists were retained.

Since a number of names are known to have been omitted from biblical genealogies, it is logical to conclude that these genealogies should be used in a wide sense to indicate overall descent ("X fathered the line culminating in Y") rather than a direct father-to-son relationship ("X fathered Y"). And the fact that each member of a series is said to have "begotten" the next succeeding member is not evidence in itself that some genealogical links have not been omitted.

Different Degrees of "Begot" and Gaps in the Record

Descent indicated by the word "begot" (or "beget") in the Bible is not always from biological father to son or even along the son line. For example, in the line of the "sons" of Kohath, the third, fourth, and fifth names represent brothers, not sons, as shown by comparing Exod. 6:24 with 1 Chron. 6:36–37. Also, a comparison of 1 Chron. 1:36 with Gen. 36:11, 12 shows that the "seven sons of Epiphaz" are really six sons, and the sixth "son" was Epiphaz' concubine, who was the mother of his seventh son.[56] Sometimes "begot" does not even apply to people. It can also refer to geography (e.g., Elishah, Tarshish; Gen. 10:4 and 1 Chron. 1:2), to cities (e.g., Sidon; Gen. 10:15), to people groups or tribes (e.g., Kittim and Dodanim; Gen. 10:4 and 1 Chron. 1:17), and even to nations (e.g.,Canaan, the grandson of Noah is said to have begotten the Jebusites, Amorites, etc.; Gen. 10:16–18).

These gaps in people, and the flexibility of the word "begot," must be considered in the interpretation of the stated ages of the patriarchs. When it is said, for example, in Gen. 5:9: *And Enosh lived ninety years, and begot Kenan*, how do we know that "begot" means that Kenan was the immediate son of Enosh or if he was in the descendent line of Enosh? Perhaps Enosh was ninety years old when his grandson Kenan or great-grandson Kenan was born.

Correlation of Genesis Chronologies with "Real" Time

If the patriarchal ages are considered to be literal and complete, then one can approximate the length of time back to Adam. Archaeological and geologic evidence places Abraham at ~2000 BC.[57] If 2,000 years is added to the total of 2,046 years from Adam to Abraham (Masoretic text), then these dates add up to about 4000 BC, or ~6,000 years before the present (YBP). And, if one also assumes that the dates in Genesis 1 are literal 24-hour days, then this also places the creation of the Earth and universe at about 6,000 years ago—a basic tenant of Young-Earth Creationism.

However, not only does this date of ~6000 YBP contradict astronomical evidence (that places the age of the universe at 13.7

billion years) and geological evidence (that places the age of the Earth at 4.6 billion years), it also does not fit with archaeological evidence from the Near East. It is known that Egyptian and Babylonian civilizations were highly developed *before* 4000 BC, and that Ubaid culture (the first civilization that has been discovered in Mesopotamia) is as old as ~5500 BC. However, if there are "missing links" or "gaps" in these genealogies, as has been discussed above, perhaps these dates can be pushed back further in time.

Green concluded from his in-depth study of Genesis that the genealogies in chapters 5 and 11 were not intended to be used – and cannot properly be used – for the construction of a chronology on an absolute time scale.

The question is: How far back in time can biblical genealogies be stretched, assuming that legitimate gaps exist in the record? Some people have suggested that Adam may have been a hominid created some two or more million years ago,[58] while others have sought a "mitochondrial Eve" or "Y-Chromosome Adam" who lived ~40,000–200,000 years ago in Africa.[59] While recognizing that there may be gaps in the biblical record, is it reasonable to push the date for Adam and Eve back tens of thousands to hundreds of thousands to millions of years? The gap from Kohath to Amram to Aaron and Moses (Exod. 6:20) is a mere 300 years, not 3,000 or 30,000 or 300,000 or 3 million years. Matthew's (1:8) gap is limited to just three kingly generations comprising a total of only 70 years, not 700 or 7,000 or 70,000 years! The known gaps can push biblical chronology back at least several hundred years and up to one thousand years or so at the most.[60]

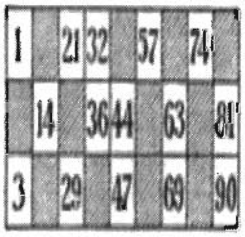
The Bible itself seems to constrain how far the genealogies in Genesis can be stretched. According to Gen. 4:2: *Abel was a keeper of sheep, but Cain was a tiller of the ground.* Archaeology has revealed that both agriculture and husbandry (domestication of animals including sheep) originated in the Middle East at about 10,000 YBP.[61] If this is true, then Cain and Abel must have lived sometime after 10,000 years ago. Archaeologists also know that people first began to live in cities in the Middle East during the fourth millennium BC,[62] and this places Cain and Abel at around 4000 BC (or later), since the Bible claims that Cain went out from Eden and established a city (Gen. 4:17). Also, the "Professions list" of Gen. 4:19–22 places the descendants of Cain (Jabal, Jubal, and Tubal-cain) somewhere in the time frame of about 3300–3100 BC.[63] So even if there were some gaps between Adam and these descendants, surely the Bible does not imply that the gaps amounted to thousands or to millions of years!

From the above discussion, it appears that the biblical chronologies based on the patriarchal ages roughly correlate with the archaeological record of the Middle East. Therefore the question can be asked: Do the patriarchal ages hold some significance to real time? Perhaps the biblical writers had an approximate idea of how much real (secular) time had elapsed between Adam and Noah and between the Flood and their day and thus constructed the chronologies to fit into this overall real-time frame, all the while maintaining a sacred-numbers literary style. Following this hypothesis let us speculate that the biblical writer(s) allowed for approximately 2,000 years between Adam and Abraham, with Noah and the Flood being the most important person and event in the story line. Also let us hypothesize that, for an average "begetting" age of 40, there would have been a total of fifty generations in the genealogical line from Adam to Abraham. This would then imply that thirty generations of less-important people were excluded from the record, while only the twenty most important people in the two 10-generation schemes were included in the direct line from Adam to Abraham. Sacred ages were then ascribed to these people that befit their relative importance in the story line; e.g., Noah was 600 years (60 x 10 = a perfect number) when the Flood started. This idea is a variation on the "dynasty" or "clan" explanation described at the beginning of this paper, but allows for the interaction of persons in the narrative. For example, the sons of Noah would have been his real sons – interacting with him on the ark – but the 500-year age of Noah when his sons were born only indicated Noah's relative prominence in a story line containing many genealogical "gaps" in the "clan" line between Adam and Noah.

What then is to be made of the Genesis chronologies? Green concluded from his in-depth study of Genesis that the genealogies in chapters 5 and 11 were not intended to be used – and cannot properly be used – for the construction of a chronology on an absolute time scale.[64] To do so would be a fundamental mistake. It is putting the chronologies to a purpose for which they were not designed to serve, and for which the biblical writers did not intend. Biblical genealogies were intended to confirm a specific line of descent for the Jews in the Old Testament, from Adam down to Jesus in the New Testament.

Conclusion

The fact that the numbers in Genesis may have been "contrived" or "intentional" rather than "real" is difficult for many people to accept. Does this compromise the integrity of the Bible and mean that the Bible cannot be trusted? Does it mean that it cannot be taken "literally"? No, it means only that the text must be approached from the



Ironically, by interpreting the numbers of Genesis "literally" Christians have created a mythological world that does not fit with the historical or scientific record. ... [It] has caused millions of people to reject the Bible and the truths contained therein.

culture of the people who wrote it. We have to try and "get into the minds" of these ancient people and understand what made them tick—just like modern missionaries must try and understand the world view of the people they are trying to evangelize. In the case of Genesis, we must try to understand the text from the world view of the ancient Near East of ~2000 BC, not from the world view of the early 1600s AD (King James) Europe or the scientific world view of the twentieth through twenty-first centuries. Peoples of the ancient Near East simply did not think along the same lines, or express themselves in the same manner, as the European races.[65]

The important question to ask is: Is Genesis, and the record of the patriarchs from Adam to Abraham, to be considered mythological or historical? Ironically, by interpreting the numbers of Genesis "literally" Christians have created a mythological world that does not fit with the historical or scientific record. Or as Hyers aptly put it: "unwittingly, 'literal' or 'concordist' views are secular rather than sacred interpretations of the text."[66] The "literal" (or numerical) view is secular while the "symbolic" (or numerological) view is sacred because that is how the original biblical author(s) intended for it to be. To faithfully interpret Genesis is to be faithful to what it really means as it was written, not to what people living in a later age assume or desire it to be. It is also ironic that the mythological world created by many well-intentioned and serious "literal" Christians, based partly on the numbers in Genesis, has caused millions of people to reject the Bible and the truths contained therein. ★

Acknowledgments

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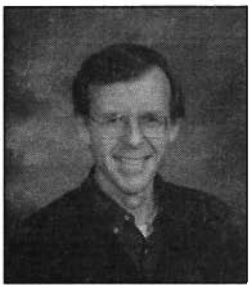
The GISP2 Ice Core: Ultimate Proof that Noah's Flood Was Not Global

Paul H. Seely



Paul H. Seely

Recently an ice core nearly two miles long has been extracted from the Greenland ice sheet. The first 110,000 annual layers of snow in that ice core (GISP2) have been visually counted and corroborated by two to three different and independent methods as well as by correlation with volcanic eruptions and other datable events. Since the ice sheet would have floated away in the event of a global flood, the ice core is strong evidence that there was no global flood any time in the last 110,000 years.

The latest and greatest [Greenland ice cores] are GRIP (Greenland Ice Project) and GISP2 (Greenland Ice Sheet Project 2) ...

There is an ice sheet nearly two miles deep covering most of Greenland. Each year snow accumulates on it and presses the layers of snow below into thinner layers and into ice. Drilling rigs can cut down through the ice and bring up a continuous record of the ice as cores in segments three to eighteen feet long and three to five inches in diameter (5" for GISP2).[1]

There are a dozen or so important Greenland ice cores, but the latest and greatest are GRIP (Greenland Ice Project) and GISP2 (Greenland Ice Sheet Project 2), which were extracted at the Summit where the ice rarely melts. GRIP was dated by counting back annual layers from the surface to c. 14,500 BP (before the present, dated 1950) using electrical conductivity method (ECM, see below) and the rest of the ice core was dated on the basis of flow modeling and chemical techniques.[2] GISP2 was dated by visually counting annual hoar frost layers back to c. 12,000 BP and from 12,000 to 110,000 BP by visually counting annual dust layers.

Back to 12,000 BP, this counting was validated by a *very* close agreement of three independent methods of counting the annual layers. From 12,000 BP back to 40,000 BP, the counting was validated by a *very* close agreement of two independent methods of counting the annual layers, and from 40,000 BP back to 110,000 BP by a close agreement of two independent methods. Also, despite the different methods used for dating GRIP and GISP2, there is "excellent agreement" between them (and with deep sea cores as well); so the cores corroborate each other.[3]

Mainstream creation science writers are in agreement that the Greenland ice sheet could not have been deposited before a global flood because the supposed climate of the pre-Flood world was too warm to allow the build-up of an ice sheet. They also believe that even if an ice sheet had built up, the water of a global flood would have caused the ice sheet to rise, break up, float away, and melt.[4] So the annual layers in the GISP2 ice core reflect the years *since* the Flood according to creationist theory. This means that if the dating of the GISP2 ice core is valid and there was a global flood, it must have occurred at least 40,000 years ago and probably more than 110,000 years ago. Yet even 40,000 years ago does not at all fit the biblical indications for the date of Noah's Flood, which cannot be dated earlier than around 6000 BC (8000 BP).[5] If the dating of the GISP2 ice core is valid, it falsifies the theory that Noah's flood was a global flood.

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It should also be noted that if there was an ice sheet before the Flood and it did not float away, Gen 7:19–8:4 virtually demands that it was covered by the ocean. If this had happened, the core would show an extra-large melt layer sometime in the past with saline marine residues, but there is no such layer. And if the ocean contained all the earth materials which creation science theorists attribute to it at the time of the Flood, there would also be a silt deposit of some kind in the core, but there is none.

The 110,000 regular annual layers of fresh-water ice in the GISP2 ice core falsify the theory of a global Flood in the time of Noah.

If one supposes the rather unbiblical scenario that the ice sheet existed before the Flood but neither floated away nor was covered by the ocean, the extraordinary amounts of precipitation at the time of the Flood (Gen 7:4, 12) would cause the ice core to have either an extra-large melt layer from rain as well as ice pipes, lenses, glands, and such in the snow above or an extra-large annual layer of snow sometime in the past, probably in the last 8,000 years, but it does not. If the Flood lifted such an ice sheet, it probably would have floated away, but if by some chance the Flood set it back down, ocean currents would have kept it from coming back down exactly in its former place with the shape of the bottom of the ice sheet exactly matching the complex topographic shape of the Greenland bedrock—as it now does. In addition, the sloping parts of the ice sheet would have produced a unique "marine" ice that is found under ice shelves but has never been found under a grounded ice sheet and is not under the Greenland ice sheet.[6]

We can see then that on any possible scenario, without any need to appeal to radiometric dating, the 110,000 regular annual layers of fresh-water ice in the GISP2 ice core falsify the theory of a global Flood in the time of Noah. The only critical question is: How do we know the layers being counted are really annual? The answer to this question is three-fold and more.

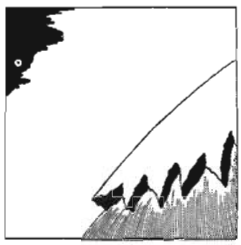
Ice Crystals Vary from Summer to Winter

The first way we know the top 12,000 layers are annual is because the snow that falls in the summer in Greenland is affected by the sun (which only shines in the summer) in such a way that its crystals become much more coarse-grained than winter snow. At the GISP2 site, on the summit of the ice cap, the temperature only warms up enough to melt the ice about once in a couple of centuries.[7] But, the annual summer sun regularly heats the first inch of snow during the day with the result that much of it evaporates, leaving it light and airy. Then during the summer nights the snow surface and the air just above it cool and form fog. The fog in turn condenses as frost on the surface of the snow. The result of this daily warming, cooling, and frost-forming is that an inch of fine-grained high density snow becomes two inches of coarse-grained low density snow called *hoar*.[8]

This process of warming, cooling, and frost-forming does not occur in the winter because the sun does not shine at all in Greenland during the winter. Hence the fine-grained high density snow which falls in the winter remains fine-grained high density snow.[9] The difference between the summer and winter snow is easily seen by leaving marked poles in the snow at the end of the summer, coming back the next summer, and digging pits in the snow deep enough to see how the new winter snow varies from the older summer snow (not only over the last year but over several earlier years as well). The summer snow appears as light bands, while the winter snow shows up as homogeneous darker-appearing snow, and this same alternation of light and dark snow is seen in the ice core.[10]

In the ice core, at about 200 feet down, compression results in the large crystals of the summer snow being less prominent than the large air bubbles which have been trapped inside them. When one shines a light through the ice core, the coarse crystals of the summer snow or their large air bubbles show up as light bands which alternate with the darker finer crystals of the winter snow. These bands can be counted by eye and dated throughout the Holocene period and into the interglacial, that is, back to c. 12,000 BP albeit the large air bubbles from c. 8000 BP slowly become too compressed to be seen when the core is first removed, and researchers must wait for them to become depressurized (this takes about a year) before they can be seen and counted.

About the same time as the air bubbles begin to disappear (c. 8000 BP) due to being under such great pressure from the ice above, the dust in the summer layers slowly begins to become more prominent. So, for a while both dust layers and hoar layers are counted. Then, as the large air bubbles disappear altogether, the dust layers alone are counted. After the large air bubbles in the summer layer reappear, they are counted as well, giving a double visual read on the annual layers back to c. 12,000 BP. In the Holocene (back to c. 11,500 BP) the count of the re-emerged large air bubbles agrees very closely (better than 98%) with the dust layer count, and the dust layers are independent of the hoar frost and its bubbles; so they corroborate the hoar frost/air bubble count. From c. 12,000 BP to 110,000 BP, it is the dust layers rather than the hoar frost layers that are visually counted. These dust layers eventually become so



The three main methods of [dating are the] visual counting of hoar frost (back to 12,000 BP) and dust (back to 110,000 BP), laser light scattering, and the electrical conductivity method.

prominent they can be counted by eye from across the room.[11]

Dust Concentrations Vary Seasonally

Another way to distinguish the annual layers is to note the dust concentrations. In the late winter/early spring when the wind is stronger than usual, significantly more dust (insoluble matter of various kinds) is carried in the air—even from the Southern hemisphere and Asia—and is deposited in the layers of snow in Greenland. Although large influxes of dust can occur at other times than during the late winter/early spring, a number of studies have shown that there is usually a clear and decided difference in the amount of dust in the late winter/early spring layers compared to the rest of the year.[12]

Although there are several ways to measure the amount of dust in the layers of an ice core, 90° laser light scattering (LLS) is the most rapid and effective way to measure it.[13] Ram and Koenig found that using this method on ice meltwater from the top 1800 meters of the GISP2 ice core down (I estimate around 16,500 annual layers down) showed "clear, sharp, seasonal dust peaks."[14] In the lower half of GISP2 (1,678 meters to the bottom) where the dust is more concentrated, Ram and Koenig could scatter the laser light directly off the ice without having to melt it—and could do this mechanically one mm at a time—and feed the data directly into a computer. The readout showed the seasonal variations as a series of peaks and valleys. In this way, they were able to date the ice down to 2,849 meters at around 127,600 BP.

At c. 2,464 meters down, their dating of the volcanic ash found there (57,300 ± 1700 BP) agrees very closely with the Z2 layer of volcanic ash found in Atlantic sea cores which is dated 57,500 ± 1300 BP. At 2,808 meters down, their dating was c. 115,000 BP which was in essential agreement with the independent gas-age dating of c. 111,000 BP for that level.[15] Although the ice below 2,850 meters may be disturbed, Ram and Koenig continued measuring via LLS both with 1 mm and some 0.5 mm steps; and, this yielded an estimated age for the ice at the silty ice boundary of "at least 250,000 BP."

Electrical Conductivity Varies from Summer to Winter

The third way annual layers can be distinguished is via the electrical conductivity of the layers.[16] In the spring and summer when the sun is shining, nitric acid is produced in the stratosphere and enters the snow, but this does not happen in the winter.[17] The acid in the spring/summer layer enables an electrical current to easily flow through that layer, but the relative lack of acid in the winter layer allows much less electricity to flow through that layer. So, as two electrodes mechanically run down the ice core the readout (mm by mm) of the resultant flows of electricity shows the successive years as a series of peaks (summer) and valleys (winter).

Thus the electrical conductivity method (ECM) is an excellent indicator of annual layers, though there can be occasional peaks of acidity from other sources, primarily volcanoes. Peaks from volcanoes, however, are relatively rare and are easily distinguished from the regular summer peaks because they are much higher and because, in the Greenland ice cores, the acid is sulfuric rather than nitric from the spring/summer stratosphere.

The ^{18}Oxygen/^{16}Oxygen Ratio Varies from Summer to Winter

One of the older methods for dating ice cores is to use a mass spectrometer to identify the summer vs. the winter layers in the ice. The mass spectrometer can measure the ratio of the heavier oxygen isotopes (^{18}O) to the lighter oxygen isotopes (^{16}O). Because water containing the lighter isotope evaporates preferentially from the ocean (it is even more efficiently separated from the ocean water when temperatures are low), winter snow contains more of the lighter isotope than does summer snow. As each pair of summer and winter snow layers are identified they equal one year, so they can be used to date the ice core.[18] This neat difference can be disturbed somewhat if summer and winter snow layers are mixed by wind, but Greenland ice cores seem to be relatively immune to this problem.

More importantly, because in most of Greenland the annual seasonal variations of the ratio are obliterated by diffusion of the oxygen in ice older than 10,000 years, this method is usually only good for dating the most recent ten thousand years or so of the Greenland ice cores.[19] It was a major dating method for dating the Dye 3 core back to c. 10,000 BP[20] but was only used back c. 1100 years (300 meters) in the GISP2 core and only as a secondary method corroborating the three main methods of visual counting of hoar frost (back to 12,000 BP) and dust (back to 110,000 BP), laser light scattering, and the electrical conductivity method.[21]

In addition to the agreement of the three main methods of dating, the years are correlated as far as possible with volcanic events which can be dated.

It is to a large extent the correlation and corroborating testimony of these three main methods of counting the annual layers in the GISP2 core which guarantees the validity of the ice core dating.[22] The three methods have excellent correlation with each other down to 2500 m, that is, back to c. 57,000 BP.[23] In the upper 2300 m (down to c. 40,000 BP) the correspondence of the three methods has been called "remarkable."[24] As Ram and Illing said of the LLS method:

> When combined with visual stratigraphy and ECM, the distinct annual spring/summer dust peaks we observe can be used to date the core with tree-ring-like precision.[25]

In addition to the agreement of the three main methods of dating, the years are correlated as far as possible with volcanic events which can be dated. The Icelandic volcano Laki had an enormous eruption in 1783/1784. On the GISP2 ice core, a large acid peak via ECM was found at the level visually counted to be 1785; and, volcanic glass found at that level in the ice core matched the volcanic glass from Laki. A high reading of sulfuric acid was also found in the GISP2 core at 1623 BC (3573 BP) which correlates very well with the tree-ring dates of 1625 and 1628 BC for the Santorini eruption.[26]

Reaching back even further, in addition to sulfuric acid peaks, tephra has been found in both the GRIP and GISP2 ice cores which matches the composition of tephra from particular volcanic eruptions around 10,300 BP and 52,700 BP. Zielinski, et al. comment:

> Tephra has been found in both cores with a composition similar to that originating from the Vatnaöldur Icelandic eruption that produced the Settlement layer in Iceland (mid-AD 870s), from the Icelandic eruption that produced the Saksunarvatn ash (~10,300 years ago), and from the Icelandic eruption(s) that produced the Z2 ash zone in North Atlantic marine cores (~52,700 years ago). The presence of these layers provides absolute time lines for correlation between the two cores and for correlation with proxy records from marine sediment cores and terrestrial deposits containing these same tephras.[27]

The cross correlations of the varied independent methods of counting annual layers plus the correlations with known volcanic events show that for the first 11,500 BP, the layer counting is correct to within 1% over century length times and from 11,500 BP down to c. 50,000 BP within 5% over millennial or longer intervals.[28] From 50,000 BP down to 110,000 BP, the accuracy is within about 10% to 20%.[29] As one goes deeper down the ice core, the layers become more narrow and harder and harder to separate; and the movement of the ice distorts the layers. Nevertheless, even though accuracy beyond the 110,000 year level is uncertain, there is reason to believe the ice cores from Summit, Greenland are c. 250,000 years old at the bottom.

Creation Science and Ice Cores

Larry Vardiman, who teaches at the Institute for Creation Research, has written three papers on ice cores primarily with reference to the age of the earth. In his 1992 paper, he considered the ice core at Camp Century near the northern tip of Greenland.[30] He admitted that "it is relatively easy to count annual layers downward from the surface through considerable depths in the Greenland ice sheet" but said an age of 6,000 years which he had roughly calculated for the age of the ice sheet is "in relatively good agreement with the number of annual oscillations currently observed in Greenland cores." This was an optimistic stretch of the dating of the ice sheet even at that time, and now the 110,000 annual oscillations counted in the GISP2 core completely invalidate an age of just 6,000 years for the ice sheet.

In his 1992 paper, Vardiman also considered the Vostok ice core of Antarctica which could not be dated by counting the annual layers because they are too thin, so it was dated partly by an ice flow model and partly by measuring the $^{18}O/^{16}O$ ratio at intervals down the core. Since this method of dating is less exact and dependent upon a model as opposed to the direct methods used on the GISP2 core, Vardiman had room to speculate that it might not be accurate.

Vardiman's second paper in 1994 presented a young-earth ice flow model to take the place of the model that was being used at that time to help date the ice sheets.[31] He had heard about the counting of 14,500 annual layers in

Vardiman's three papers do not provide any scientific data which would falsify the fact that some 110,000 annual layers have been counted in the GISP2 core, the first 40,000 of which are strongly validated by the consistent agreement of two different and independent methods of determining annual layers (LLS and ECM).

the GRIP ice core, awaited publication of the raw data, and in his conclusion accepted the possibility that Aardsma might be right about dating the Flood 14,000 years ago.[32] It is to Vardiman's credit that he took the counting of the annual layers in the GRIP core seriously and never attempted to deny their validity on the basis of a mere hypothesis. Now that the annual layers counted in the GISP2 core by methods not dependent on ice flow modeling indisputably push the date of the Flood back at least 40,000 years and probably more than 110,000 years, even a date of 12,000 BC for the Flood is falsified.

In his 1997 paper, Vardiman presented a young-earth scenario to explain why $^{18}O/^{16}O$ decreases from the beginning of the ice age to its end and then increases and remains fairly constant for the last thousand years.[33] This paper has strictly to do with climate and did not make any attempt to disprove the summer/winter $^{18}O/^{16}O$ differences which are used to count annual layers.

In conclusion, it must be emphasized that Vardiman's three papers do not provide any scientific data which would falsify the fact that some 110,000 annual layers have been counted in the GISP2 core, the first 40,000 of which are strongly validated by the consistent agreement of two different and independent methods of determining annual layers (LLS and ECM). Even his scientifically unsupported suggestion that the annual layers may be just due to storms was only made with reference to the layers "deep in the Greenland ice sheet," not at the top where the annual layers were counted by ECM. Vardiman did not address the GISP2 ice core or make any attempt to refute the three major methods which were used to count the top 110,000 annual layers. The fact that Vardiman took the counting of the top 14,500 layers in the GRIP core seriously suggests that, if anything, his papers support the validity of the counting of the 110,000 layers as annual. There is *nothing* in his papers which even addresses, much less refutes, that counting.

Oard's Proofs that the Layers Are Less than Annual

Michael Oard published a paper in 2001 attempting to show that the annual layers in the GISP2 and GRIP ice cores are subannual.[34] This paper went beyond Vardiman by claiming that even the main methods used for dating the ice cores (hoar frost, LLS, ECM) could not be trusted to be annual except over the last 2,000 years or so. He offered five reasons why the layers being counted could be less than annual layers.

His first argument is that the interpretation of annual layers from all of the dating methods "has been determined by the thickness of the annual layers that they expect, based on their model."[35]

The estimated annual thickness of the layers is relevant to the way some ice cores like the Devon Island core have been dated, but it is *not* an assumption underlying the visual counting of hoar frost/dust, LLS, or ECM methods of counting annual layers; and these are the methods that were used to count the first 110,000 layers of the GISP2 ice core. Contrary to Oard, the expected annual thickness of the layers down the core does *not* determine what uniformitarian scientists conclude with these latter methods. The truth is exactly the opposite: LLS counting is used to correct the initial estimated thickness of the annual layers.[36] Oard's statement that the hoar frost, LLS, and ECM methods of dating the annual layers are dependent upon an assumption as to the thickness of the annual layers, is false and should be retracted.

Oard's second argument is based on his hypothesis that there was only one Ice Age and that the ice sheet during that time (c. 2700 to 2000 BC) would have been lower and temperatures warmer, and this would have produced "more melt or hoar frost layers (cloudy bands) ... Therefore, what uniformitarian scientists are claiming as annual variations are simply oscillations that occur *within* a single year."[37]

If the weather was sufficiently warmer in the past to frequently raise the temperature above freezing, then more melt layers would be produced. But, Oard has confused melt layers with hoar frost layers. Any experienced glaciologist will tell you that melt layers are quite different in nature and appearance from hoar frost layers; and thus are easy to spot and discount.[38] Melt layers were not counted as annual layers in the GISP2 core. Furthermore, the annual alternation of hoar frost layers—being abundantly present in the summer snow but not in the winter snow—is due to the fact that the sun

shines in the summer in Greenland but not in the winter. Warmer weather would not change this seasonal alternation and hence would not change hoar frost from being an annual indicator. Oard's confusion of melt-layers with hoar frost layers and his failure to understand that the latter are due to seasonal differences invalidates his second argument.

Oard's third argument is that storms have warm and cold sectors that could produce oscillations on the order of just several days; and he cites glaciologists Grootes and Stuiver to document this fact.

This third reason is false, however, because the warm and cold oscillations of storms are too weak to either cause or disrupt the sharp differences in the ice that the radical differences between the seasons cause. The peaks and valleys of hoar frost, dust, and acidity take months to develop. Individual storms cannot produce them. If individual storms could have produced these differences, they would have shown up throughout the GISP2 ice core over the last 2,000 years and been mistakenly counted as annual. But as Oard admits, the last 2,000 layers are annual and have been accurately counted; so, storms that have obviously occurred many times in the last 2,000 years do not cause or disrupt the annual signals which are being counted. Nor incidentally would more snow each year disrupt the annual signals. In fact, increased yearly snowfall would make the counting even easier.

As for the citation from Grootes and Stuiver, they do say that the $^{18}O/^{16}O$ ratio varies on a timescale of days, but they go on to say that this variability "is not preserved in accumulating snow but is smoothed to yield a distinct seasonal cycle."[39] So Oard's citation is out of context. The variation of $^{18}O/^{16}O$ that occurs in summer storms is consistently within a summer range of values, whereas the variation of the ratio in winter storms is within a contrastingly different range of winter values. The daily variations of $^{18}O/^{16}O$, therefore, do not obscure the clear difference between the summer and winter ratios. And since the $^{18}O/^{16}O$ ratios were only used to date the GISP2 core in the very upper part which Oard admits was accurately counted, Oard's argument from the daily variations of the $^{18}O/^{16}O$ ratio is not only invalid (because the seasonal variation is not obscured by the daily variations), it is irrelevant to the dating of GISP2.

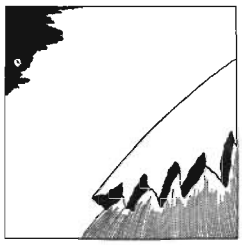
Oard's fourth argument is that snow dunes can occur and add sub-annual layers. This is true, but it is evident from the accuracy of the counting of the first 2,000 years that the sub-annual layers added by snow dunes can normally be distinguished from true annual layers because they have different characteristics.[40] In addition, a weak summer signal can subtract an annual layer. The sum effect of these rare events, therefore, is zero. Consequently, snow dunes do not constitute a logical basis for arguing that radically fewer years have passed than the 110,000 years counted in the GISP2 core. Finally, even if snow dunes had been a hundred times more frequent, they would only confuse the visual counting of the hoar frost layers. The annual layers would still be counted correctly by the LLS and/or the ECM method of counting. In short, sub-annual layers added by snow dunes or storms are rare, usually recognizable, even when not recognized may be offset by weak summer signals, and even if they had been abundant, the other methods of counting annual layers would still uphold the validity of the 110,000 annual layers in the GISP2 core.

Oard's young-earth model is essentially just speculation. It does not have the extensive empirical foundation that underlies the dating of the GISP2 ice core.

Oard's fifth argument is that cold or warm weather patterns can run in cycles as low as a week or as long as a month or even a season; so they could make a problem for estimating the number of annual layers. Perhaps they could, but the *estimation* of the number of annual layers, as noted above, is not relevant to the 110,000 annual layers of the GISP2 core. The estimation was, in fact, corrected by the actual counting of the layers. In addition, the accuracy of the counting of the annual layers in the last 2,000 years of the core shows that this problem is neither insurmountable nor serious enough to serve as a basis for denying the substantial accuracy of the dating of the GISP2 core.

Oard concludes by saying that uniformitarian scientists base their interpretation of the oscillations as annual "on their long-ages model with an ice sheet in equilibrium for several million years" and thus "manage to 'squeak out' 110,000 years of 'annual' cycles by using several parameters." Against this interpretation he sets forth "the creationist young-earth model, including a rapid ice age."[41] Thus Oard would have his readers believe that it is all just a matter of which model one follows. There is a particle of truth in this for some cores other than GISP2 and for the bottom of GISP2 below the 110,000 annual layers; but it is a false and misleading statement with regard to the 110,000 annual layers counted in the upper part of the GISP2 core, which are not dependent upon a model.

In addition, Oard's young-earth model is essentially just speculation. It does not have the extensive empirical foundation that underlies the dating of the GISP2 ice core. As explained and documented above, there is good empirical evidence showing that the light bubbly hoar layers, the heavier dust concentrations, and the greater electrical conductivity of the summer layers are indeed annual, and



The area in which the Lost Squadron landed, which is southern Greenland c. 10 miles from the east coast, with its high rate of snow accumulation ... vs. the area of GISP2 in central Greenland with its comparatively low rate of snow accumulation ... is why 250 feet of snow represents just 50 years for the Lost Squadron but around 250 years for the GISP2 ice core.

not from storms or sub-annual differences. If they had not been annual, they would not have correlated chronologically with the dates of historically known volcanic eruptions. And there is *no objective evidence* indicating that they changed from being annual to being sub-annual indicators.

The Lost Squadron Argument

In July of 1942, six pursuit planes (P-38's) and two bombers (B-17's) crash-landed on the Greenland ice cap. By 1990 they were found under c. 250 feet of ice and snow, which depth corresponds to c. 250 years of accumulation for the GISP2 ice core. In his 1992 paper, Larry Vardiman mentioned the surprising burial depth of the Lost Squadron planes, but he admitted that their depth of burial could not be simplistically used as evidence that the ice cores are being misdated. Some young-earthers have not been as wise and have argued from the depth of the WWII planes to the rejection of the age of the ice cores.

Carl Wieland wrote a short paper in 1997 arguing on the basis of the depth of the WWII airplanes that the 3,000 meter long GRIP ice core "would only represent some 2000 years of accumulation."[42] Allowing for some compression of lower layers and the greater snowfall for a few centuries after the Flood, he concluded, "There is ample time in the 4,000 or so years since Noah's day for the existing amounts of ice to have built up."

Kent Hovind, who has a four-minute tape on the Internet about ice cores, calculated that the WWII planes were covered at the rate of c. 5½ feet of snow/year. He then said that if you divide that rate into the 10,000 foot ice core, you only get 1,824 years; so "4400 is a really reasonable assumption."[43] Hovind also telephoned Bob Cardin, who was one of the main people who raised one of the planes to the surface and asked him if he had noticed how many layers there were in the ice in the hole made to excavate the plane. Cardin answered off the cuff, "Many hundreds of them." On the basis of this answer, Hovind concluded that the lines in the ice cores are not summer/winter, but warm/cold lines and that thirty of them could be made in a single year.

Two experienced glaciologists informed me that Hovind is largely correct about the "hundreds" of lines in the hole dug to remove the WW2 planes. They both said that the area where the planes landed is a relatively warm area because of its lower, southern elevation, and several melt layers can be formed every year in regions like that which would appear as layers in the hole. Add to these melt layers the actual annual layers, which near the top show up as several lines within the space of a few inches, and you can have an off the cuff estimate of "hundreds of lines." One can understand Hovind's confusion.

But let's make this perfectly clear: The 110,000 layers of the GISP2 ice core are not due to melting. They are *definitely not* melt layers. Even if melting had occurred more often in the past, layers due to melting are readily recognized and would certainly not be counted as annual.[44]

This leaves the question: How could some 250 feet of snow in the area of GISP2 cover a period of c. 250 years while 250 feet of snow in the area of the Lost Squadron planes only covers c. 50 years? In Richard Alley's book, *The Two Mile Time Machine*, he says he is often asked this question. The answer is: "The World War II planes landed in one of the regions of Greenland where snow accumulates fastest."[45] And in answer to the question: Did anyone ever figure out why the Lost Squadron planes were buried so much deeper than expected? Bob Cardin told me that it was because the average snow accumulation in that area is c. 7 feet/year (7 x 50 = 350 feet deep). If you allow for some compression, it is easy to understand how the planes got buried 250 feet deep.

So, the area in which the Lost Squadron landed, which is southern Greenland c. 10 miles from the east coast, with its high rate of snow accumulation (c. 7 feet/year) vs. the area of GISP2 in central Greenland with its comparatively low rate of snow accumulation (1 foot or so/year)[46] is why 250 feet of snow represents just 50 years for the Lost Squadron but around 250 years for the GISP2 ice core.[47] And, of course, as one goes down the core, the snow/ice is compressed more and more so that each foot of ice represents greater and greater lengths of time.

In conclusion we see that creation science has offered little more than speculation as evidence to disprove the validity of the dating of the GISP2 ice core. Opposing this speculation is solid empirical evidence that the layers of hoar frost, dust, and electrical conductivity are seasonal, not from storms, melting, different climate conditions or any other such supposition. Although one of the methods of counting annual layers may fail on rare occasions, the other methods fill in and sustain the accuracy of the counting; and the three methods regularly and repeatedly corroborate each other. In addition, the validity of the dating is established by the fact that there is a dovetailing of the dates of GISP2 with the dates of solar cycles,[48] sea cores, tree rings, volcanic events, and more.[49] The GISP2 ice core thus provides clear, scientific proof that there was no global flood any time in the last 40,000 to 110,000 years.

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Acknowledgment

Special thanks to glaciologists Todd Hinkley (at the National Ice Core Laboratory) and Richard Alley for their help in understanding some of the technicalities and to Christopher Sharp for suggesting the topic.

Notes

[1]The quickest overview of GISP2 can be found in Richard B. Alley and Michael Bender, "Greenland Ice Cores: Frozen in Time," *Scientific American* (February 1998): 81–5. A more thorough but still easy to read popular description is found in Richard B. Alley, *The Two Mile Time Machine* (Princeton: Princeton University Press, 2000). Some good photographs of ice cores are in Kendrick Taylor, "Rapid Climate Change," *American Scientist* 87 (July–Aug. 1999): 320–2.

[2]D. A. Meese, et. al., "The Greenland Ice Sheet Project 2 Depth-Age Scale: Methods and Results," *Journal of Geophysical Research* 102 (1997): 26,422; Sigfus J. Johnsen, et. al., "The Eem Stable Isotope Record along the GRIP Ice Core and Its Interpretation," *Quaternary Research* 43 (1995): 119.

[3]Jean Jouzel, "Ice Cores North and South," *Nature* 372 (1994): 612. Down to 103,000 BP they are "almost identical" (Johnsen, et. al., "The Eem Stable Isotope Record," 121).

[4]Cf. below, Vardiman, Oard, Wieland, and Hovind.

[5]Since Adam's Neolithic culture cannot be dated earlier than c. 10,000 BC and Abraham is dated c. 2000 BC, there are 8,000 years at most between the two men. The genealogies of both Gen. 5 and 11 place the Flood in the middle of these 8,000 years, hence roughly c. 6000 BC. Also, the Tower of Babel cannot be dated earlier than c. 3500 BC (Paul H. Seely, "The Date of the Tower of Babel and Some Theological Implications," *Westminster Theological Journal* 63 [2001]: 15–38) and it is probably closer to the Flood than to Abraham (c. 2000 BC), so the Flood is probably not earlier than c. 5000 BC.

[6]Personal communication from Dr. Richard Alley.

[7]Alley, *The Two Mile Time Machine*, 43–4. A layer from melting is easy to spot in the ice core because melted and refrozen ice is nearly bubble free and is glassy looking where the rest of the ice core is bubbly and milky. On the nature of melt layers and the ease with which they are spotted, see R. B. Alley, et. al., "Visual-Stratigraphic Dating of the Greenland Ice Sheet Project 2 Ice Core: Basis, Reproducibility, and Application," *Journal of Geophysics Research* 102 (1997): 26,367–8, Michael M. Herron, Susan L. Herron and Chester C. Langway, Jr., "Climatic Signal of Ice Melt Features in Southern Greenland," *Nature* 293 (1981): 389, and R. B. Alley and S. Anandakrishnan, "Variations in Melt-Layer Frequency in the GISP2 Ice Core: Implications for Holocene Summer Temperatures in Central Greenland," *Annual Glaciology* 21 (1990): 64.

[8]R. B. Alley, E. S. Saltzman, K. M. Cuffey, and J. J. Fitzpatrick, "Summertime Formation of Depth Hoar in Central Greenland," *Geophysics Research Letter* 17 (1990): 2393–6; Alley, *The Two Mile Time Machine*, 44.

[9]A depositional hoar layer, as opposed to a true annual diagenetic hoar layer which forms in the summer, does occasionally form in the winter; but, these winter hoar layers are rare and can be distinguished from the regular summer hoar layers by density, thickness, and shape. See Richard B. Alley, "Concerning the Deposition and Diagenesis of Strata in Polar Firn," *Journal of Glaciology* 34 (1988): 283–90.

[10]Alley, *The Two Mile Time Machine*, 45–7. See the photos in Paul Andrew Mayewski and Frank White, *The Ice Chronicles* (Hanover, NH: University Press of New England, 2002), 74, 75.

[11]Alley, *The Two Mile Time Machine*, 50–1.

[12]W. L. Hamilton and C. C. Langway Jr., "A Correlation of Microparticle Concentrations with Oxygen Isotope Ratios in 700 Year Old Greenland Ice," *Earth Planetary Science Letter* 3 (1967): 363–6; C. C. Langway, Jr., "Stratigraphic Analysis of a Deep Ice Core from Greenland," *Geological Society of America, Special Paper 125* (1970); C. U. Hammer, "Dating Greenland Ice Cores by Microparticle Concentrations," 297–301 and "Dust Studies on Greenland Ice Cores," 365–70, both in *Symposium on Isotopes and Impurities in Snow and Ice* (Proceedings of the Grenoble Sumposium, 1975), *IAHS-AISH Publication No. 118* (1977); T. Risbo, H. B. Clausen and K. L. Rasmussen, "Supernovae and Nitrate in the Greenland Ice Sheet," *Nature* 294 (1981): 637–9; Todd K. Hinkley, "Variation of Rock-Forming Metals in Sub-Annual Increments of Modern Greenland Snow," *Atmospheric Environment* 26A, no. 13 (1992): 2283–93.

[13]M. Ram and M. Illing, "Polar Ice Stratigraphy from Laster-Light Scattering: Scattering from Meltwater," *Journal of Glaciology* 40 (1994): 504–8.

[14]Michael Ram and Gershon Koenig, "Continuous Dust Concentration Profile of Pre-Holocene Ice from the Greenland Ice Sheet Project 2 Ice Core: Dust Stadials, Interstadials, and the Eemian," *Journal of Geophysics Research* 102 (1997): 26,641.

[15]Ram and Koenig, "Continuous Dust Concentration Profile," 26,642.

[16]C. U. Hammer, "Acidity of Polar Ice Cores in Relation to Absolute Dating, Past Volcanism, and Radio-Echos," *Journal of Glaciology* 25 (1980): 359–72; K. Taylor, et. al., "Ice-Core Dating and Chemistry by Direct-Current Electrical Conductivity," *Journal of Glaciology* 38 (1992): 325–32.

[17]M. M. Herron, "Impurity Sources of F^-, Cl^-, NO_3^-, and SO_4^{2-} in Greenland and Antarctic Precipitation," *Journal of Geophysics Research* 87 (1982): 3052–4060; A. Neftel, et. al, "Measurements of a Kind of DC-Conductivity on Cores from Dye 3" in *Greenland Ice Core: Geophysics, Geochemistry, and the Environment*, ed. C. C. Langway Jr., H. Oeschger, and W. Dansgaard (Washington, DC: AGU, 1985), 36–7.

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[30]Larry Vardiman, *Ice Cores and the Age of the Earth* (San Diego: Institute for Creation Research, 1993).

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[40]Note 9.

[41]Oard, "Do Greenland ice cores," 42.

[42]Carl Wieland, "The Lost Squadron," *Creation Ex Nihilo* 19:3 (1997): 10–4; also at www.answersingenesis.org/docs/233.asp

[43]*Creation Seminar Online, Part 1, The Age of the Earth*, Seminar 1B O. www.drdino.com/SeminarOnline/Audio/Part1/index.jsp

[44]Note 7.

[45]Alley, *The Two Mile Time Machine*, 33.

[46]Average annual snow accumulation at Summit for the last 100 years is .24 ± 0.05 m; and over the last 75 years just .21 m (D. A. Meese, et. al., "The Accumulation Record from the GISP2 Core as an Indicator of Climate Change throughout the Holocene," *Science* 266 [1994]: 1681–2)

[47]59 meters of ice (c. 195 feet) at Summit = AD 1816, which is 176 years, and 67.6 meters (c. 223 feet) = AD 1783, which is 209 years (S. J. Johnsen, et. al., "Irregular Glacial Interstadials Recorded in a New Greenland Ice Core," *Nature* 359 [24 Sept. 1992]: 312.)

[48]G. Wagner, et. al., "Presence of the Solar de Vries Cycle (~205 years) During the Last Ice Age," *Geophysical Research Letters* 28:2 (2001): 303–6.

[49]Around 11,500 BP in particular, there is a host of indicators from varying disciplines operating from different starting points (glaciology, oceanography, palynology, volcanology, dendrochronology) which all dovetail with the evidence from GISP2 that there was an abrupt radical change in climate at that time.

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Book Reviews

ANTHROPOLOGY & ARCHEOLOGY

IN THE BLINK OF AN EYE by Andrew Parker. Cambridge, MA: Perseus Publishing, 2003. 299 pages. Paperback; $27.50. ISBN: 0738206075.

The title only hints at the subject contained in the book, which should appeal to those of us interested in the Cambrian explosion. Parker, a zoologist at Oxford University, was named one of the *London Times* three most important young scientists because of the views outlined here. *In the Blink of an Eye* explains the Cambrian explosion as the result of the evolution of the first image forming eye. Having extensively researched this area for my 2001 *PSCF* article, I find this the only theory that seems to make sense.

With only a short space to tell the story, one must abridge the long chain of reasoning through which Parker takes his reader. But Parker's basic observation which set him thinking about the Cambrian explosion came from a study of isopods off of Australia. In the shallow waters, large numbers of species flourished. But as one went into deeper, darker waters, the number of species diminished and the size of the isopods grew with depth. In the deepest waters is found *Bathynomus* a giant isopod half a meter long. Originally the researchers expected that there would be more species found in these kilometer deep waters. But there weren't. All isopods deeper than 200 meters looked alike. And more interesting was the discovery that isopods from these depths from India and Mexico were almost identical with the Australian form. This particular isopod linage began 160 million years ago, giving rise to hundreds of species in the shallow waters, but few in the dark. Parker backs this up with studies of life in caves. Without light, life has fewer ecological niches to fill; no coloration or camouflage mechanisms are required leading to fewer species. In the dark, life takes on a boring, unchanging existence.

Parker then looks for evidence of the earliest eyes. Evidence for eyes was lacking in the Precambrian creatures, but by the time of the Burgess fauna 515 MYR ago it was common for arthropods to have eyes. Amazingly, the earliest evidence of coloration in the form of diffraction grating surfaces on Burgess animals appears as well. The 525 myr old Chinese Chengjiang arthropods and the 540 MYR Moroccan arthropod *Fallotaspis* display the earliest eyes. Parker proposes that the first phylum to develop image-forming eyes were the arthropods, and it occurred somewhere between 544 and 543 MYR ago, the Cambrian-Precambrian boundary.

The evolution of the eye opened up the ecological niche of predation. The first evidence of predation was 550 MYR ago. Prior to this time animals found food by blindly bumping into it as they randomly crawled around. Now, animals could *see* their prey and the prey's behavior. This drove the evolution of hard shells, coloration, camouflage and defensive spines which become so common in the Cambrian.

Animal phyla existed in soft-bodied form prior to the explosion and the explosion is actually only the evolution of the outward body plan, not the internal plan. Parker documents the existence of proto-trilobites found in the Ediacaran Hills of Australia. Others have documented the existence of mollusks and other phyla living in the Precambrian.

Change was slow prior to the first eye. Animals changed at the Cambrian-Precambrian boundary or they would die. Vision opened up new niches and allowed fierce predators to roam the seas.

Hopefully, some of the errors in my uncorrected proof copy of this book will be fixed before final publication. There is one absolutely abysmal paragraph in which Parker claims that the chalk cliffs of Dover are made of seed-shrimp (they are made of coccoliths) and that seed-shrimp are good indicators of oil with all oil companies hiring ostracod specialists. This is not quite true. Plankton is much more useful. The book errs in calling the animal which was the first victim of predation *Claudina* instead of *Cloudina*. It was named in honor of Preston Cloud. Other than these deviations, the book is a very, very important contribution to the understanding of the Cambrian explosion. From now on, those who discuss the explosion must deal with Parker's ideas.

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

ETHICS

ANIMALS: Their Past and Future by G. H. Pember. Elkton, MD: Pneuma Books, 2003. 77 pages. Hardcover; $14.95. ISBN: 0972513906.

George Hawkins Pember (1837–1910) is thought to be "one of the foremost theologians of prophetic study in the Victorian age" and this book "the classic theological treatise on animal rights." This book is a reprint of Pember's undated 1800s pamphlet. This compact book manages to include a preface, notes, bibliography, biography, Internet resources, a few sketches, and an index. This leaves forty-seven pages for the text's appeal to the Bible as authority on animal treatment.

Pember says that life improved for people and animals in the nineteenth century. However, apathy toward the plight of animals prevailed. His one goal in this treatise is to see whether the Bible casts light on how animals should be treated.

These are his conclusions: (1) animals, like people, are under God's curse; (2) future animals will not eat each other and will speak; (3) fish and snakes will be absent from the renewed earth; (4) future redemption of creation includes animals as well as people; and (5) humanity should show "tenderest consideration" for animals.

This is not a preachy book, and it excludes discussion of many contemporary animal rights issues. However,

research on the Internet addresses included provides commentary on the present situation. This book can be read in less than one hour, and it provides valuable insight into what the Bible says about the treatment and future of animals.

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

REMEMBERING JESUS: Christian Community, Scripture, and the Moral Life by Allen Verhey. Grand Rapids, MI: Eerdmans, 2002. xii + 526 pages, indexes. Hardcover; $35.00. ISBN: 0802803237.

Verhey teaches religion at Hope College. The book's five parts (introduction, medical ethics, sex and gender, economics, and political ethic) seek to apply the Bible and early church teachings to contemporary ethical issues. Verhey thinks Christian ethics should be based, not on moral codes, but on the discernment of the Christian community based on the Bible's ethical teaching in stories.

Verhey emphasizes that in terminal illness the patient's suffering should not be extended. He deplores the neglect of the patient's welfare caused by some advanced medical technology. He might have added that the problem involved in terminal illness is often caused by the patient's family leaving decisions to doctors. Also, patients who participate in experimental treatments may benefit future patients.

Verhey takes the egalitarian view about gender role. He praises Atwood's *The Handmaid's Tale* to disparage those who take the opposite view. He notes that Jesus said nothing about homosexuality and that the phenomenon of sexual orientation was not known to biblical writers. Jesus' silence regarding homosexuality may have resulted because he lived in a Judean culture where homosexuality was not a problem.

Verhey is ambivalent about capitalism. He criticizes classical capitalism, but realizes that economic policy cannot be decided by pure ideology. He emphasizes that Christians must remember the poor because Jesus cared about them. One wishes that Verhey emphasized more the responsibilities of the poor to work and of the public to provide means for the poor to be educated and trained. The example of Asian economic success provides a lesson about the importance of education. The solution for the Third World totalitarian societies may not reside only in liberation theology, but also in a Puritan work ethic.

Verhey emphasizes the concept of theocracy in the political arena and rejects pacifism. He interprets theocracy different from Calvin's practice and identifies it with the lordship of Christ in all areas of life. He claims that Jesus shifted emphasis from rules for conduct to the formation of character. One would differ here because Jesus said that he completed the law, so what Jesus really did was a shift from ceremonial to ethical law. Verhey applies the concept of theocracy in health policy and promotes universal access to health care.

Overall Verhey stands between liberal and conservative evangelicals. He blames the Enlightenment, instead of liberal theology, for moral deterioration in American society. He accepts the conclusions of biblical higher criticism. He borders on placing community above the Scriptures and gives general guidelines without providing detailed deliberations. For example, he omits dealing with hard questions such as: when should medical treatment be withheld from the terminally ill, to what extent should health care be provided, and to what degree can the welfare system be limited without neglecting the needy? Despite these reservations, Verhey's book can be recommended as exploring a Christian position on contemporary ethical issues.

Reviewed by T. Timothy Chen, Southwestern Baptist Theological Seminary, Fort Worth, TX 76122.

FAITH & SCIENCE

HABITS OF THE MIND: Intellectual Life as a Christian Calling by James W. Sire. Downers Grove, IL: IV Press, 2000. 256 pages, index. Paperback; $14.99. ISBN: 0830322739.

Sire, former editor of Inter-Varsity Press, is also the author of several books. For Sire fans, it is always good news that another book from his pen is now in print. They will not be disappointed in this book, for it lives up to what we have come to expect. I am still amazed at the sheer magnitude of the number of books he has read. The endnotes number thirty pages of references in small print! Sire writes: "The primary goal in this book is to encourage you to think more and better than you did before reading it, to strive toward the perfection of the intellect: to enjoy the proper habits of the mind" (p. 11). Sire states also that "this book is about the integral value of the intellectual life."

Sire quotes Richard Hofstadter who lists the following qualities that characterize intellectual life: fresh observations, free speculation, creative novelty, radical criticism, generalizing power and disinterested intelligence. Sire then adds this observation: "A Christian intellectual is one who is all of the above to the glory of God."

In chapter two, Sire writes that John Henry Newman (1801–1890) has become a model as a Christian intellectual. He explains that the experience of reading two of Newman's works, *Apologia Pro Vita Sua* and *The Idea of a University*, while a graduate student at the University of Missouri were major factors in his selection. I would have selected C. S. Lewis as my model for a Christian intellectual. My reason is that I believe Lewis's world view is more biblical than Newman's, and his writings were at least as excellent as were Newman's. However, I have read more of Lewis's books than Newman's. Sire himself admonishes us (pp. 166–7) to seek out the world view of the author of any book we read. I have not read all of Newman's writings, but from the extensive quotations from Newman that are cited here, I deduce the following about Newman's view of the world.

Since Newman lived in the Victorian era, he apparently adopted the utopian, optimistic world view of that era. Key literary figures of that era (besides Newman) were Robert Browning and Alfred Lord Tennyson. Browning believed in the perfectibility of humankind. He proclaimed exuberantly, "God's in his heaven,—all's right

with the world." Tennyson believed that one day soon the "battle flags" of the nations would be furled in "the parliament of man, the federation of the world." Alas for such dreams: the next century had two world wars and the holocaust! Newman may be excused to a degree if his world view was more optimistic than ours is today since he hopes that the human intellect can be "perfected." In spite of Newman's optimistic view of humankind, I believe Sire is justified in citing Newman as a great Christian intellectual.

The last four chapters of this book are the best of the lot in my opinion. I found much food for thought in chapter 8, entitled "Thinking by Reading." I was excited to see the comparison of monastic reading and scholastic thinking. That was a new insight for me. Chapter 9 on "Jesus, the Reasoner" is worth the price of the book. His explanation that "Jesus was the smartest man who ever lived" is outstanding. There is a real message for contemporary Christian intellectuals in chapter 10 entitled "The Responsibility of the Christian Intellectual."

Sire is distressed (and so am I) that so few Christian intellectuals in the late twentieth century have put aside their fear that their career advancement will be terminated if they speak out for truth. I know some Christian researchers in the life sciences who do not accept Darwinian evolution as scientific, but will not write such a paper for fear that it will not be accepted in the peer review stage. After all, promotions and tenure depend on publications! Sire mentions C. S. Lewis, Nicholas Wolterstorff, Alvin Plantinga and George Marsden who are not afraid to speak the truth as they see it from a Christian world view. To this list I would add Phillip Johnson, Michael Behe and William Dembski. One of the great delights to the reader of this book are the hundreds of "pithy" quotations that Sire has interspersed within the text. They stand out as bright jewels in the tapestry of this thought-provoking book. I heartily recommend the book to anyone who wants to be classified as "Christian Intellectual."

Reviewed by O. C. Karkalits, College of Engineering and Technology, McNeese State University, Lake Charles, LA 70609.

TOWARD A CHRISTIAN VIEW OF A SCIENTIFIC WORLD: Fifteen Topics for Study by George L. Murphy. Lima, OH: CSS Publishing Company, Inc., 2001. 151 pages. Paperback; $13.95. ISBN: 0788018078.

Murphy, an ASA Fellow, has published many articles but few books in the area of science and religion. For this reason, he may not be familiar to ASA members who are not versed in the many journals related to "science-and-religion," unless they happen to follow the ASA E-mail list. When I still kept up with the discussions a few years ago, Murphy was a regular, cogent and patient contributor, and his erudition and easy writing style are apparent in this book.

This book is probably the best introduction to the intersection of science with Christianity for the average layperson. It is the first text I have seen that is aimed at the general Christian public and suitable for readers with a high-school education or less. The other available texts, with the possible exception of Nancy Murphey's *Reconciling Theology and Science,* are aimed at college students or the college-educated.

As a Lutheran pastor who has for some years been associated with an Episcopal parish in Columbus, OH, Murphy understands the questions that congregations may have, and his book is designed to explore them in the context of a small study group. As an instructor for several years at Trinity Theological Seminary, he has theological depth and sophistication. As a theoretical physicist who still publishes an occasional paper in the refereed literature, he has first-hand experience with how science works.

The thing I particularly like about Murphy is that he does not practice the bloodless "natural theology" of so many others in "science-and-religion" or even in "science-and-Christianity." Instead he bases his treatment firmly within the Christian faith and Luther's theology of the Cross. He understands that nature does not prove the existence or teach the precise nature of God. But he thinks nature can help us understand and interpret what we know of God from elsewhere. This book explores how nature can do so.

Murphy's book is firmly based in Scripture. Whenever God's nature or role is considered, the discussion is first grounded in the Bible. Following that grounding, nonscriptural considerations are introduced. Coverage is thorough and well-ordered. It progresses from the questions most commonly asked, through how we know about God and about nature, to consideration of the Church's mission in a scientific age. Along the way, Murphy touches on topics from the conventional ("How to Read the Bible") to the possibly impractical ("Angels, Aliens and AI"), all in a spirit of firmly Christian inquiry and a luminous assurance that knowledge about the world can only confirm our faith in Christ.

My only complaint is that the book has not been thoroughly edited for errors of fact. There is a serious error on page 84, in which the electrostatic force between protons is said to be attractive. The sense of the passage makes clear that this is a typographical or editorial error, but it nevertheless makes me apprehensive about the possibility of garbling in areas with which I am not so intimately familiar. I also had some problems with Murphy's versions of the "collapse of the wave function" and of the Many-Worlds Interpretation of quantum mechanics.

In spite of these reservations, I wholeheartedly recommend this book to ASA members and to church study groups of all denominations.

Reviewed by Daniel J. Berger, Professor of Chemistry, Bluffton College, Bluffton, OH 45817.

SCIENCE AND THE SEARCH FOR GOD by Gary Kowalski. New York: Lantern Books, 2003. 186 pages, bibliography. Paperback; $15.00. ISBN: 15905600450.

Kowalski is a Unitarian minister in Burlington, VT. This book is based on a class he developed for his congregation on "Topics in Science and Religion." It includes ten pages of discussion questions at the end of the text. Other books written by Kowalski include *The Souls of Animals, Green*

Mountain Spring and Other Leaps of Faith, and *The Bible according to Noah: Theology as if Animals Mattered.*

From reading this book, I assume that Kowalski does not accept the Bible or the God of the Bible. He describes his belief as naturalistic theology and states: "The ancient myths of the Hebrews and the Greeks are indeed lovely and suggestive of many profound insights but not literally true ..." He calls for a new creation epic that "provides a unified account of the natural world, without reference to any other supernatural domains."

He asserts that the creator is not separate from the creation and that the universe is wholly material. Kowalski cannot accept the God of the Bible because this God leaves no room for freedom. Rather, he accepts the process concept of God and prefers process thought because then his alternatives are not limited.

This book has eleven chapters with titles like "Tell Me Why" (religion should never presume to contradict the findings of physics, chemistry and geology, and who can say what happens when we die), "Star Dust" (the religion of the next millennium will find its inspiration, not in the domain of the supernatural, but rather in oneness with the natural world), and "Gaia and the Great Mother" (life is a property, not of molecules, genes, or even individual organisms, but of whole planetary systems).

Kowalski's purpose in this book is apparently to argue that the results of science make it impossible for educated and intelligent people to believe in a supernatural God, who is separate from creation. He is supportive of the Gaia hypothesis as a scientific theory. "One day people will know the earth as holy and all creatures sacred. The creative power that enlivens our universe will then be as close and accessible as a mother to her child." Kowalski is prone to making unsupported statements, e.g., "design does not necessarily imply a designer," or "God is that loving whole of which you and I and others in the cosmic conversation are active parts and partners," or "we are star dust, deeply and forever related to a beautiful and ever-changing cosmos." I can find nothing in this book to recommend it to ASA members.

Reviewed by Bernard J. Piersma, Professor of Chemistry, Houghton College, Houghton, NY 14744.

THE ILLUSION OF TIME: Seeing Scripture through Science by William R. Nesbitt, Jr. San Diego, CA: Black Forest Press, 2002. 178 pages, index. Paperback; $13.95. ISBN: 1582750750.

The book has fourteen chapters, an introduction, bibliography, a glossary of terms, and a number of black-and-white illustrations. The early chapters of the book give a very conversational description of multidimensional physics. This physics is used to explain how God can view all of time and can be in all places at all times. Nesbitt, an ASA member, offers scriptural references of appearances of angels and other beings that he says are consistent with hyper dimensional theory. All of this is given as evidence that a multidimensional theory of physics is consistent with a biblical record and confirmation of a Christian faith. The later chapters rely more on Nesbitt's extensive experience as a military doctor and other personal life stories to give real life illustrations of his evangelical message.

Time is an illusion says Nesbitt. Creation was laid down from a hyper dimensional perspective. This perspective sees all of time as now, as a painter may see an entire canvas. It is only sin that limits us to seeing only the present due to the loss of our ability to perceive the higher dimensions. The present can be described as one looking through a narrow slit as it passes across the canvas, changing the view and giving an illusion of time.

The strength of this book lies in its easy reading, popular periodical style. Even children will be able to follow the story line. And because the story sparkles with personal tidbits, the story never becomes dull. Nesbitt is a great storyteller who conveys not only the Christian message of salvation but much general wisdom as well.

The strength of the book might also be seen as a weakness. There is nothing in Nesbitt's book that is not more thoroughly described in the books of Hugh Ross and Gerald Schroeder, both of whom are quoted by Nesbitt. This book would be a useful resource for anyone interested in an introductory perspective to multidimensional physics.

Reviewed by Gary De Boer, Associate Professor of Chemistry, LeTourneau University, Longview, TX 75607-7001.

REBUILDING THE MATRIX: Science and Faith in the 21st Century by Denis Alexander. Grand Rapids, MI: Zondervan, 2003. 473 pages, notes, index. Hardcover; $29.99. ISBN: 0310250188.

Sometimes I wish I were British. In contrast to the low wheat-to-chaff ratio for American books on science and faith, the UK seems to produce a disproportionate number of well-reasoned books from a sound Christian perspective, such as those by John Polkinghorne and David Wilkinson. To this list we can add molecular biologist Denis Alexander, whose *Rebuilding the Matrix* is being distributed in the US after publication in England in 2001.

An early chapter examines the ways in which an unfounded idea can become widely accepted. This sets the stage for the majority of the book, which is devoted to refuting two related paradigms about science and faith that many today take for granted.

The first false idea is the "warfare" model of the history of science and Christianity, in which science marches toward truth, opposed at every step by stubborn believers trying to keep the world in darkness. Alexander exposes the origins of the warfare myth, and shows that science and Christianity have (with exceptions) historically coexisted in harmony. He also argues that the Christian view of nature as contingent on its Creator greatly aided the development of science. While I was generally aware of these points, they were made so well and so thoroughly that I gained a deeper appreciation for how utterly wrong the warfare model is.

Alexander then moves to the present, where many people assume that science and faith can no longer coexist, largely due to the theory of evolution. The material will be

familiar to many ASA readers, but it is presented well. Science and theology are viewed as complementary ways of knowing, each taking a "critical realist" approach. It is argued that early Genesis should be read as a theological document in its historical context, rather than being twisted into a scientific text. Abuse of the theory of evolution for unscientific ends, like social Darwinism and the promotion of atheism, is denounced. It is pointed out that it is not only atheists who are guilty of erroneously attributing God-excluding metaphysical meaning to evolution, but also Christians whose "God of the gaps" philosophy compels them to oppose the science. Evolution is compared to a ship, with barnacles corresponding to the metaphysical baggage both "sides" have attached to it. Stripped of the barnacles, the ship can steam ahead without threatening our faith.

Additional chapters critique ideas of Michael Ruse on the evolution of morality (an interesting choice of opponent, since Ruse's recent *Can a Darwinian be a Christian?* has many points of agreement with *Rebuilding the Matrix*), examine (and cautiously endorse) anthropic arguments for theism, and criticize David Hume's circular argument against miracles. A final chapter discusses how theism can provide a matrix not only for making sense of the cosmos and human experience, but also for channeling the power of science in worthwhile directions.

I recommend *Rebuilding the Matrix* for anybody, believer or not, interested in the relationship between science and faith both in history and in the present. Even though it is well-written, it is not light reading. But readers willing to invest some thought and effort will be rewarded.

My only major criticism may reflect the book's British origin. While the flaws of the "natural theology" most closely associated with Paley are discussed, there is no mention of Paley's (mostly American) successors who arose during the 1990s. Many of the author's wise observations (like noting that many Christians make the same category mistake as Richard Dawkins in viewing creation and evolution as rival explanations) could be applied to the "Intelligent Design" movement, but the only Christians criticized for such errors are those of the young-earth variety. As good as *Rebuilding the Matrix* is, it is rendered less useful for American readers by its neglect of a movement that, at least on this side of the Atlantic, has become a major force for needless warfare between science and Christianity in the twenty-first century.

Reviewed by Allan H. Harvey, 1575 Bradley Dr., Boulder, CO 80305.

GENERAL SCIENCE

DIGITAL SOUL: Intelligent Machines and Human Values by Thomas M. Georges. Boulder: Westview, 2003. 285 pages. Hardcover; $26.00. ISBN: 0813340578.

Georges is interested in problems of the relationship between machines and humans and in the nature of such a relationship for the future of humanity. The philosophical stage is set by the statement that the distinction between artificial and real intelligence is "merely a linguistic trap" (p. 5). There is no real difference between humans and machines because humans *are* machines. There is no soul, no inner life, no emotions, no consciousness, no free will; or, at best, these are just names for certain physical attributes or processes and references to them only demonstrate the level of our ignorance about physico-biological mechanisms to which they are reducible.

If humans are conscious, so are machines. Georges sees consciousness not as a thing, but as a process (p. 77), not quite consistently with the view that consciousness is information, that is, "the way things are arranged" (p. 96). With such a definition, everything may be deemed conscious, and the author does not shirk from such a consequence. People, animals, and machines "all need some degree of self-awareness to survive" (p. 84). In computers, self-understanding is manifested by printing an error message (pp. 83–4, 92) and "even a book with a table of contents might qualify as self-aware in the crudest sense" (p. 83). Crudest sense, indeed.

For the author, the meaning of life is to "survive and reproduce" (p. 155) and because natural selection wants us to be "genetically prolific," it "favors societies that create moral and ethical structures that work in the competitive environment in which they must function" (p. 126). However, such a vision of social Darwinism does not sit well with the author, and he wants humans to go against such evolutionary tendencies and take charge of the development of society and its morality. In his view, we should replace existing moral values by "new moral codes based on reason" (p. 133) and the author is specific about one rule presumably based on reason.

The rule states that the blame for misdeeds should not be placed in individual responsibility (p. 133). It is the genetic and social environment that is at fault (p. 134). "If punishment is not appropriate for a machine, is it appropriate for humans, if we are merely 'soft' machines?" (pp. 147–8), he asks rhetorically. And so, humans, like machines, can be repaired. But is lobotomy as a fixing procedure so different from rewiring the brain of a criminal, advocated by the author (p. 206)? "What needs to be changed is the environment, not some mythical internal attitude" (p. 201). One just needs to rationally design "suitable environmental controls" which is possible only if we "abandon our cherished 'values' of freedom and dignity altogether" (p. 202). Why does the author find prisons as the means of such behavioral engineering repugnant if they serve so well the purpose of abandoning our cherished values of freedom? This rational approach has been tried already in the former USSR based on the Marxist doctrine of historical materialism that social and economic conditions exercise an alienating influence on people, and change must concentrate on these conditions.

Georges embraces Wooldridge's statement that "men who know they are machines should be able to bring a higher degree of objectivity to bear on their problems" (p. 208). The more machine-like our behavior is, the more rational it becomes. And yet, he flatly contradicts himself by stating that "the greatest threat to our dignity and our humanity will not come from machines that act like people, but from people who act like machines" (p. 217). The author wants to have it both ways: naturalist reductionism, on the one hand, and compassion and fair treatment of people, on the other. However, human treatment

simply does not square well with reducing people to the level of machines and to seeing survival and reproduction as the meaning of life. Why be human if this undermines being genetically prolific? Why have any qualms about anything if the excuse, "my genes made me do it," is "technically correct" (p. 206)?

The case for a materialist view of man made by Georges is thus self-contradictory and unconvincing. The book is more a doctrinaire treatise than a carefully thought-out case arguing for a point. His home-spun psychology is a far cry from what can be found in other books written by authors who try to explain the phenomenon of humans in physical and biological terms (e.g., Pylyshyn, Searle, Dennett, Pinker).

Reviewed by Adam Drozdek, Duquesne University, Pittsburgh, PA 15282.

IN OUR IMAGE: Artificial Intelligence and the Human Spirit by Noreen L. Herzfeld. Minneapolis: Fortress Press, 2002. 135 pages. Paperback; $16.00. ISBN: 0800634764.

In this book, the author is interested in uncovering the roots of our fascination with artificial intelligence (AI). The problem is an important one because this fascination tells us more about ourselves than about the potential of computers. Herzfeld begins her investigation by presenting some views on the image of God (chap. 2). She presents the substantive approach (the image of God is an attribute of the human being, such as rationality), functional approach (the image of God is a title ascribed to humans on account of what they do, e.g., exercise dominion), and relational approach (humans are images of God because of their genuine relationship with God and with one another). She then finds counterparts of these three approaches in AI (chap. 3).

Treating an intelligent system as a physical symbol system is a substantive view of intelligence as an ability of symbol processing, a traditional view of AI much criticized by Dreyfus, Searle, and others. The functional approach is visible in the pragmatic view of AI as a set of workable techniques that can be usefully applied in some domains. Herzfeld sees the relational view as being embodied in the Turing test. Because such a test (strengthened by Harnad to the total Turing test) requires a measure of interaction, if only verbal, between an AI system and a human, the interaction may be viewed as an indispensable component of intelligence. Herzfeld finds the third approach most compelling, which she illustrates with the vision of AI beings presented in science fiction movies (chap. 4). She states: "We seek artificial intelligence for its relational potential rather than merely its rational or functional potentials" (p. 66). This gives priority to the moral dimension of humans and all beings that we would like to treat on a par with humans. Rational dimension is a tool with which moral dimension realizes its goals. As Herzfeld puts it: "It may well be that intelligence is not the most important aspect of human nature" (p. 94).

Why are we interested in AI? In chap. 5, the author lists some reasons. The first reason is a dream of immortality, accomplished by being downloaded into a computer as envisioned, e.g., by Rucker in his *Software*. Herzfeld is correct in stating that this cybernetic dream is incompatible with Christian eschatology. When she says that this is "the dream of a few highly educated North American white men" (p. 75), she is correct in that it is a view of an intellectual minority; but the qualification that they are just white men is belied by her own quotation from Nicole Steiger who pontificates about cyberspace as paradise (p. 72). Herzfeld fares better with the second reason of our interest in AI, which is a need for machines that act independently, presumably in dangerous environments. But it seems that, as of now, the military is most interested in this type of devices. The third reason is the desire to create an entity with which we may relate.

It appears that the first reason is somewhat fanciful, and the second reason is utilitarian and not necessarily misguided. The third reason, however, is not acceptable, at least from a Christian perspective, and Herzfeld discusses this problem in the closing chapter. She concludes with statements that human-computer interaction cannot be a substitute for human-human interaction and certainly not for God-human relationship.

Reviewed by Adam Drozdek, Duquesne University, Pittsburgh, PA 15282.

HISTORY OF SCIENCE

THE NEW SCIENCE AND JESUIT SCIENCE: Seventeenth Century Perspectives by Mordechai Feingold, ed. Boston: Kluwer Academic Publishers, 2003. 270 pages, index. Hardcover; $113.00. ISBN: 1402008481.

JESUIT SCIENCE AND THE REPUBLIC OF LETTERS by Mordechai Feingold, ed. Cambridge, MA: The MIT Press, 2003. Hardcover; $50.00. ISBN: 0262062348.

Two recent and notable series for scholarship in the history and philosophy of science and technology are ideal forums to take up the long neglected issue at the core of these volumes of essays. Accusations commencing with Galileo and his peers through caustic remarks by Descartes, the distinguished English historian Macauley and beyond, coupled with aspersions from many other prominent scientists, thinkers, and historians, link the early Jesuits (founded in 1540) with the active suppression of innovative ideas in the emerging Scientific Revolution. As is often the case, the truth turns out to be much more complex and interesting, even if it means the inevitable death of prejudice and ill-founded "facts" and the adoption of a more carefully nuanced understanding of the complex relationships that can exist among science, scholarship, inquiry, and religion.

Six essays in the Kluwer volume and another ten in the MIT book seek to reassess in some detail selected aspects of the received view. Contributors hail from a wide range of American and European universities including Stanford, VA Tech, Nijmegen, Catholic University of America, Padua, Valencia, and Indiana as well as the Medici Archives. The authors accept as credible the broad outlines concerning the early Jesuits including their initial focus on itinerant ministry and their shift within two decades to teaching as the principal vehicle for reaching

souls. The Jesuit instructional system emphasized the humanist learning of the ancient Greeks and Romans and even their harshest critics admitted that they admirably succeeded in educating their students to a very high standard in the 850 or so schools that they administered before their dissolution in 1773. (They were reconstituted in 1814.) Jesuits were staunch defenders of Aristotle and his disciples and the theology associated with Saint Thomas Aquinas making them the ideal chief protagonists leading the Catholic Counter Reformation and enforcing the Council of Trent.

Consistent with a wider movement over the past twenty years on the part of historians to create a more detailed, textured, and nuanced view of the early Scientific Revolution, these essays provide case studies of selected issues and institutions related to the Jesuits that probe the overall veracity, limitations, and qualifications of the standard view of Jesuit obstruction and opposition to early modern science. The MIT Press book opens with a summary essay by its editor that makes the case for Jesuits as the *savants* of their time. Ugo Baldini, drawing upon the catalog and the works particularly of Clavius, conducts a careful study of the role of Jesuit science within the mathematics professors of the distinguished *Collegio Romano* that was founded by Saint Ignatius Loyola in 1551. He argues for the Jesuits' profound direct and indirect influence on Galileo and many other Catholic men of science, most of them educated in Jesuit schools. At the same time, he is careful not to sweep under the rug contradictory evidence and admits that definitive evidence to address some of these issues simply did not survive.

That the *Collegio Romano* was without peer as a science teaching institution during this time frame is not in doubt. Baldini suggests that its very prestige and position within the Catholic world may have created the unavoidable tension with the *new sciences*. William Wallace pursues another line of evidence by carefully detailing the interactions that Galileo had with professors at the *Collegio Romano* around 1588–1591 when he first took up the teaching post at Pisa and follows that thread over a 25-year period as Galileo moved from place to place and continued his work. He argues, successfully in this reviewer's opinion, that Galileo benefitted much from these interactions and that his scientific views and arguments were greatly strengthened via these exchanges by focusing his efforts in logic which helped him construct a valid scientific demonstration and by "keeping him honest." Edward Grant then extends this argument by showing how medieval cosmology was already under reconstruction by the Jesuits themselves in the sixteenth and seventeenth centuries.

In a similar manner, Roger Ariew explores the relationship between Descartes and the Jesuits, Alfredo Dinis dissects the work of Giovanni Battista Riccioli, Paula Findlen considers Athanasius Kircher and the Roman College Museum. Jesuit support for patronage of printed books in the seventeenth century is probed by Martha Baldwin, and Victor Navarro appraises the role of the Jesuits in early modern Spain, specifically in relation to tradition and scientific change. G. H. W. Vanpaemel takes Navarro's exploration into the Spanish Netherlands and Brendan Dooley concludes the volume with a study of the Jesuit encyclopedia journal *Storia letteraria d'Italia* that appeared in 1750.

The shorter Kluwer volume complements the MIT volume with a series of six essays that explore other dimensions of the interactions among Jesuits and their engagement with the wider academic world. Michel Gorman considers the mathematical problems of Christoph Grienberger while Feingold departs from his editorial role to explore the grounds for conflict among Grienberger, Grassi, and Galileo. Francesco De Ceglia looks at how Giuseppe Baiancani reads Galileo in an unedited censored text while Carla Palmerino carefully studies the Jesuit responses of Fabri and Le Cazre to Galileo's *Science of Motion*. Henrique Leitno offers a case study of Jesuit mathematics in Portugal and Carlos Camenietzki closes the volume with a look at the work of Jesuit astronomer and missionary Valentin Stansel (1621–1705) in Brazil.

The reader will leave these two volumes with a much better grasp of the particularities associated with Jesuit science in the early modern period. The polemics of the Reformation and Counter Reformation have often made the past far murkier. These essays help clarify one's vision into this tumultuous period within Western civilization. These careful historical studies provide analogues to better understand the dynamics in today's science and religion debate, engagement, reconciliation, separation, or warfare (depending on one's viewpoint or interest). While the prices may prohibit personal copies, these two books will enhance a library collection in science and religion.

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NATURAL SCIENCE

DIMENSIONS OF TIME by Wolfgang Achtner, Stefan Kunz, and Thomas Walter (trans. Arthur H. Williams, Jr.). Grand Rapids, MI: Eerdmans Publishing Co., 2002 (originally published in German, 1998). 196 pages, bibliography, index of names, index of subjects. Paperback; $30.00. ISBN: 0802849989.

Achtner is campus minister and part-time lecturer on the dialogue between science and religion at the University of Giessen, Germany. Kunz is a pastor in Bensheim, Germany and Walter is professor of information technology at the University of Kaiserslautern, Germany. This book arose as a result of a study group called "Dialogue of Physicists and Theologians" to which the authors belong. After a year-long study on the theme, "Time in Physics," the authors continued to study the topic independently for five years. Their discussion is the basis for this book.

The authors have developed a new concept of the tri-polar system of time. The first section of the book is a development of a theoretical approach to the tri-polar structure of time. The authors then apply their structure to the time of humans, the time of the world, and the time of God.

The tri-polar structure of time is introduced with a diagram of an equilateral triangle representing humans and their threefold structure of relationships. A human relates

to the world (a base angle), his or her self (the other base angle) and religion (the peak angle). This model is applied to time with the base angles representing Exogenous Time (world) and Endogenous Time (self) while the peak represents Transcendent Time (religion).

Endogenous Time are the forms of time experienced by all humans. Exogenous Time includes the forms of time in which humans relate to the environment. Transcendent Time include religious experiences of time. In this structure, time is both subjective and objective.

The section, Time of Humans, comprises well over half of the book. The discussion of humankind's perception of time begins with the mythic-cyclical experiences of time as shown in ancient Egypt and Mesopotamia. The rational-linear concept of time was introduced by the Greeks and is the current concept of time in the West. The mystic experience of time is also reviewed and is seen "as a sublime expression of the highest creative possibility of our humanity" (p. 102).

The next section covers the Time of the World and the scientific view of time. The authors note that the classical laws of physics do not change with the reversal of time. However, the introduction of the second law of thermodynamics does show that there are irreversible processes, thus giving time direction. The use of scientific formulae, such as the Euler-Lagrange, Schrödinger, and Heisenberg equations, makes this section non-understandable to the general public. An explanation of the concepts without calculus would have been preferred.

The last section investigates the Time of God. The authors do not presuppose to know something of God's inner nature and limit themselves to the effects of transcendent time on humans. Jesus' time on earth was an invasion of transcendent time into the time of the world.

The majority of this book would not be of interest to Christians without a scientific background. At the conclusion of the book, however, the authors speak of "fulfilled time." Christians have the experience of Christ and transcendent time within. Thus, the Christian can "rest" and not be driven by exogenous time. The Christian can have faith without fear, knowing that what God has promised of the future is true.

The authors have done a good job of laying a basis for classifying and interpreting past and current human experiences of time. The brief section at the end of the book falls short, however, in their goal, "to show ways of solving the temporal crisis of our "accelerated society'" (p. 173).

Reviewed by Joan Nienhuis, owner, His Place Christian Bookstore, Oak Harbor, WA 98277.

A Requested Explanation

It is commonly held that we owe our concept of linear time and history to the biblical world view, so it comes as a surprise to hear it said that this idea of time originated with the Greeks. It must be remembered, however, that this book deals with three different "times," that of humans, the world, and God, and also distinguishes between mythic-cyclic time, rational-linear time, and mystic-holistic time. It is in connection with the time of humans that it concludes that the "nomadic" (i.e., early) Hebrews did not attain a concept of rational-linear time structure, which originated instead among the Greeks. In their later discussion of the time of God, the authors make it clear that the later prophets of Israel and Christianity overcame cyclic views of time and history.

While the Greeks were aware of a linear concept of temporality, it seems to me that the authors overstate its significance for that culture. It can still be said that our linear concept of history—and especially of the value of history—originated primarily with the biblical world view. *Dimensions of Time* does indicate that this concept did not simply spring up full-grown, but developed in a more complex fashion.

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WHEN CULTURE AND BIOLOGY COLLIDE: Why We Are Stressed, Depressed, and Self-Obsessed by E. O. Smith. New Brunswick, NJ: Rutgers University Press, 2002. 266 pages. Hardcover. ISBN: 0813531039.

Smith is an associate professor of anthropology at Emory University. He argues that the discord between our evolved behaviors and current environment "sets up conditions in which there can be real conflict between our evolved psychological predispositions and the dictates of culture." His book is divided into sections on road rage, beauty, diet, depression and welfare. Each chapter is filled with thoroughly researched, documented and fascinating facts.

For example, we learn that in 1917 the physically perfect woman was 5'4" and weighed 137 lbs, while today she is 5'9" and 115 lbs. As we have evolved to store fat to survive, there is a collision between biology and our culture. Smith explains why our evolved preferences for salt and fat and sugar lead to Big Mac attacks.

Under the chapter on depression we learn that the ability to be depressed served an evolutionary purpose. It was to alert us that something is wrong in our environment and needs correcting. Smith does not deny the need to treat depression or condone the use of all anti-depressants. However, anti-depressants today are over-prescribed as a result of drug advertising, cuts by insurance companies to the funding of talk therapy, and the fact that 95% of anti-depressants are prescribed by family doctors, especially to children.

The last chapter, "Welfare, Cooperation and Emotion," tries to explain altruism through evolution. He explains the theories of nepotism and politics. At the end of each chapter are common sense proposals to better society. It appears to me that for Smith, the worth of the individual is axiomatic. Any effort to explain why human life is precious, and self-sacrifice is required of us, will have to go beyond evolutionary biology. I think I will send Smith a copy of C. S. Lewis's *Miracles*.

Reviewed by Leland P. Gamson, 607 W. Spencer Ave., Marion, IN 46952.

INTO THE SHADOWS: A Journey of Faith and Love into Alzheimer's by Robert F. DeHaan. Grand Haven, MI: FaithWalk Publishing, 2003. 256 pages, appendix. Paperback; $14.99. ISBN: 0972419632.

DeHaan, colleague, friend, and fellow ASA member, writes in this profound volume of a journey of a long goodbye, the account of his wife Roberta's descent into the mystery and emptiness of Alzheimer's disease. But it is not so much an account of that journey as it is a powerful love story, of how two lovers gradually and painfully parted.

DeHaan, who before his retirement was the chair of the Psychology Department at Hope College, writes from his heart as he tells the story of the years 1998–2002. It is an account of God's leading along a torturous path, a divine presence that was, and is, sufficient. There is no "Hollywood ending," of course; at this writing (April 2003) Roberta Timmer DeHaan, confined to a nursing home, has almost (but not quite yet) faded from this world. Yet throughout the book, I was continually aware of God's grace and everlasting love, always aware that what I was reading was only "chapter one" of a story which will be continued, in triumph, in glory. The book carries the message of hope to Bob's fellow Christians, who know that not a sparrow falls without God's notice.

On May 2, 2001, Bob and Roberta shared together their last bedtime snack; Roberta would enter the Alzheimer's care unit the next morning. Bob relates (pp. 236-7) how he turned this event into a communion service using pita bread dipped in grape juice. He writes:

> We continued our snack with long silences until the bread was consumed. Then we finished off the juice, she holding the chalice to her lips followed by me doing the same. Roberta looked at me. "That was communion," she commented in a calm voice. "Yes, Roberta," I said, "that was Communion."

As a Stephen Minister, I have read many books which speak to the "long dying" of the Alzheimer patient. This book, written by one with a clear and abiding Christian faith, and also a deep and abiding love for his companion of over fifty years, stands head and shoulders above the rest. Nearly 25% of adults in our country are friends, relatives, or, in some cases, caregivers to someone affected by this disease. If you are one of these, this book is a must read. If you are not, it is worth reading to understand a "real" love story. I cannot recommend it too highly.

Reviewed by John W. Burgeson, Physicist, US Government (retired), IBM Corporation (retired), Denver, CO 80210.

ORIGINS & COSMOLOGY

FROM COMPLEXITY TO LIFE: On the Emergence of Life and Meaning by Niels Henrik Gregersen, ed. New York: Oxford University Press, 2003. 243 pages. Hardcover; $35.00. ISBN: 0195150708.

In its Jan/Feb. 2000 edition, the ASA *Newsletter* reported that a research symposium, sponsored by the John Templeton Foundation, was held in Santa Fe, NM, in October 1999 on the subject "Complexity, Information, and Design: A Critical Approach." Led by Paul Davies, the physicist and prolific popularizer known for books such as *God and the New Physics*, a group of ten leading scientists met to consider the issues raised by information theory and complexity. This book is a collection of essays that came out of that symposium. Gregersen has edited ten previous books and written three more in many fields of systematic theology, often in science and theology. His training is in philosophy of religion and his dissertation examined the interface between theology and culture in programs of theology as science. He is now teaching theology at the Faculty of Theology, Aarhus University, Denmark.

Davies observes in his introduction that "Regardless of our own religious sympathies or antipathies, we approach much of life through emergent qualities such as trust, love, and the sense of beauty ... How does a sense of meaning emerge from a universe of inanimate matter subject to blind and purposeless forces?" The authors contributing to this volume address the question of emergence from a wide spectrum of viewpoints, many of which go well beyond mainstream thought.

In Part I, "Defining Complexity," Gregory Chaitin discusses randomness and mathematical proof in an article reprinted from *Scientific American* (May 1975). Charles Bennett examines various notions of complexity in his reprint. Both authors, whom I am honored to have as colleagues at the IBM Thomas J Watson Research Center, strive for precision in their definitions of randomness and complexity, thereby providing better tools for understanding emergence.

Part II, entitled "The Concept of Information in Physics and Biology," comprises five essays by Stuart Kauffman, Paul Davies, William Dembski, Ian Stewart, and Werner Loewenstein. Kauffman and Dembski provide somewhat more radical views of autonomous agents and intelligent design, respectively, while Stewart informs us of "The Second Law of Gravitics and the Fourth Law of Thermodynamics." Davies and Loewenstein focus on the "arrows of time." Loewenstein's essay alone is worth the price of the book. Addressing "Two Arrows from a Mighty Bow," he explores the implications of time and thermodynamics, concluding that "it gives one a wondrous strange feeling to be able to read the script that nature renders and to peer into her designs ... it is a way, and for a scientist the most satisfying one, to see God in His splendor."

Part III addresses "Philosophical and Religious Perspectives." Harold Morowitz, Arthur Peacocke, and Niels Gregersen contribute the final three essays. Gregersen's concluding contribution, "From Anthropic Design to Self-Organized Complexity" is most valuable. He says:

> ... theology seems to face a stark dilemma. After all, religious life is more interested in the active presence of a providential God in the midst of the world than in a designer God at the edge of the universe. Yet the design argument is viable in the context of the anthropic principle (where its religious significance is rather faint), whereas the design argument seems to be without value in the context of self-organized complexity (where its application would be religiously significant) ... I intend to show, however, that the two theological options – the first concerned

with divine causality and the other concerned with meaning—are indeed supplementary.

The arguments espoused in this volume are themselves complex but glimpses of understanding do indeed begin to emerge from the discussion. The participants in the discussion are prominent figures in current debate on emergence and represent a wide spectrum of views. The ASA community would benefit from reading this book, despite some obtuse sections.

Reviewed by Randy Isaac, IBM Research VP of Science and Technology, South Salem, NY 10590.

DEEPER THAN DARWIN: The Prospect for Religion in the Age of Evolution by John F. Haught. Boulder, CO: Westview Press, 2003. 229 pages, notes. Hardcover; $26.00. ISBN: 0813365902.

Haught describes this book as a sequel to his recent *God After Darwin* (2000). In the introduction, he states its purpose:

> The point of this book is to dig deeper than Darwin. I will assume here the fundamental correctness of evolutionary biology, but I want to question the nonscientific belief that evolutionary biology—or for that matter the cumulative body of natural sciences—amounts to an adequate explanation of living phenomena (p. xi).

The book is largely an answer to materialist readings of reality and criticisms of religion. Not content with merely challenging the views of prominent popularizers of a materialist belief system, Haught goes beyond to address the question of "how, after Darwin, religions may plausibly claim to be bearers of *truth* and not just of meaning and adaptation" (p. xvi).

Many of the arguments that Haught proffers will not be new to readers of his books and articles, but there are some important points. In the second chapter, Haught attacks the literalism that characterizes both young earth creationists' readings of the Bible and materialists' readings of the Book of Nature. He points out that the literalism of the latter lies on two levels. Critics of religion like E. O. Wilson and Daniel Dennett reject the Bible because it and other ancient texts do not provide the scientific information they demand of it. But they as well as Richard Dawkins, Peter Atkins, and Steven Weinberg also literalize nature, claiming to find in it the fundamental "text" that explains everything.

In subsequent chapters, Haught sets out to demonstrate the shallowness of such thinking and the ideological agenda that incorporates it. Contrary to materialists' claims that there is nothing going on in the world besides mindless, impersonal, pointless activities of lifeless matter and genetic domination of evolution, Haught argues that the universe does show purpose and promise, but one has to go to the "inexhaustible depth" out of which revelation "erupts" and inspires religious and theological readings of nature in order to find it. From this perspective Haught proceeds in subsequent chapters to deconstruct the incomplete narratives of reality that Dennett, Dawkins, and others dogmatically proclaim as totalizing. He points out that science itself offers various levels of explanation (physical, chemical, etc.) that are commensurable and complementary, and therefore it is metaphysical and unscientific to latch on to one of them as ultimate.

Haught also faults intelligent design proponents for a similar literalism. He says:

> Both IDT and Darwinian materialism shrink what could be an extensively storied hierarchy of explanations of life down to one level. This single level is construed differently in each case, but both sides refuse to entertain the idea of a plurality of complementary explanations (p. 108).

He also takes on materialist critics who claim that religion is a survival mechanism traceable to genes. Such naturalistic explanations transfer the quality of "striving" that characterizes the religious enterprise to our genes themselves, and "divest all religious teachings of any plausible claims to truth." But in denying a deeper level of explanation that exists alongside the naturalistic, "they end up locating the agency that gives rise to religion in a fictitious realm of subjectivity (that of the selfish gene) ..." (p. 133).

Haught offers an understanding of God's relationship to an evolving creation that draws upon favorite thinkers Alfred North Whitehead and Pierre Teilhard de Chardin, but more foundationally upon the biblical revelation of a God who speaks to the creation from the future. The One who "makes all things new" is a promise-making God whose providential care for this unfinished universe can be characterized as "a reservoir of possibilities gently proffered to the world throughout its creative advance ... Evolution does not destroy but confirms the religious intuition that there is everlasting care at the bottom of things" (p. 158).

Evangelical readers might be struck by the dearth of references to Scripture, but Haught is aiming at a broad audience. He writes in a fulsome style that is sometimes overly repetitive, not wholly accounted for by the fact that the book is based on a number of previously published articles. And his religious notions have the tentative quality of a theology in the making. But the book is worth reading not only for its solid criticisms of materialist belief systems but also for its theological reflections.

Reviewed by Robert J. Schneider, Adjunct Associate Professor, Appalachian State University, Boone, NC 28608.

THE GHOSTS OF EVOLUTION: Nonsensical Fruit, Missing Partners, and Other Ecological Anachronisms by Connie Barlow. New York: Basic Books, 2001. 304 pages. Hardcover; $26.00. ISBN: 465005519.

Barlow is an author and editor whose previous books include *Green Space, Green Time; The Way of Science; Evolution Extended* (editor); and *From Gaia to Selfish Genes* (editor). The basic premise of this book was first introduced in an article published in a 1982 edition of *Science*, coauthored by tropical ecologist Dan Janzen and Pleistocene ecologist Paul Martin. The article, entitled "Neotropical Anachronisms: The Fruits the Gomphotheres Ate," introduced the idea that many of the larger fruits of the tropics tend to pile up and rot beneath the trees that produce them because the dispersal partners they evolved with no lon-

ger exist. Barlow provides further evidence for the validity of this idea while also discussing a number of examples of "anachronistic" fruits from the temperate regions of North America.

What is an evolutionary anachronism? One definition, quoted in the book and provided by Janzen, states that if a tree evolved a trait in response to some pressure and that trait is around later on despite the pressure having been lifted, then that trait is an anachronism. Another definition, suggested by zoologist John Byers, describes anachronisms as traits that are overbuilt, and it is the overbuilt qualities of biological structures, physiologies, or behaviors that encourage us to look for missing partners. The partners that were once so vitally important in shaping these traits, suffered the fate of extinction many centuries ago. The fruits of tropical trees such as avocado and papaya and temperate trees such as osage orange and honey locust are too large for the gapes of currently available mouths. For some botanical anachronisms, the seed is too big to be swallowed; for others the pulp is laced with toxins that no stomach will tolerate today. All such anachronisms are haunted by ghosts. These ghosts (former seed dispersers) were most likely the extinct gomphotheres, glyptodonts, and toxodonts that roamed the earth during the Pleistocene era.

Two ways to test the anachronism idea are described in chapter two. One test involves comparing the array of fruits eaten and seeds dispersed by large mammals of Africa and Asia (elephants, rhinos, etc.) with the fruits of other parts of the world which lack these large mammals. A second test discussed is the test of simulation involving the study of the effects of "reintroducing Pleistocene mammals such as horses to the neotropics and observing their response to the fruits and the response of the plant populations to the mammals." Dan Janzen carried out such tests of simulation with horses on the fruits of crescentia and guanacaste trees. The results indicated that horses, serving as proxies for extinct Peistocene megafauna, are relatively efficient seed dispersers for trees which have no other contemporary dispersal partners. The seed dispersal efficiency of horses and cattle that eat the pods of the honey locust, a tree of temperate North America, is also presented as further evidence for the anachronism concept.

Chapter three is devoted to a presentation of the "megafaunal dispersal syndrome." A number of characteristics of the types of fruits that could only have been dispersed by extinct megafauna are described in detail. This description is followed by criticisms of the anachronism concept in chapter four. One important challenge to the concept centers upon the question of how species of plants that have long lost their dispersal agents could continue to survive for thousands of years. This challenge is answered by a discussion of "compensatory life history traits" such as the ability of a species to live for a long time, the capacity for root sprouting or suckering, and the presence of human mutualists. The author's three-part system of grading potential anachronisms (moderate, substantial, extreme) is also explained in chapter four. Specific examples of each category from the temperate regions of North America are then provided in chapters five and six. Plants discussed include pawpaw, persimmon, osage orange, Kentucky coffee tree, honey locust, desert gourd, and the imported gingko tree. Other potential anachronisms such as the armaments of cacti, hawthorns, Devil's walking stick, and honey locust are also described in detail in chapter seven.

This book is one that definitely should be read by botanists, ecologists, evolutionary biologists, and anyone else who is fascinated by plant morphology and diversity. Notes are provided at the end of each chapter for the serious researcher and an extensive list of references is also included at the end of the book. Numerous black-and-white photos and illustrations are scattered throughout the book, which is also available in paperback. The fact that this book is authored by a science writer rather than a scientist makes it all the more interesting and entertaining to read. Barlow not only explains the science behind the anachronism concept in language that everyone should understand, she also reveals the human side of science with vivid descriptions of her own attempts and the attempts of others to test various seed dispersal hypotheses. The book ends with a warning regarding our current extinction crisis and what it might mean for future generations. She also argues for a stewardship ethic that encompasses even those plants from which we as humans can expect no reward. These plants, she writes, should be kept alive "solely because we choose to honor the past and carry forward the richness of life on Earth." All Christians should seriously consider incorporating this type of attitude toward the natural world into their own world view.

Reviewed by J. David Holland, Associate Professor of Life Science, Nyack College, One South Boulevard, Nyack, NY 10960.

ECHO OF THE BIG BANG by Michael D. Lemonick. Princeton, NJ: Princeton University Press, 2003. 215 pages, index, glossary. Hardcover; $25.00. ISBN: 0691102783.

"This will be a day that everyone will remember where they were when they heard the news." So pronounced John Bachall, director of the Institute of Advanced Study in Princeton. Bachall was not referring to the Colombia shuttle disaster or to the fall of Saddam Hussein's statue in Baghdad, but to the newly released results of the Wilkinson Microwave Anisotropy Probe, or WMAP, on February 11, 2003. (WMAP, initially called MAP, was renamed in honor of David Wilkinson for his decades of pioneering work in experimental cosmology. Sadly, Wilkinson died after a long battle with lymphoma before the end of the mission.)

What does WMAP do? Why are its results monumentally significant? Lemonick, senior science writer for *Time* magazine, answers these questions. With full access to WMAP team members and personally present at various stages of WMAP's development, Lemonick weaves together twelve chapters of history and experiences that culminated in the satellite heralding the age of "precision cosmology."

Lemonick begins with a brief overview of the work of the "usual suspects" associated with the big bang: Einstein, De Sitter, Lemaitre, Friedmann, Slipher, Hubble, and Humason. Early on, however, most astronomers were not ready to accept the big bang, especially since a philosophically more satisfying competitor—the Steady State Theory of Hoyle, Bondi, and Gold—had not been ruled

out. (Incidentally, Fred Hoyle coined the term "big bang" as a derisive appellative during a 1950 radio interview.)

In the mid-forties, George Gamow, Ralph Alpher, and Robert Herman formulated a testable hypothesis for the big bang. They realized that if the universe began in an ultra-hot, dense, brilliant state, remnant blackbody radiation would be pervading the universe at present. This radiation has come to be known as the cosmic microwave background (CMB). It was first detected in 1965 by Bell Labs scientists Arno Penzias and Robert Wilson, who later received the Nobel Prize for their discovery.

In spite of the significance of detecting the CMB, many unknowns about the universe remained: What is its geometry? How much ordinary (baryonic) matter is present? How much cold dark matter is there? What is the true value of Hubble's constant? Is inflation correct? Lemonick explains why anisotropies—minor temperature differences in the CMB that vary with direction—are crucial to answering these questions.

Anisotropies were first seen by the COBE satellite. This important discovery led project scientist George Smoot to claim in 1992 that he had "seen the face of God," a famous comment that pleased crowds but irked fellow COBE investigators and cosmologists in general. (Lemonick takes a chapter to discuss Smoot's somewhat self-centered interaction with other scientists, which is an interesting story in itself.) COBE, however, detected large-scale anisotropies; it could not detect small-scale, acoustic wave anisotropies that contain information about the fundamental characteristics of the cosmos.

Another satellite had to be built to observe what COBE could not, and this is where WMAP comes in. WMAP is a joint effort between the cosmology group at Princeton and NASA Goddard. Lemonick describes the mechanics of bringing together project teams, obtaining funding from NASA, handling external contractors, writing required software, finishing pre-launch testing, and devising solutions to unanticipated problems. Lemonick lifts the curtain on the pains and the triumphs of the team that delivered a successful project that beat out the competition attempting the same kind of measurements.

WMAP was launched on June 30, 2001, but it took about a year's worth of observations before the team felt comfortable releasing their results. WMAP pinned down with astounding accuracy the major parameters of the universe that astronomers have attempted to measure over seven decades. We now know the universe is flat; it contains 4% baryonic matter and 23% cold dark matter; 73% of the universe is mysterious dark energy that is accelerating the expansion; Hubble's constant is 71 kilometers/second/megaparsec; and the first stars formed a mere 200 million years after the big bang. WMAP, in Lemonick's words, is reading the "genome" of cosmology.

Lemonick clearly relates the importance of WMAP and the science behind its mission. His descriptions and personal anecdotes of project scientists (especially David Spergel, Charles Bennett, and Wilkinson) make the reader feel like a neighbor talking over the fence with team members about their work. The book makes for enjoyable, profitable reading for anyone interested in cosmology.

Reviewed by Perry G. Phillips, Magnolia, MA 01930.

SOCIAL SCIENCE

ROLL BACK THE STONE: Death and Burial in the World of Jesus by Byron R. McCane. Harrisburg, PA: Trinity Press International, 2003. 163 pages. Paperback; $20.00. ISBN: 1563384027.

The purpose of this book is to provide information and understanding on how the people of early Roman Palestine dealt with human death. McCane thinks examination of death rituals are effective ways to explore social and cultural boundaries. The author has the qualifications for this task inasmuch as he is an Associate Professor of Religion at Converse College and Academic Director of the Sepphoris Acropolis Excavations in Northern Israel.

McCane gathered his information from both literary and archaeological sources. In addition, he used some sociological and anthropological theory, evidence from Q (a collection of sayings of Jesus), Christian reflections on Jesus' burial, data suggesting Jewish and Christian burial practices were beginning to diverge during the Byzantine Period, and Christian appropriation of paradise images from Greek and Jewish sources.

Jews and Christians in early Roman Palestine shared both a common ethnicity and approach to death. Their concerns about burial in early Roman Palestine were pretty much the same as contemporary folks: how much would it cost, what social impact would it make, how ostentatious would it be, and how sincere were the mourners. (Archelaus's grief at the death of his father Herod the Great was an obvious sham because he mourned in the day and indulged in drunken orgies at night).

Of particular interest to readers of this journal is an analysis of the 2002 report of an ossuary bearing the inscription "James, son of Joseph, brother of Jesus." McCane thinks it unlikely that this is "the first epigraphic mention—from about 63 CE—of Jesus of Nazareth," as contended by Andre Lemaire, an eminent French epigrapher. In reference to Jesus' burial, McCane thinks the New Testament and archaeology support his contention that it was in shame and dishonor.

The book contains an abundance of interesting information about burial ritual in early Roman Palestine. For example, burial was usually done the same day in subterranean caves away from human habitation. Primary burial consisted of interment, eulogies and sympathy expressions. Lamps, perfume bottles, cooking pots, and coins were sometimes buried with the deceased. Family members, for a week following burial, remained in mourning at home and abstained from working, bathing, wearing shoes, and social participation including sexual activity. Secondary burial occurred a year following primary burial. (The year it took to bury someone sheds light on Jesus' statement "Let the dead bury the dead.") It involved collecting the bones of the deceased and placing them with the bones of other relatives. Sarcophagi and ossuaries were sometimes used.

The very long paragraphs in this book (sometimes approaching two pages, 47–9) do not facilitate easy reading. Jesus' conversation with Nicodemus occurred in John 3 (not John 2, p. 99). McCane does not think the Bible

is totally reliable, but he culls information from it and other early writings. The author is helpfully redundant. When he embarks on a new theme, he recounts what he has already stated. His summaries are also helpful.

In conclusion, McCane shares quite a bit of interesting funeral ritual information about what people did, how they felt, and what social significance final rites conveyed in early Roman Palestine. He writes in an engaging fashion, and his background as a teacher and archeologist serve him well in pulling together a lot of relevant data from a variety of sources. Eric Meyers, noted archaeologist from Duke University and McCane's mentor, describes this as a "superbly written work ... sure to turn heads in a new and exciting direction." I agree.

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

AMERICA'S GOD by Mark A. Noll. New York: Oxford University Press, 2002. 622 pages, appendix, notes, glossary, bibliography, index. Hardcover; $35.00. ISBN: 0195151119.

Noll's reputation as a historian of the first rank was assured before he wrote *America's God*. This, his latest in a series of notable works on aspects of American evangelicalism, bodes to enhance that reputation even further. Noll is McManis Professor of Christian Thought at Wheaton (Illinois) College. Among the many books he has written or edited are *God and Mammon: Protestants, Money, and the Market, 1790-1860* (2001), *The Scandal of the Evangelical Mind* (1994), and *Religion and American Politics* (1989). Evangelical and non-evangelical historians alike acknowledge Noll as one of America's leading historians. *America's God* is marked by the excellence of scholarship, insight, and lucidity that are Noll's trademarks.

America's God is a history of American theological thought from the time of Jonathan Edwards until the end of the Civil War. The book sets forth the simple thesis that, between (roughly) 1790 and 1865, Americans wove colonial theology, republicanism, and Scottish common sense philosophy into a distinctly American synthesis that profoundly shaped and was shaped by American social, economic, and political thought. Not until the slavery question divided the nation did this synthesis fall apart

Noll begins by describing theology in colonial America, beginning with the Great Awakening. His emphasis falls on New England Puritanism, but he also discusses colonial Presbyterianism, Anglicanism, and separatist thinking. Noll goes on to describe the subsequent "collapse of the Puritan canopy," followed by the revival of a significantly modified Calvinism that could be harmonized with republican ideas drawn from the Real Whigs of Great Britain and with Scottish common sense philosophy. Noll traces the evolution and consolidation of the new synthesis, an intellectual framework accepted by even those who, like the Methodists and Campbellites, explicitly rejected earlier traditional Calvinism. He then tells how the new American synthesis contributed to the unprecedented surge of evangelism in America following the Second Great Awakening.

Noll recounts both how theology was modified by the American experience and how the new theology provided an intellectual framework (and justification) for the social, political, and economic behavior of nearly all Americans, cultural elites as well common citizens. He does not neglect to tell of the various minorities-African American Christians, Old School Presbyterians, Lutherans and other Protestants with Continental rather than British roots, and Roman Catholics who consciously rejected aspects of the new synthesis and, in some cases, followed other intellectual traditions. Noll makes the case that the era of the synthesis was one in which religion was more important in American public life than before or since, an era in which America was almost Christianized (in white, evangelical Protestant terms). He concludes by demonstrating how the American synthesis was unable to continue holding together a nation increasingly polarized by the slavery issue and by describing how the synthesis itself unraveled.

Noll establishes his case with a wealth of documentation (1494 endnotes, a 29-page bibliography), but does not overwhelm the reader with erudition. Although he rings the changes on his theme over and over again, he does not bore. He defines key terms in a glossary, a boon to a non-historian like me. Though Noll himself is a Presbyterian and devotes much of the book to examining changes in Calvinist thought, he consciously writes in a non-sectarian manner. In his own words, "It is of course impossible to neutralize theological standpoint, but I hope ... that in this book the historian wins out over the theologian."

The reader who has little interest in theology *per se* may wish Noll had focused more on religious events of the era: the revivals of the first and second Great Awakenings, the churching of the frontier, the work of voluntary societies like the American Bible Society, the rise of sects like the Unitarians and Mormons, anti-slavery agitation, and the beginnings of American foreign missions. But this book is for those who believe ideas have consequences. For them it is a must read, a gold mine of facts magisterially interpreted. More than that, *America's God* may help open your eyes (as it has mine), not only to learn the theological history of our nation, but to realize how particularly American is our Christian view of people and things.

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

IS RELIGION KILLING US? by Jack Nelson-Pallmeyer. New York: Trinity Press International, 2003. 169 pages, index. Hardcover; $24.00. ISBN: 1563384086.

Is religion killing us? Yes, says Nelson-Pallmeyer. He claims the Quran and the Bible would lead the reader to justify the use of violence in the name of religion. In his first two chapters he describes the violent perspectives of Islamic groups such as those associated with Ossama bin Laden. Later chapters deal with examples of violent texts in the Quran and the Bible. There is also a discussion of the mainstream Islamic, Jewish, and Christian doctrinal perspectives that go beyond any specific passages. The final chapters offer Nelson-Pallmeyer's answer to the problem of cyclic violence and injustice that result from the violent views of the three religions.

To stop the cycle of violent religious doctrines that logically arise from sacred texts, the author suggests that they not be considered sacred. A literary type of treatment would respect the insights of the religious authors while acknowledging their fallibility and rejecting their violent themes.

Nelson-Pallmeyer thinks Gandhi, Kahn, and Jesus disagreed with the sacredness and blind obedience to violent passages. They relied on their own life experiences and observations which contradict the apparent teachings in the violent passages. Jesus' parable of the workmen in the vineyard who murder the owner's son, is given as an example of how violence leads to violence, and is therefore not the answer. The author continues this theme by constructing a dialogue in which Jesus makes the author's case for desacradizing the religious texts. This is done using the sayings and parables of Jesus as a response to those who interpret the texts literally and dogmatically as the sacred words of God.

Nelson-Pallmeyer also discusses the liberation theology and US foreign policy in Central America, South America, and the Middle East. He claims that an acceptance of religious violence by Americans has resulted in oppression and abuse of many peoples in the name of US security.

The book's strength lies in its frank discussion of the texts and religious doctrines of the three religions discussed. The weakness may be seen in the lack of a defined theology of atonement that would be consistent with this perspective. The reader can infer that the author rejects the traditional themes of atonement and violent judgments of God, but he offers no alternatives. Nelson-Pallmeyer's approach seems to lead to an undeified Christ for whom atonement themes were added later as Christianity evolved from the violent religion theologies of the day. The author does not address this issue directly. Perhaps he thinks it is too large a subject to include.

This book would be a useful resource for anyone interested in a better understanding of religious violence stemming from religious texts.

Jack Nelson-Pallmeyer, Assistant Professor of Justice and Peace Studies at the University of St. Thomas in St. Paul, Minnesota, has authored *Jesus Against Christianity: Reclaiming the Missing Jesus* and *School of Assassins: Guns, Greed, and Globalization*.

Reviewed by Gary De Boer, Assistant Professor of Chemistry, LeTourneau University, Longview, TX 75607-7001.

MY BROTHER'S KEEPER: What the Social Sciences Do (and Don't) Tell Us about Masculinity by Mary Stewart Van Leeuwen. Downers Grove, IL: InterVarsity Press, 2002. 255 pages, indexes. Paperback; $17.00. ISBN: 0830826904.

This book is a companion to Van Leeuwen's renowned *Gender and Grace* (IVP, 1990). Based on social scientific data and theological values in women's studies, it focused upon the desirability of mutuality and flexibility instead of hierarchy and rigidity in gender roles and relationships. This analysis from the perspective of masculinity aims to help readers "understand some of the cultural, historical, developmental and biological forces within which men as well as women are called to make responsible and just decisions about gender relations as God's stewards and regents on earth" (p. 10). It fully accomplishes that goal.

The widely-published professor of psychology and philosophy at Eastern University cites so many resources, mostly in bottom-page footnotes, that the four-column Name Index consumes more than four pages. (Alas, the Subject Index of just over two pages is far from complete.) If there were a Scripture Index, it would be impressive, for references to Bible passages repeatedly appear. Misinterpretations of Scripture about gender roles and doctrines of rigid separate spheres for men and women that are unfair to both men and women are behind many discussions. These need correction because they are inconsistent with cross-cultural observations, biblical values, and the variability among either men or women that far exceeds average differences between them. Overascribing selected traits to either men or women from passages like Gen. 1:28 and 3:16 transforms cultural mandates of sociability and dominion that God intended to be "mere scaffolding for life ... into the entire building" (p. 48).

The twelve chapters are organized under four parts: Background Issues (masculinity problems and Bible interpretations), Disciplinary Perspectives (biology, developmental psychology; culture studies), Continuing Challenges (evolutionary psychology and the feminist and masculine distortions of religious and cultural advocacy), and Contemporary Applications (marriage, parenting, sexuality, and an agenda for gender reconciliation).

Among the interesting topics covered are the health benefits of Christianity and of marriage, the harm that occurs from "harmless pornography," original sin as a generic "stubborn determination to function apart from God" and a source of specific sins like patriarchalism, the Promise Keepers as "a moving target in an evangelical landscape," the biased selectivity of "scientific rationality" that's more correctly labeled "scientific rationalization," and the complicity of evangelical Protestants with the cultural values and behavior patterns related to divorce, sexuality, and marriage of their society. We now are reaping the cumulative effects from three decades of "relational junk food" (p. 208).

Perhaps because Van Leeuwen's main emphasis is on the social sciences, she omitted explicit reference to Rom. 12:2, even though non-conformity to this world is her major theme. The case for Christian non-compliance with culture and the recognition that all cultural practices must be judged by both God's creation and the distortions resulting from human fallenness pervade her discussions. Similarly, her solid emphasis on biblical values about the need for flexible shared leadership in marital relationships and parenting could have been reinforced by reference to Eph. 5:21, for the teaching that all Christians should be subject to one another out of reverence for Christ is the central message of Eph. 5:22–6:9.

Everyone puzzled by questions about "proper" relationships between men and women, what the Bible and the biological and social sciences reveal about relationships between them, how to promote shalom in families and society, or where to find relevant studies on gender

relationships in contemporary society will benefit from this thorough exposition.

Reviewed by David O. Moberg, Sociology Professor Emeritus, Marquette University, 7120 W. Dove Ct., Milwaukee, WI 53223.

Letters

A Response to Carol Hill's "Noachian Flood" Account

I must say Carol A. Hill's article "The Noachian Flood: Universal or Local?" (Sept. 2002) was a thriller to read. She almost had me convinced she had found the answers among biblical theology, biblical history, and real earth history. She says that she is taking the "realistic approach," Genesis is truthful, and, of course, the scientific disciplines can also accurately be applied. For Carol to come to her conclusions, she has to set two dates.

First, she sets a date for Noah to be alive at about 3000–2900 BC.[1] I am sure there are many Christian groups that would say she is 500 years later than what it should be. Next, Carol thinks that there was a great Mesopotamia flood that happened at about the same time frame in Kish, Shuruppak, Uruk [biblical Erech], and Lagash. Her flood happened about 1,000 years after the Mesopotamia flood which Sir Charles L. Woolley discovered while he was excavating in Ur.[2]

One of the main problems with Carol's flood in 3000 BC at Kish is that the excavations found four different levels of flood clay, not one. They extended over a period of about four centuries. The earliest was dated to about 3300 BC, the latest to about 2900 BC and the upper most level was about one foot deep compared to ten feet at Ur. The question then is: Which one of the four local flood levels should be chosen as the basis for building a flood legend for the biblical texts? The excavators found that none of the layers seem to be that significant, and the multiple layers dampen the enthusiasm for identifying any one of them with the biblical story. Also the sterile soil layers at Lagash probably did not come from a local river or canal flood but was rather from the foundation of one of the temples of Lagash, according to Andre Parrot, who excavated Telloh in 1930–1931.[3]

In the other two sites both in the same canal, Eric Schmidt found a deposit of alluvium two feet deep in tell Fara and Julius Jordon found a sterile stratum in Uruk, five feet thick. If we look at all the flood mud in these four cities we find that none of them comes close to what Woolley found in Ur. When the pattern is considered as a whole, however, there is very little archaeological proof for such a big flood theory for 3000 BC.[4]

Carol's theory is that Mesopotamia was Eden and that God placed Adam/Eve there about 5500 BC. In around 3000 BC, Noah was in a big flood that killed all but eight people. If this theory is true then somewhere in the book of Genesis there should be two devastating flood stories, the first flood in Eden was in 4000 BC that Utnapishtim the Sumerian wrote about and the second in 3000 BC about Noah and his Ark. One would think, if there had been two great floods in Eden that almost wiped out civilization twice, then surely God would have recorded it in the book of Genesis.

But for the sake of argument, let's consider Carol's theory that there was a big flood in 3000 BC in Eden and that God first created humankind there in about 5500 BC. How does she account for all the people who had been living in Old Jericho for 4,000 years before the biblical creation date of 5500 BC?[5] Also Carol claims that *Homo sapiens* have been on earth from 50,000 to 150,000 years.[6] I was wondering how she correlates this with Christianity and Original Sin.

I have noticed in Carol's last two published articles that she uses a lot of ambiguous scenarios: it might be, it could be, most likely, seems to suggest, it is probable, one can imagine, this must be, therefore, it must have been, if there was, it is possible, etc. Then in her "conclusions," somehow her ambiguous scenarios leap into a positive logical conclusion. These so-called "leaps of logic" are not what scientific-minded people should delve into.

There is a point or two that I would like to add that Carol did not address in her article on the local flood. The Tigris/Euphrates valley is like a half-bowl, any water you put in at the western end of the half-bowl valley will never fill the valley because it is always runs down hill. And water in a riverine flood travels at a speed of about 3–5 miles per hour, and occasionally faster. The Mesopotamian basin generally flows to the southeast, which is where the Ark would travel. Carol's map, on p. 173, shows that the Tigris River is about 1200 miles long. If we assume that the floodwaters were very heavy, say up to seven miles per hour, it would take only 170 hours or about seven days to float the entire length of the Tigris River in heavy floodwaters. The story in Genesis says that it rained 40 days and 40 nights and that the flood waters abated after five months, about 150 days (Gen. 8:3–4). But wait a minute; Carol says that the Ark landed at a place called "Jabel Judi" which is only about 120 miles from the headwaters of the Tigris River. If what Carol says is true, then the only place the Ark could have been built was up stream from "Jabel Judi," which means that the Ark only floated about 120 miles and in just seventeen hours, or about one day. How does Carol explain where the rest of the 149 days were spent for the good ship Ark to cruise?

What I do not understand is why Carol is trying to make Mesopotamia and Eden the same place? According to Gen. 3:23–24, God cast Adam and Eve out of the Garden of Eden when they sinned and put a flaming sword at the east end of the garden. No one should have been living in Eden when one or both of the Genesis flood stories happened. This one truth alone negates all of Carol's Mesopotamia/Eden ideas.

I am sorry but I cannot find any "realistic approach" to Carol's theories.

Notes

[1]Carol A. Hill, "A Time and a Place for Noah," *Perspectives on Science and Christian Faith* 53, no.1 (March 2001): 24–40.

[2]Read chap. 3, "Digging up the Flood," in Werner Keller, *The Bible as History* (New York: William Morrow and Co., Inc., 1981).

[3]Dr. William H. Shea, "The Flood: Just a Local Catastrophe?" http://education.gc.adventist.org/dialogue/essays/Shea.htm

Letters

[4]Ibid.
[5]"Jericho," *Encyclopedia Americana* (1996) and at www.visit-palestine.com/jericho/places/place.htm
[6]Private e-mail with Carol in 2003.

Arlan Blodgett
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Just Wait

I would like to briefly address Arlan Blodgett's letter, "A Response to Carol Hill's 'Noachian Flood' Account."

1. *Date for Noah/Flood.* Yes, I know that many Christians date the Flood 500-1000 years before ~3000 BC. Some also date it much later than I do. This is because there is no real way of knowing when Noah's Flood occurred, and so one can only do one's best to bracket the date using clues from archaeology and the Bible (which I tried to do in my article "A Time and Place for Noah," *PSCF* 53, no. 1 [March 2001]: 24–40). If it happened a thousand years earlier, Noah's Flood could correspond to the flood of Utnapishtim (the date of which is not firm) and to Woolley's "flood deposits" at Ur. However, since floods are endemic to Mesopotamia, this could have been another flood entirely.

2. *Flood Deposits.* Two points relate to this discussion:

   (a) Floods not only *deposit* sediment, they also *erode* sediment. Therefore, the intensity or "greatness" of a past flood *cannot* be determined by the thickness of sedimentary deposits in any specific place (such as at Ur).

   (b) There have been no recent comprehensive studies done on the absolute dating, distribution, deep drilling, or correlation of flood deposits in different parts of the Mesopotamian hydrologic basin. Most studies are old, such as those of Woolley (1920s) and Parrot (1930s). Therefore, any firm conclusions concerning the age and extent of flood deposits in Mesopotamia is premature (i.e., "ambiguous," and so should be treated as such, as I have tried to do).

3. In my past articles on the Garden of Eden and the Flood (*PSCF*, March 2000, March 2001, September 2002), I do not discuss the Origins problem at all—for good reason. This is a very complicated and controversial subject that is not possible to address in a short paper, let alone in a brief response letter. For one possible scenario, the reader is referred to John McIntyre's article on "The Historical Adam" (*PSCF* 54, no. 3 [September 2002]: 150–7).

4. *How Could the Ark Have Traveled Up-Gradient to Jabal Judi?* A series of articles on the hydrology of the Flood is planned for sometime in the future. Arlan Blodgett and others will just have to wait for this explanation.

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Concordism Revisited

I have followed with interest the correspondence between Carol Hill, Art Hill, and Paul Seely concerning a local Genesis flood (*PSCF* March 2003, June 2003, and September 2003). However, not being a geologist, I do not wish to enter into the discussion about the nature of the flood itself.

On the other hand, I would like to comment on an issue that Seely raises concerning the kind of record presented in the early chapters of Genesis. In his letter (June 2003), Seely comments:

> I do not believe that concordism's long-standing attempt to read Scripture as describing a merely local flood covering no more than Mesopotamia or the Black Sea is any closer to the biblical data than creation science is to the scientific data.

The purpose of this letter is to note that present archeological data lead to the *presumption* that the chapters of Genesis before Abraham in 2000 BC (chapter 11 back to the formation of Adam in Gen 2:7) present the same kind of reliable history as the chapters after Abraham. Because of this *presumption*, the interpretation of these early chapters (including the flood in chapters 6–8) should assume that the Genesis record is historical.

The basis for this *presumption* of historicity for the early chapters of Genesis is that Scripture has been shown to be in agreement with secular history back to Abraham. For example, in his *History of Israel* (1959), John Bright writes:

> It has become increasingly evident that a new and more sympathetic evaluation of the traditions is called for ... Far the most important of these (various lines of objective study) has been the light cast by archaeological research on the age of Israel's origin ... And, as the early second millennium has emerged into the light of day, it has become clear that the patriarchal narratives, far from reflecting the circumstances of a later day, fit precisely in the age of which they purport to tell.[1]

Bright repeats this statement verbatim in the 1981 edition of his book.

Scriptural history, then, is reliable back through Abraham (about 2000 BC) in Chapter 12 of Genesis. But the earlier chapters of Genesis, back to the formation of Adam in Gen 2:7, are connected by genealogies to Abraham. Furthermore, these genealogies are repeated without interruption in Luke 3 from Christ to Adam through Abraham. The *presumption*, then, is that the history before Abraham is a continuation of the confirmed history after Abraham. The account of the flood, as part of the history before Abraham, should be historical.

During his investigation of Adam,[2] I have been surprised how often secular history supports the *presumption* that the Adam of Gen 2–4 is an historical person. Scripture presents Adam as a farmer in lower Mesopotamia with sons who are a farmer and a herdsman. From this information, secular history (archeology) concludes that Adam and his sons lived in Mesopotamia after 10,000 BC.[3] This being true, secular history also reveals that other people were living in Mesopotamia at the same time as Adam and his family. The presence of these people from secular

history in turn explains several of the puzzles in Scripture arising from the traditional assumption that Adam was the first man. Cain found a wife from among these Mesopotamians and Cain's fear of other men becomes understandable. Scripture also says that Cain was building a city east of Eden. Again, Scripture interacts with secular history which knows that the first cities in the world were built in Mesopotamia and in the Susiana plain 250 km to the east about 4000 BC.[4] Assuming the scriptural and the archeological cities to be the same, this information dates Cain after about 4000 BC. And finally, the puzzling passage in Gen 6:1 can be explained:

> When men began to increase in number on the earth and daughters were born to them, the sons of God saw that the daughters of men were beautiful, and they married any of them they chose.

The commentators explain the sons of God as angels[5] or as pagan myths.[6] On the other hand, with an historical scriptural Adam the sons of God are from Adam's family (Adam is called the son of God in Luke 3:37) and the daughters of men are children of the Mesopotamians living at the same time. Just as for the scriptural account of Abraham, the scriptural account of Adam "fits precisely in the age of which it purports to tell."

We are witnessing, then, the same uncovering of Scripture as that for other ancient historical records. When I was in school, we were taught that the Trojan Wars were a myth. Now Troy has been found and dated. As ancient history continues to come up over the horizon of time, we are finally seeing the early chapters of Genesis come into view.

Notes

[1]John Bright, *A History of Israel* (Philadelphia: Westminster, 1959), 62–3.
[2]John A. McIntyre, "The Historical Adam," *Perspectives on Science and Christian Faith* 54 (2002): 150–7.
[3]See e.g., R. J. Wenke, *Patterns in Prehistory* (New York: Oxford, 1999), 289.
[4]Wenke, *Patterns in Prehistory*, 404–8.
[5]Gerhard von Rad, *Genesis* (Philadelphia: Westminster, 1961), 113.
[6]Claus Westermann, *Genesis* (Grand Rapids, MI: Eerdmans, 1987), 43; and Bruce Vawter, *On Genesis* (Garden City: Doubleday, 1977), 110.

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On the Hills of Concordism and Creation Science

In his contribution to the discussion of the extent of Noah's flood,[1] Paul Seely explains why he doubts that "concordism's long-standing attempt to read Scripture as describing a merely local flood covering no more than Mesopotamia or the Black Sea is any closer to the biblical data than creation science is to the scientific data." He evidently believes that the Genesis flood account is an inspired version of an ancient myth, a "theological revelation ... accommodated to the already ingrained prehistorical traditions present in Israel at the time that God revealed himself to them."

We may seem to have only three major alternatives: Moses gave either (1) a true account of a local flood, (2) a true account of a flood that left no land above the waves anywhere on the planet, or (3) a fictional account of a flood too extensive to be considered merely local. Probably very few *PSCF* readers know that a fourth alternative has recently been advanced: (4) a true account of a flood that was neither merely local nor quite universal.

According to Seely, the flood account in Genesis implies "that God has spoken in Scripture ... as a Father to his little children, as a tutor (Gal. 3:24), accommodating his theological lessons to the mentality and preconceptions of his young children, aware that in time they will learn better of both history and science." We can agree that God speaks to us as Father, tutoring even through such things as the law of Moses, yet knowing that his people would not always remain under its supervision (Gal. 3:25). One must also concede that the Bible includes only a small part of all history and science (John 21:25).

The interesting question here is whether God uses fictional stories, cleverly disguised as factual history, to reveal some kind of truth, as Seely evidently believes. References to a "literally moving sun" do not prove his hypothesis. Even modern astronomy texts mention sunset as though it were the sun, not the earth, that moves, and since the Bible is for ordinary people, it is no surprise to find terms like *earth*, *sky*, and *star* that are understood more superficially by some folks than by others. There may even be popular misconceptions related to such things, of course, but pedantic technicalities alone cannot compromise the gist or integrity of a history.

If God actually does teach through fiction in the guise of history, then how can one separate fact from myth when reading the Bible? Did Jesus really rise from the dead, or was the resurrection story only an accommodation for people too ignorant to know that such a thing is impossible? To the men who wrote John 21:24, Gal. 1:11–12, and 2 Peter 1:16, confidence in the trustworthiness of God's words, warnings, and promises was more precious than life. We can conclude that the Christian faith is supposed to be rooted in factual history stretching seamlessly all the way back to creation (Acts 7; 2 Peter 2:4–9; and 3:3–7).

Seely wrote: "Nowhere in Scripture does God say or imply with logical necessity that divine inspiration guarantees the scientific and historical accuracy of biblical historical accounts." How then should we understand Hebrews 11? Here several heroes of faith are mentioned, including Abel, Noah, Moses, Samuel, and the prophets. At the very end of the chapter, the writer even works himself and his readers into the mix. If Noah is fictional, what about the others? Would the tutorial value of the chapter be enhanced in our day by including Spiderman or Santa Claus to impress children who might believe these are all real people?

To what extent can history as recorded in the Old Testament be confirmed through secular data? Sixty or seventy years ago, the kingdoms of Judah and Israel could not be related with confidence to the secular history of the region, and the recorded lengths of the various reigns appeared to

be hopelessly inconsistent. Then Edwin Thiele solved the puzzle, and the accuracy of this part of the Bible has been firmly established ever since.[2] The period in question began in 931 BC, but unfortunately, clear synchronizations with Old Testament stories about earlier periods have been difficult to find and defend, suggesting that something may be seriously wrong with one or more of the chronologies being compared. Many scholars, evidently including Seely, have concluded instead that we should not regard the older stories as real history after all.

Gerald Aardsma has recently published theories that arguably solve the Old Testament chronology problem all the way back to creation. His key claim is that 1 Kings 6:1 ought to be emended to restore one digit dropped through an early scribal error.[3] It should read the 1480th year, not the 480th year. This one simple correction shifts the chronology of all events before the time of the judges back a full millennium.

Better evidence for synchronizations with secular data in the earlier periods of interest suggests that Aardsma really is onto something exciting, at least for those of us who rejoice to find the Bible vindicated. This evidence points to a flood in 3520–21 BC that was by no means merely local.[4] The challenge for Seely is to prove his own claim "that no global flood has occurred in the last 10,000 years and more." We should be skeptical, because negatives are notoriously difficult to prove. Even if Aardsma's unconventional flood theory later proves to be false, his idea about a chronological correction may well remain valid regardless.

According to Aardsma, the flood was the result of water from the southern oceans moving north to cover most of the northern hemisphere,[5] leaving some areas dry: Antarctica, Australia, the southern parts of Africa and America, as well as northern lands at low latitudes or high altitudes. Aardsma believes the event was too tranquil to have deposited all the global sedimentary rock that most creationists attribute to the flood, but the flooded populations were destroyed. Aardsma has also proposed a physical cause for this flood. Some may prematurely dismiss his suggestion, but people who give it a fair hearing should find it reasonable and promising on closer examination.

If Aardsma's theories prevail, we should agree with the claim by Art Hill, Paul Seely, and the creationists that the flood was not merely local, and with the claim by Carol Hill and Seely that geological data may cast doubt on some aspects of the flood model popular among creationists. We should also agree with both Hills that God gave us factual narratives, even in Genesis 1–11. The prospects for corroborating this point are too good to recommend joining Seely's desperate expedition beyond the "Hills" of concordism and creation science.

Notes

[1]"Beyond the Hills of Concordism and Creation Science" in *PSCF* (June 2003): 138–9. The title alludes to earlier *PSCF* letters by Art Hill and Carol Hill.

[2]Edwin R. Thiele, *The Mysterious Numbers of the Hebrew Kings*, new revised edition (Grand Rapids, MI: Kregel Publications, 1983).

[3]Gerald E. Aardsma, *A New Approach to the Chronology of Biblical History from Abraham to Samuel*, 2d ed. (Loda, IL: Aardsma Research & Publishing, 1995); Gerald E. Aardsma, "New Radiocarbon Dates for the Reed Mat from the Cave of the Treasure, Israel," *Radiocarbon* 43:3 (2001): 1247–54; and H. J. Bruins, I. Carmi, and E. Boaretto, eds., *Proceedings of the 17th International ^{14}C Conference*.

[4]Gerald E. Aardsma, "Noah's Flood: The Irish Evidence," *The Biblical Chronologist* 5.3 (1999): 1–7.

[5]Gerald E. Aardsma, "The Origin and Antiquity of the Biblical Text," *The Biblical Chronologist* 8.6 (2002): 2–3.

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Reflections on Newman's "Problems for Theistic Evolution"

I am writing in response to the article by Robert Newman, "Some Problems for Theistic Evolution," that appeared in the June 2003 issue of *PSCF*. I will address the theological issues that he raises, since the scientific ones are covered elsewhere.

I favor the view that Adam and Eve are historical individuals who underwent the Fall as described in Genesis 3. However, the fundamental Christian doctrine here is that all humankind is sinful and in need of God's forgiveness, not exactly how we came to be in that unhappy state. The Bible contains plenty of evidence for our fallen state, even if the book of Genesis were to disappear tomorrow without a trace (see Rom. 3:23).

The text of Genesis 2-3 does indeed contain indications that it is in part a symbolic account. We have:

1. A snake that can talk. Most readers assume that the serpent is Satan.
2. Trees of Life and the Knowledge of Good and Evil. These are not ordinary trees.
3. Adam and Eve, who stand in spiritually for the entire human race.
4. Curses given and received. These fall upon all descendants of the primary character.
5. A messianic prophecy given in Gen. 3:15. Note that an event can be both historical and symbolic, as when Pontius Pilate washed his hands before the crucifixion of Jesus Christ.

Glenn Morton and I both affirm an interventionist view of human origins, where God stepped into a biological line of succession and made something spiritually special happen. God did something similar with Moses in selecting him to receive his covenant, and later became incarnate in the second Adam, Jesus Christ (see 1 Cor. 15:45). If Jesus was willing to come into this world through an ordinary family in Bethlehem, why should we object to our origins from a bipedal primate in a corner of Africa? God is in the business of exalting the lowly and raising up the humble.

God somehow "sustains" the world by natural means that science can explore; and by outright miracles, which science cannot. God works both ways. When we get to heaven he will answer all our questions in person. Until then, science in general, and biological evolution in particular, will continue to be the witness of God's creation.

The heavens are still telling the glory of God! (Ps. 19:1). So is the earth beneath our feet.

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Newman's Reply to Drews

I have no particular objections to Carl Drews' letter, as he does not deny the historicity of the account. I affirm that God often uses symbolic actions (which, however, are real actions). I would not weight the talking snake as counting against historicity, given the similar Balaam incident in Numbers 22. The phenomenon of prophecy spoken to people directly but applied to their descendants has precedent in Genesis 49.

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"The House of Elijah"

In reviewing Repcheck's *The Man Who Found Time* in the September 2003 issue of *PSCF* (p. 196), Robert Rogland quoted from it: "... the prophecy ... of Elijah ... proclaimed that the last two thousand years of the total six thousand would be the Age of the Messiah." Rogland then commented: "That is not in my Bible." However, the "House of Elijah" is connected with similar information on "the age of the Messiah" in the Talmud, as cited in a scholarly critique by James Barr: "Why the World was Created in 4004 BC: Archbishop Ussher and Biblical Chronology" in the *Bulletin of the John Rylands University Library of Manchester* 67 (pp. 575–608). Barr, Regius Professor of Hebrew at Oxford, writes:

> In placing creation around 4000 years before Christ, Ussher had ... predecessors. The Talmud itself had spoken to the same effect: B. Abodah Zarah 9a (Soncino, ed., p. 43) ... reported the Tanna of the House of Elijah as saying "The world is to exist 6000 years. The first 2000 years are to be void (Hebrew *tohu*); the next 2000 years are the period of the Torah; ... the following 2000 years are the period of the Messiah."

Barr's article came from his lecture at Rylands University in May 1984, and Stephen J. Gould cited Barr in "Fall in the House of Ussher" (*Natural History* [11/91]: 16).

ASA member Davis Young also wrote about this matter in his book, *Christianity & the Age of the Earth* (Grand Rapids, MI: Zondervan [1982], 20):

> (A) widespread conviction existed that the present world order would last for six thousand years ... (then) ... Christ would return to establish His kingdom. ... the church fathers regarded the days of creation as ordinary days ... Yet they (also regarded) the days in a more figurative sense. Virtually all of them were struck by Psalm 90:4, "For a thousand years in your sight are like a day" and by 2 Peter 3:8, "With the Lord a day is like a thousand years ..." They had no difficulty in transferring the days of creation into thousand-year periods on (this) basis. They did not believe that the creation had taken place over six millennia but that ... human history would occupy six thousand years, a millennium of history for each of the six days of creation ... Why this connection was made is obscure. No reason for it is given by the fathers; it was simply assumed and taught.

An explanation for this enigma may be that the church fathers knew of the information reported by the Tanna (House of Elijah) in the Talmud, described above in Barr's quote.

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Randomness and Divine Agency

In their article "Random Worms: Evidence of Random and Nonrandom Processes in the Chromosomal Structure of Archaea, Bacteria and Eukaryotes" (*PSCF* 55, no. 3 [September 2003]: 175–84), Glenn Morton and Gordon Simons make a valuable contribution to the design debate. However, a couple of comments might be in order.

First, I am not sure they have correctly applied biblical references to the Urim and Thrummim or to casting lots. In those examples, the point is not that God used randomness, the point is that when instruments of chance were employed to seek the divine will, the outcome was not random at all. As the authors themselves say, "God predetermined the result" (p. 176, bottom of the left hand column). A predetermined result is not an expression of chance. That makes the application of those examples to processes in nature problematic. If "humans are not able to distinguish between the appearance of chance and the actuality of chance" (p. 176, top of the first full paragraph in the right hand column), and if "randomness is something that cannot be proven" (p. 178, top of the first full paragraph of the right hand column), then it is not clear why "Christian apologists need to incorporate chance and randomness into their world views" (p. 183, bottom of the right hand column). After all, we can neither distinguish it nor prove it, and it does not exist from God's point of view.

Second, the authors claim that "Dembski's model is inadequate to the task he intends" (p. 183, middle of the second full paragraph in the left hand column). But if randomness cannot be distinguished or proved, if, as the authors maintain, it is an illusion created by human perspective, and if higher information content creates the appearance of randomness (p. 183, top of the left hand column), then it seems to me that the "bar" for Dembski is lowered, not raised. Under such circumstances, all Dembski must do is provide a plausible alternative to the randomness claim.

Letters

It may be that the authors were thinking along the lines of the Westminster Confession where in the second section of the fifth chapter we read: "Although in relation to the foreknowledge and decree of God, the first cause, all things come to pass immutably and infallibly, yet by the same providence he ordereth them to fall out, according to the nature of the second causes, either necessarily, freely, or contingently." If so, it would have been helpful had they made that explicit. However, I suspect they might have been thinking more along the lines laid out by Peter Zoeller-Greer in his March 2000 article, "Genesis, Quantum Physics and Reality" (*PSCF* 52, no. 1, pp. 8–17). Again, it would be interesting to know.

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Divine Sovereignty, Chance and Design: A Response to Carter

We are delighted that our article (*PSCF* 55, no. 3 [September 2003]: 175–84) has elicited further discussion of the role of randomness in Christian theology and we hope this continues. In response to Carter's first point, we wonder what evidence he has that "a predetermined result [by God] is not an expression of chance [from our vantage point]." This statement appears to us to have the earmarks of an unsupportable faith statement. Consider the situation if we flip a series of coins, observe the outcome, but do not tell you what the sequence is. Then, we ask you to guess the sequence one by one. From our perspective the coin tosses are predetermined, but for you, it appears random. We are making no claim that God needs to flip a coin to make decisions that appear to us to be random ones. We suspect that he does not, but we have no way of knowing one way or the other. We recognize that Christians have a difficult time accepting that what appears random to us can actually be fully within the scope of a sovereign God, but one of the points of the paper is to encourage Christians to get over this conceptual difficulty. We think the interpretation we have given to random-appearing events described in the Bible is a reasonable one, which in no way robs God of his sovereignty. Moreover, as we have explained in some detail, it squares well with what has been observed in DNA sequences.

We think it unwise for Christians to draw a line in the sand and insist that an appearance of randomness to humans is evidence to support an atheistic viewpoint—and therefore must be resisted at all cost. Of course, non-Christians are just as vulnerable as Christians are to fall into this trap. There is no justifiable reason for Christians to expect better of non-Christians. But Christians, who have properly digested the message of God to Job, should be able to accept, with humility and due reverence to their Creator, the huge gap between God's perspective and ours. Rather than argue with the non-Christian that what clearly appears random is not, we should agree with them that it really does appear random, and then point to the scriptural references (cited in our original article), which shows that God is still God.

Concerning the second point about lowering the bar for the detection of design, we do not feel that it is lowered. Just as with randomness, which cannot be proven, neither can design be proven. When an entire group of people is engaged in trying to prove the demonstrably unprovable, the assessment, "a waste of time," comes to mind. We must remember that Christianity is a faith, not a proof.

Finally, as to what "lines" we were thinking along, we were merely incorporating what we were seeing in the statistical structure of DNA into what we view as the best theological approach, given the observational data. Since we wrote this article for *PSCF*, we have encountered even more compelling evidence of randomness in DNA data, including human DNA data. Anyone who is interested may request an electronic copy of the manuscript "Global Markov Models for Eukaryote Base Data."

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What Is Randomness?

Randomness is a phenomenon very hard to verify. Statistical tests are used to test for randomness. Every statistical test is based on a null hypothesis (e.g., randomness) and a probability model associated with the null hypothesis. The test statistic is a condensation or summarization of data (e.g., a measure of randomness), and it has sampling distributions under the assumed probability model. The test statistic obtained from the data with its numerical value is compared with this sampling distribution. If the value is too extreme, then one can reject the null hypothesis. If the value is not extreme, one can only conclude that the null hypothesis is not rejected, but not that the null hypothesis is established. The reasons are several: the sample size may not provide enough power to reject the null hypothesis, the particular test is not powerful against certain deviations from the null hypothesis, or there are other possible probability models associated with the null hypothesis. Usually one could not conclude randomness just by a single test or measure. However, Morton and Simons (*PSCF* 55 [2003]: 175–84) used only one measure, the length of string, to carry out statistical tests. Their tests are examples of tests based on the total number of runs (See Jean D. Gibbons and S. Chakraborti, *Nonparametric Statistical Inference*, 3rd ed. [New York: Marcel Dekker, 1992], 68–93). There are other aspects and measures in the chromosomal structure that are worthwhile investigating (See Bruce S. Weir, *Genetic Data Analysis II: Methods for Discrete Population Genetic Data* [Sunderland, MA: Sinauer Associates, 1996], 291–340).

From Figure 1 (p. 179 in the Morton and Simons article), the total number of genes is 512, which is different from 522, the number given in the first row of Table 1 (p. 180). [*Managing Editor's note*: There is a typesetting mistake in Figure 1. In row Strings 61–80, the number in the tenth col-

umn should read 12, not 2.] The test provided (Model 1) has two components: one is for p = 0.5 and the other for randomness in arrangement. When the test statistic has extreme value, it could be due to deviation in either component or both. It will be useful to separate the test into these two components and find out what is the reason for deviation. It seems that there is no *a priori* reason why p should be 0.5; the deviation from p = 0.5 should not be viewed as against randomness. After decomposing the test, more insights could be gained. From the results given in the paper one can only make a limited conclusion that, regarding the length of strings and under the probability models considered, more randomness is found in more complex eukaryotes.

Even if a collection of data can pass many tests of randomness, it may not warrant the conclusion that the data are random. For example, the random numbers generated by computer are called pseudo-random numbers because they are not truly random. They could pass many tests of randomness, but they are generated by a deterministic algorithm. When one knows the seed number and the detailed algorithm, the data sequence is entirely predictable. The same is true for some chaotic patterns. They are generated by some deterministic means, which could be repeated under the identical initial conditions. Therefore, appearance of unpredictability is compatible with algorithmic determinism. Some choose to differentiate between unpredictability and randomness.

Randomness can only be evaluated in a population scale (Dembski distinguishes between randomness and chance). All of the statistical tests depend on sufficient amount of data. Even if a collection of data is random (passes all tests of randomness), that does not imply that an individual data point is necessarily random. Therefore, population randomness is compatible with individual determinism. That could be the basis of statements in Prov. 16:33 and Rom. 8:28. That also provides justification of applying probability theory and statistical models for the investigation of natural and human phenomena. For all practical purposes, the probability theory and statistical models provide good approximations or descriptions of some population phenomena. Florence Nightingale was quoted in saying: "To understand God's thoughts we must study statistics, for these are the measure of his purpose."

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Can Inanimate Objects Exercise Rationality?

The shortcoming I see in the article "Faith and the Human Genome" by Francis Collins (*PSCF* 55, no. 3 [September 2003]: 142–53) is just about as fundamental as a shortcoming can be. Collins asks inanimate objects to exercise rational judgment. Yes, it is "amazing to contemplate the elegance of DNA carrying information." But it is even more than amazing to go one more step and to contemplate how inert materials know how and when to do what needs to be done if a process is to proceed as required. The author is certainly not alone in saying that clumps of inanimate atoms are "able to direct all of the biological properties in a human being." In fact, I am made to feel like a very lone voice in the vastest of wildernesses when I argue that articles such as this one only describe the prosaic, the superficial features of biological events and circumstances. As such, the resources that are inherent in the pursuit of science give way to other human endeavors that are willing to answer the public's urge to know what it really means to be alive.

This is why I have tried to encourage science teachers to explore with their students the possibility that life is an entity in itself, something beyond the realm of familiar chemical and physical kinetics. Something every bit as real as energy, equally impossible to experience apart from interaction with matter, equally impossible to destroy and improbable to create anew, equally infinite in time and space. Yes, I realize that I am challenging the mindset of our most honored scientists. However, to me, there is no other way to address the discrepancy between the paltry dimensions of the physical-chemical concept of life and the actual magnitude of whatever it is that tells us a newborn is breathing, a kernel of wheat may germinate, an anthrax spore is infectious, a giant redwood will stay green, or a stem cell will show differentiation.

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Institution	Degree	Major	Year

Field of Study (broad): _____ Concentration (2-word limit): _____

Briefly describe your present or expected vocation: _____

_____

_____

6. How did you learn about the ASA? _____

I am interested in the goals of the American Scientific Affiliation. Upon the basis of the data herewith submitted and my signature affixed to the ASA Statement below, please process my application for membership.

Statement of Faith

I hereby subscribe to the Doctrinal Statement as required by the Constitution:

1. We accept the divine inspiration, trustworthiness and authority of the Bible in matters of faith and conduct.
2. We confess the Triune God affirmed in the Nicene and Apostles' creeds which we accept as brief, faithful statements of Christian doctrine based upon Scripture.
3. We believe that in creating and preserving the universe God has endowed it with contingent order and intelligibility, the basis of scientific investigation.
4. We recognize our responsibility, as stewards of God's creation, to use science and technology for the good of humanity and the whole world.

Signature: _____ Date: _____

(required for Full Member, Associate Member, Student Member, Student Associate status)

7. If you are an active overseas missionary, please give the name and address of your mission board or organization to qualify for complimentary membership.

Mission Board: _____

Street: _____

City: _____ State: _____ Zip: _____

8. I have enclosed in U.S. funds (Please check one):

_____ $55, Full Member _____ $55, Associate Member _____ $55, Friend of the ASA

_____ $20, Student Member _____ $20, Student Associate _____ $10, Spouse

_____ $35, Subscriber

MasterCard or VISA: ❑❑❑❑-❑❑❑❑-❑❑❑❑-❑❑❑❑

Expiration Date: _____ Signature: _____

Name as it appears on your credit card: _____

(Please print)

Please mail to: American Scientific Affiliation, PO Box 668, Ipswich, MA 01938-0668

What Is the American Scientific Affiliation?

The American Scientific Affiliation (ASA) is a fellowship of men and women in science and related disciplines, who share a common fidelity to the Word of God and a commitment to integrity in the practice of science. Founded in 1941, the ASA has grown significantly since then. The ASA's stated purposes are: "to investigate any area relating Christian faith and science" and "to make known the results of such investigations for comment and criticism by the Christian community and by the scientific community."

How Do I Join The ASA?

Anyone interested in the objectives of the Affiliation may have a part in the ASA.

Full membership is open to all persons with at least a bachelor's degree in science who can give assent to our statement of faith. Science is interpreted broadly to include anthropology, archeology, economics, engineering, history, mathematics, medicine, political science, psychology, and sociology as well as the generally recognized science disciplines. Philosophers and theologians who are interested in science are very welcome. Full members have voting privileges and can hold office.

Associate membership is available to interested nonscientists who can give assent to our statement of faith. Associates receive all member benefits and publications and take part in all the affairs of the ASA except voting and holding office.

Full-time students may join as **Student Members** (science majors) with voting privileges or as **Student Associates** (nonscience majors) with no voting privileges.

Spouses may qualify for a reduced rate. **Full-time overseas missionaries** are entitled to a complimentary membership.

An individual wishing to participate in the ASA without joining as a member or giving assent to our statement of faith may become a **Friend** of the ASA. Friends receive all member benefits and publications and take part in all the affairs of the ASA except voting and holding office.

Subscriptions to *Perspectives on Science & Christian Faith (PSCF),* are available at $35/year (individuals), $55/year (institutions) and $20/year (students).

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American Scientific Affiliation

Founded in 1941 out of a concern for the relationship between science and Christian faith, the American Scientific Affiliation is an association of men and women who have made a personal commitment of themselves and their lives to Jesus Christ as Lord and Savior, and who have made a personal commitment of themselves and their lives to a scientific description of the world. The purpose of the Affiliation is to explore any and every area relating Christian faith and science. *Perspectives on Science and Christian Faith* is one of the means by which the results of such exploration are made known for the benefit and criticism of the Christian community and of the scientific community.

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Canadian Scientific & Christian Affiliation

A closely affiliated organization, the Canadian Scientific and Christian Affiliation, was formed in 1973 with a distinctively Canadian orientation. The CSCA and the ASA share publications (*Perspectives on Science and Christian Faith* and the *ASA/CSCA Newsletter*). The CSCA subscribes to the same statement of faith as the ASA, and has the same general structure; however, it has its own governing body with a separate annual meeting in Canada. Contact CSCA by writing to: Canadian Scientific and Christian Affiliation, PO Box 40086, 75 King St. S., Waterloo, ON N2J 4V1 or visit their web site at: www.csca.ca.

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