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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Perspectives on Science and Christian Faith

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3. Use endnotes for all references. Each note must have a unique number. Follow *The Chicago Style Manual* (14th ed., sections 15.1 to 15.426).
4. If possible, include graphics (electronic file preferred) that enhance the theme of the paper. Figures and diagrams not in electronic format should be clear, black and white, line ink drawings or glossy photographs *suitable for direct reproduction*. Provide captions separately.

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The View from Shepherd's Knoll

"Beyond the Edge?"

After reading "world view" papers written by senior undergraduate students in my Philosophy of Science and Ethics class, I was troubled by the disclosure of two students, who described their passage from orthodox Christianity to a reality that no longer esteems the God of the Bible. While questions challenging faith and presuppositions are part of the liberal arts education experience, Christian educators hope that students will emerge as stronger, thoughtful Christians by considering new ideas. When the experience turns a tender Christian faith into an agnostic, it gives one pause. Though I enjoy debating controversial ideas, I do not want to be the instrument through which others reject the God of Truth. A phrase from "Dover Beach" written by nineteenth-century English agnostic poet Matthew Arnold comes to my mind: "The Sea of Faith was once, too, at the full ... but now I only hear its melancholy, long, withdrawing roar." How far can the "edge be pushed" so that the outcome is still profitable? Falling off the precipice is not the desired outcome.

As your journal editor, I struggle to evaluate the morass of divergent submitted manuscripts that pass over my desk. Which ones are most profitable? Should we entertain manuscripts that "push the edge" of orthodoxy or established science? Within the pages of this journal, we solicit manuscripts "dealing with the interaction between science and Christian faith in a manner consistent with scientific and theological integrity." Does theological integrity require adherence to Christian creeds written centuries ago? Is it restricted to literal interpretations of Christian Scripture? Can process theology bring any insights to issues of faith and science? Do water dowsing and morphic resonance have any scientific integrity? I recently rejected, without using peer reviewers, a submitted well-written manuscript that advanced an interesting theory about the Star of Bethlehem based on astrological signs and a careful literal reading of the Gospel passages. Should that article have been made available to our readers?

I believe a balanced intake is the key to a healthy developing maturity. We need experiences that challenge perceptions, as well as thoughtful doctrinal insights that secure foundations of faith and experience. Maybe this journal can provide both. ❋

Roman J. Miller, Editor

In This Issue

On the inside front cover with **bold type**, we welcome five people who have recently joined our Editorial Board. We anticipate their continuing contributions to this journal.

In the News & Views section, Shawn Dawson, Richard Aulie, and Arthur Hill offer critiques on specific origin views. Do you agree with any of their ideas? The empty Young Scientists' Corner needs submissions for the remaining issues of the year.

In the Articles section, George Murphy provides a theological basis, the self-limitation of God, for "creation's functional integrity." Mark Kalthoff delves into historical lectures of John Henry Newman to envision how the ideas of this Victorian cleric interact with modern Intelligent Design theorists. Using archaeological evidence, Carol Hill finds a real time and place for Noah's activities as described in the Bible. Glenn Morton posits several transitional biological organisms as support for phyla evolution.

Following the 2000 Donor List, we include eighteen book reviews sorted into eight categories. Check them out to see which books you may want to read next. We conclude this issue with five Letters that advance alternative views on previously published material.

Jocund Reading,
RJM

News & Views

Another View on an Alleged Fatal Flaw in Evolution

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The theory of biological evolution has always had religious foes. From Bishop Wilberforce in the nineteenth century to contemporary advocates of intelligent design, many people have seen evolution as a threat. Recently, John A. McIntyre has written that a logical fallacy lies at the heart of evolution. He thinks that evolution is necessarily committed to this fallacy and that it constitutes a fatal flaw.[1] I will try to show that McIntyre is mistaken. He has at most pointed out a fallacious inference that some evolutionists have made concerning the implications of evolution; he has not cut down evolution with one fell swoop. At the end of this essay, I will briefly consider some of the implications evolution has for Christian faith.

McIntyre argues, "the fallacy appears in the evolutionists' understanding of evolution itself" and quotes George Gaylord Simpson as a representative example:

> The meaning of evolution is that man is the result of a purposeless and materialistic process that did not have him in mind.[2]

McIntyre identifies this fallacy as *A dicto secundum quid ad dictum simpliciter*, that is, "From a statement under a condition to a statement simply, or without that condition." This is indeed a fallacy, but how does Simpson's description of evolution commit it? McIntyre claims that Simpson's description can be analyzed as an argument with a premise and a conclusion: "Since evolution proceeds through a materialistic process, there is no God to provide a purpose for the process."[3] McIntyre then proceeds to quote a few other leading evolutionists in order to establish the conclusion that the commonly accepted, authoritative description of evolution incorporates this same fallacy and is thus fatally flawed.

McIntyre's argument is in a sense ingenious, in that if it is successful, it presents a very serious problem for evolution. Unfortunately for McIntyre, his argument establishes far less than he thinks. Evolution for the most part can, quite happily and logically, continue to live.

Three questions must be considered in order to evaluate McIntyre's argument: (1) Is there a fallacy involved in inferring that there is no design or purpose behind the universe from the fact of evolution? (2) Is there a fallacy involved in inferring that there is no God from the fact of evolution? (3) Is evolution necessarily committed to either of these inferences?

Taking these questions in order, I believe the answer to the first question is yes. By the fact of evolution I mean that organisms change through time, that evolution proceeds by decent with modification, that new species evolve from preexisting ones, and that natural selection is the driving force of evolutionary change.[4] These conclusions are so well established that it would be unreasonable not to provisionally assent to them, and in that sense they are a fact.[5] From the fact of evolution it does not follow that the universe is not designed or that there is no purpose behind evolution, if for no other reason than that there may be *independent* arguments for thinking that the universe is designed or that evolution has a purpose. The various teleological arguments that use variants of the Anthropic Principle are a case in point. If they are successful, which appears unlikely, then there is independent reason to think that the universe is designed.[6]

I believe the answer to the second question is also yes, and for a similar reason. Evolution does not by itself imply God's non-existence, if for no other reason than that there may be other arguments for thinking that God exists.

This brings us to the third and crucial question. Is evolution necessarily committed to either of these fallacious inferences? My answer is, quite simply, no. Nothing in the theory of evolution itself commits the evolutionist to claiming that there is no design in the universe or that God does not exist. Oversimplifying somewhat, evolution tries to explain the order and apparent purposefulness of the living world. To do this, evolution needs only to invoke natural processes. It has no need to postulate God or a designer, because so far as evolution is concerned, nothing is explained by this postulate that is not explained equally well without it. The

crucial point is that there is a *difference* between not claiming or postulating that God exists, and claiming that God does not exist. McIntyre may think that evolution requires an intelligent designer, perhaps to explain what Michael Behe has termed "irreducible complexity."[7] On this we perhaps disagree, and, unfortunately, considerations of space prevent me from elaborating further. I will only say that even if evolution requires an intelligent designer, it does not immediately follow that the designer is God. In my opinion, the available evidence actually indicates a fallible, limited designer.[8]

Why, then, do some evolutionists like Richard Dawkins claim that evolution has made the world safe for atheists? The answer has to do with some of the other assumptions Dawkins makes that are, strictly speaking, not part of evolution. Evolution does not by itself reveal a universe without design, but it does destroy the old argument from design (the classical teleological argument), which, historically and on popular level, has been the main argument given to support theism. If one also assumes, some would say unwarrantedly, that there are no *other* arguments in favor of theism, then the conclusion that there is no God seems compelling.[9] Are there any other good arguments for theism or for intelligent design? Many evolutionists apparently do not think so. If there is a logical flaw in evolutionists' thinking, or a problem with what they are teaching, it is here, not in the heart of evolutionary theory.

I have attempted to rebut McIntyre's charge of a logical flaw in evolution and have argued that evolution does not imply that the universe is not designed or that God does not exist. What, if anything, is the "meaning" of evolution with respect to God and design? Does evolution make certain Christian claims more or less probable?

To take the last question first, evolution does not rule out that there could be a divine purpose to the evolutionary process, as McIntyre seems to suggest, but it is rather hard to see what this purpose might be. Natural processes are sufficient to explain the evolutionary process, so presumably what is meant is a goal toward which evolution is proceeding. Is the production of *Homo sapiens* the crowning glory of evolution? That seems the height of conceit and, besides, evolution is still proceeding. Furthermore, adopting a divinely guided evolution just breathes new life into the problem of evil, for now, instead of merely six to ten thousand years of apparently pointless animal suffering, we have millions upon millions of years.[10] I can see no evidence of the evolutionary process tending toward any Christian goals.

Does evolution imply that the Bible is erroneous? Everything hinges on the interpretation one gives to the Bible. If one insists upon a literal interpretation of the Bible, then many claims in it are false, such the creation story(s) in Genesis, and the claim of a geocentric cosmos.[11] Biblical interpretation and hermeneutics is a complicated field that I cannot properly discuss here, so I will simply say that I can see no reason why a literal interpretation is necessary to being a Christian.

To sum up: McIntyre has not pointed out a fatal flaw at the heart of evolution, and if there is a fallacy in many evolutionists' thinking concerning God, it lies outside evolution. This essay has provided no more than a bare sketch of the deep and important subject concerning the relationship between evolution and Christianity, but if it has clarified a few important issues, it will have served its purpose. ❋

Notes

[1] John A. McIntyre, "Evolution's Fatal Flaw," *Perspectives on Science and Christian Faith* 51, no. 3 (Sept. 1999): 162–9.
[2] As quoted in McIntyre, ibid., 162.
[3] Ibid., 163.
[4] Michael Shermer, *Why People Believe Weird Things* (New York: W.H. Freeman, 1997), chapter 10.
[5] Ibid.
[6] See Victor J. Stenger, "Anthropic Design: Does the Cosmos Show Evidence of Purpose?" *Skeptical Inquirer* 34, no. 4 (July/Aug. 1999): 40–3.
[7] Michael Behe, *Darwin's Black Box: The Biochemical Challenge to Evolution* (New York: Simon and Schuster, 1998).
[8] See David B. Myers, "New design arguments: Old millian Objections," *Religious Studies* 36, no. 2 (June 2000): 141–62.
[9] For an excellent example of a brilliant demolition of the teleological argument, brilliant answers to some creationist criticisms, and a largely undefended assumption that there are no other good theistic arguments, see Richard Dawkins, "The Improbability of God," *Free Inquiry* 18, no. 3 (Summer 1998).
[10] I am not suggesting that all instances of animal pain and suffering are apparently pointless, only that some of them are.
[11] See Hector Avalos, "The Bible and Astronomy," *Free Inquiry* 18, no. 4 (Fall 1998).

A Look at Intelligent Design

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The intelligent design (ID) movement is making headway in obtaining a sympathetic hearing before the American public. The ID platform has two planks: (1) nature has "irreducibly complex" systems, such as DNA and enzymes, that cannot be explained by evolution; and (2) information is a third category besides matter and energy.

Design theorists appear on television, publish books and popular pieces, and mount expensive conferences on university campuses. Sympathetic professors promote courses featuring ID as a legitimate topic, and uncritical evangelical opinion-makers publish glowing articles, books, and newsletters on ID. For many, ID has become a respectable way to oppose evolution. The design theorists wish to be taken seriously, and I agree. I therefore see three salient areas requiring attention: importance of creation, a critique of ID, and a description of biological changes that would occur with ID.

The Importance of Creation

To assert that evolution is against creation is to deny the historical record. When the ancient Hebrews declared that God created the world from nothing (II Maccabees 7:28), they inaugurated an innovative stream of thought that led to the Renaissance origin of science—which of course includes the theory of biological evolution.

The ancient Hebrew declaration became the Judeo-Christian-Islamic doctrine of creation, which, embraced by Jewish and Muslim scholars in the Middle Ages and Christian savants in the Renaissance, produced pivotal assumptions of modern science—linear time, origin, chance, contingency, regularity, an antecedent cause for every action. Even the title of Darwin's famous book could not have been conceived absent *creatio ex nihilo.*

A Critique

Like William Paley's *Natural Theology,* which Darwin admired, with its famous metaphor of the clock requiring a clockmaker, ID is a quasi-scientific certification of a particular religious belief, and thus serves an apologetic purpose. For Paley, design was evidence for the existence and beneficence of God. For design theorists, design is evidence of "an intelligent designer." This is, in fact, a particular interpretation of creation that all Christians, Jews, and Muslims cannot be expected to endorse, especially when the design theorists announce their intention as "a science consonant with Christian and theistic convictions." Does Christian faith require finding design in nature? Do ID admirers presume that ID fosters religious neutrality in public schools?

Unlike Paley's *Natural Theology,* which saw the handiwork of God *everywhere* in nature, ID applies only to one segment of nature where there is "irreducible complexity." Thus, one infers that a "gap" occurs in nature's fabric—since certain features of nature, such as the origin of DNA, cannot be explained by natural processes, a different explanation is required. This is the meaning of a "gap"—that modern biology lacks the modes of analysis and inference requisite for a particular segment of nature. In all other realms, natural processes prevail, and in consequence ID is not detected and is not required.

Do the ID admirers *really* believe that at the creation God left as though unfinished a "gap" in nature that requires a special method of analysis no one noticed until now? How would ID admirers avoid the charge that in ID they embrace deism?

How Biology Would Change

How would a biology course be altered if design theorists have their way? Teenagers in some public high schools and in private Christian schools are being influenced by the creationist book, *Of Pandas and People* (Percival Davis & Dean H. Kenyon, *Of Pandas and People: The Central Question of Biological Origins.* Houghton Pub. Co.; ISBN: 0914513400). Some high school teachers are sympathetic to ID, and are energized by anti-evolution sentiments and by the resourcefulness of the design theorists.

Many well-meaning and misled churchgoers think that ID is a biblical alternative to evolution. But this is not possible. When design theorists promote an alternative to evolution, it is inevitable that their proposal is the pre-Darwinian explanation that was derived from Plato and Aristotle. This is unintended, I grant, but no other explanation than the Platonic-Aristotelian is available; indeed the Bible does not possess an explanation of biological variability. Four examples of possible alterations that would occur in biology education materials are:

1. Species. In the *Pandas* explanation of *species,* the terms "blueprint," "plan," and "a pattern" usher students into the realm of Plato (p. 14). Species are hemmed in by "distinct gaps" (p. 40) and speciation occurs only "within limits" (pp. 67, 88), the readers are told. The tell-tale "type," used six times, further

discloses the idealistic and non-biblical species concept overthrown by Darwin and now advocated by ID. Do those who give courses on ID really think that modern biology should return to the pre-Darwinian Platonic concept of species?

2. Purpose. Does invoking *purpose* augment scientific inquiry? This is Aristotelian reasoning that *Pandas* readily employs (p. 144 passim). It means that the consequent precedes the antecedent, that a future condition of a biological process is both cause and effect. But how can that be? Francis Bacon and Robert Boyle piously believed that nature manifests divine purpose, yet they both warned against invoking "final causes" and purpose in science. ID ignores their timeless admonitions.

3. Archetypes. Renaissance anatomists were puzzled by the similar osteologies possessed by dissimilar vertebrate classes. The answer given in *Pandas* of a "blueprint" and "forms" (pp. 14, 133) would have pleased the British anatomist Richard Owen, who proposed a common "archetype" existing as a divine reality, apart from nature. Owen flourished in Darwin's time, and always opposed Darwin. As we know, Darwin's answer was a common ancestor. Owen said "no," found his answer in Plato (there being no answer in the Bible), and credited Plato. As for "forms," Robert Boyle, in 1667, was highly skeptical in his *Origine of Formes and Qualities* (*sic*) – they were nothing but "an easy way to resolve all difficulties" (p. 99). ID proponents are correct (in this case) in ascribing religious neutrality to their "blueprints" and "forms." They are assuredly not found in the Bible. They are Platonic.

4. Non-Material Agencies. To avoid mentioning God, *Pandas* employs a new lexicon: "an intelligent agent" (pp. 14, 26, 138), "an immaterial cause" (p. 14), "a preexisting intelligence" (p. 150), and other terms. Are these synonyms for God? I think not, given the indefinite articles. Nowhere in the ID *corpus* have I seen a definition. Whatever they are, they are redolent of the Aristotelian *pneuma, potentiality, vis essentialis, élan vital,* and *entelechy* that were conscious-like occult and directive qualities rendered obsolete by chemistry. These new terms represent a proxy or surrogate, acting in the place of God. Perhaps the design theorists do not comprehend the portent of the heterodox language they choose. Thirsting for religious neutrality, their new lexicon transfers the act of creation to an undefined, nonmaterial entity that is separate from God, thus compromising the oneness of God, the First Commandment, and the first statement of the Apostles' and Nicene Creeds. Like all anti-evolution initiatives, ID presents problems for the consistent theist, and exhibits the folly of supposing that doing away with evolution would strengthen theism.

In conclusion, evolution presupposes a world view derived from the Judeo-Christian-Islamic doctrine of creation. All anti-evolution initiatives presuppose a world view derived from Greek antiquity. With creation, we partake of the stars and are united with *Australopithecus afarensis*; we are created *imago dei* and offered redemption and eternal life. That is partly what it means to be a theist in a world wrought by Charles Darwin. From *creatio ex nihilo* came evolution. ❄

Theistic Evolution: Enough Already!

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What is it about theistic evolution (TE) that justifies hundreds of journal pages, scores of person-years and millions of research dollars? Does anyone outside of Christian colleges care? Is there anything unique to TE that helps refute scientific materialism? Does TE edify Christians?

First, my personal intellectual journey has left me skeptical of both the theological and scientific merits of TE. As a student and then as a professor, I tried to convince myself that it was logical to assume an old earth and that Darwin hit upon the mechanism that God used to create living organisms. Passing of time and continued reading of modernist theologians have made TE seem less plausible to me. TE, relative to Darwinism, does provide one essential element, namely, a source of information. The concept that biology developed by a Darwinian mechanism of "natural law plus chance" with or without injections of information by God is clearly a faith proposition and in that respect is not unlike accepting a literal interpretation of Genesis.

Second, the extremely provincial nature of TE scholarship was brought home to me during several occasions when Christian groups on my campus invited well-known TE scholars to present public lectures. The intent of such lectures should be to challenge unbelievers to consider the truth claims of Christ, and to edify believers. In my experience, neither of these effects has occurred. While these talks did not stimulate unbelievers to participate in the

question period, there were always questions from believers who predictably were of two camps, those who wanted to advance their own versions of TE and the young earth creationists. The chief goal of the two camps seemed to be to "evangelize" each other. Indeed, several TE advocates in a discussion after one TE lecture made it known that they wished to organize a program to promote TE in Canadian churches on the presumption that the literal interpretation of Genesis was an error as demonstrated by the "scientific" evidence for evolution. Even if the theory of evolution directed by God was true, the literal interpretation of Genesis could hardly undermine the foundations of Christian faith and practice. On the contrary, for many young Christians, acceptance of TE is the first step toward rejecting Scripture as the inspired Word of God. That result says nothing about the truth of TE but it certainly underlines the importance of proper handling of Scripture (2 Tim. 2:15). In fact, some modernist theologians appear to hold the unscientific and unbiblical belief that evolution is both a "scientific fact" and an essential Christian doctrine. That's my third point.

I have met theological modernists who appear to consider evolution (with a theological twist) as an essential doctrine of Christianity. Phillip Johnson in his latest book, *The Wedge of Truth*, makes a stronger statement: "I have observed that in some Christian academic circles it is considered far more offensive to deny the theory of evolution than it is to deny the divinity of Jesus or even the existence of God." Certainly most TE advocates are not so careless with the Gospel of Jesus Christ, but I am skeptical that TE scholarship has much value in the battle against scientific materialism. The goal of Christian academics everywhere ought to be to advance the Truth claims of Jesus Christ. While scholars working in the area of philosophy of science and religion are uniquely placed to honor God in this endeavor, every discipline offers opportunities to glorify God.

One way to glorify God is to honor him as creator regardless of your views on TE or special creation. A good test of Christian integrity in this regard is the way Christian scholars use terms such as evolution and natural selection when they publish in non-Christian journals. The term "evolution" in secular writing is always understood as Darwinian evolution, which by definition excludes the creator God of the Bible. My encouragement to my colleagues and to all Christian scholars is to insist on clear terminology that acknowledges and glorifies the God of creation (Rom. 1:20, 21). Reference to creation rather than evolution gives "praise to the Lord, the Almighty, the King of Creation." ❋

Call for Papers

To increase diversity of journal articles, the editor invites the submission of manuscripts on the following topics:

Ethics: How shall we live and work? Appropriate articles may include issues in medicine, health, environment, professional behavior, education, and philosophical foundations. Deadline for manuscripts: September 1, 2001.

Science Education: How are understandings of science communicated to others? What should be the role of technology in education? What methodological approaches to pedagogy are successful? What is the role of Christian faith in science education? How can misunderstandings of science in the church be corrected? These and other questions may be addressed in manuscripts submitted as regular papers, communications, and news & views articles. Deadline for manuscripts: January 1, 2002.

Submitted manuscripts must interact with science and Christian faith in a manner consistent with scientific and theological integrity. All manuscripts will be peer reviewed. Send manuscripts to: Roman J. Miller, Editor, *Perspectives on Science and Christian Faith*, 4956 Singers Glen Road, Harrisonburg, VA 22802. Email: millerrj@rica.net

Chiasmic Cosmology and Creation's Functional Integrity

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The belief that the character of God is most fully revealed in the cross of Christ is proposed here as the basis for Howard Van Till's concept of the functional integrity of creation. A theology of divine action in which the kenosis, or self-limitation, of God plays a central role is described and applied to our understanding of the world today and to the origins of the universe and life. The emphasis of this approach on the Incarnation then makes it possible to speak theologically about the design of a universe which displays functional integrity.

The Concept of Functional Integrity

A belief that God acts in the universe is a central aspect of the biblical story from Genesis through Revelation, and is assumed whenever people pray for the necessities of life. But how does God do things? Is divine action completely unpredictable, or are there patterns to which it conforms? The traditional task of doctrines of providence has been to discern how God works. This discernment comes from the biblical witness and from the knowledge of what actually takes place in the world—which in modern terms means from natural science.[1]

Ideas about the ways in which God acts in the world have implications for the type of world in which we, through observational and theoretical science, expect to find ourselves. If God acted in a random fashion, then we would be surprised to find any deep-lying regularities in nature. But since people from ancient times have discerned patterns and predictabilities in nature, and because science has been able to achieve widespread understanding in terms of mathematical laws which seem to apply throughout the known universe, we must think about divine action and the resultant nature of the world in other ways.

One valuable approach to this topic is the idea of "creation's functional integrity" for which Howard Van Till has argued.[2] He explains this as a "doctrine" which

> envisions a world that was brought into being (and is continually sustained in being) only by the effective will of God, a world radically dependent upon God for every one of its capacities for creaturely action, a world gifted by God from the outset with all of the form-producing capacities necessary for the actualization of the multitude of physical structures and life forms that have appeared in the course of Creation's formative history, and a world whose formational fecundity can be understood only as a manifestation of the Creator's continuous blessing for fruitfulness. In such a Creation there would be no need for God to perform acts of 'special creation' in time because it has no gaps in its developmental economy that would necessitate bridging by extraordinary divine interventions of the sort often postulated by Special Creationism.[3]

In other words, God has created a universe which depends continually upon God, but which has been endowed with the ability to accomplish what God wants it to accomplish without any "corrections" or "interventions." Nineteenth century Anglican clergyman Charles Kingsley put it this way: "We knew of old that God was so wise that He could make all things; but behold, He is so much wiser than that, that He can make all things make themselves."[4]

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It is a short step from this doctrine to the idea that creation is characterized by regularities which can be discerned by intelligent observers within the world, so that what happens in nature can be understood in terms of natural processes *without reference to God*. This is the concept sometimes characterized as "methodological naturalism," a term to which Van Till himself objects.[5] It is true that the term has some anti-religious affect and is too easily equated with "metaphysical naturalism," the claim that there *is* nothing but the natural world which we observe. On the other hand, it simply is true that the universe can be understood to a considerable extent without any appeal to belief in a creator or creation, even by those who hold such beliefs. We are able to comprehend the world, in an old phrase popularized through Bonhoeffer's writings, *etsi deus non daretur*, "though God were not given."[6]

It is not surprising that this idea disturbs many Christians, for it suggests that there is no "need" for God. Thus, some Christians have looked for "intelligent design" in nature or other ways in which divine action is supposedly available to scientific observation. In turn, atheists may argue that since scientific explanation does not need any concept of God, there is no reason to think that there is a God. Any talk about a creator, creation, or God's action in the world then seems to be an unnecessary metaphysical addition to what science can really tell us about nature. Why should we insist, for example, that the world's "formational fecundity can be understood only as a manifestation of the Creator's continuous blessing for fruitfulness," if the putative Creator never appears in a scientific description of the processes through which nature actually is fruitful?

The statements that creation was "good" and "very good" in Genesis 1, and that God "did not create [the earth] a chaos, he formed it to be inhabited!" (Isa. 45:18) indicate that creation is given order and harmony and that it works well. These biblical statements are certainly consistent with the idea of functional integrity, though they do not compel it. The regularities that science discovers indicate to the Christian that God's creation does possess such an integrity and, as Van Till points out, we can appeal to some of the church fathers in support of this doctrine.[7] None of these points, however, provides a really solid basis for functional integrity of a sort that would enable us to say that on theological grounds we should *expect*—and not merely have to accept—the fact that the world *qua* world can be described in terms of natural processes. Here I will try to base the doctrine of the functional integrity of creation on a fundamental Christian claim, that the character of the God who is the Creator is revealed most fully in the cross and resurrection of Jesus of Nazareth.

The Theology of the Crucified

One of the most important passages in the New Testament is found in Paul's Letter to the Philippians. To point out the type of attitude Christians should have toward life, the apostle speaks about the humiliation and exaltation of one

> who, though he was in the form of God, did not consider equality with God as something to be exploited, but emptied [*ekenōsen*] himself, taking the form of a slave, being born in human likeness. And being found in human form, he humbled himself and became obedient to the point of death—even death on a cross (Phil. 2:6–8).

Because of this

> God also highly exalted him and gave him the name that is above every name, so that at the name of Jesus every knee should bend in heaven and on earth and under the earth, and every tongue should confess that Jesus Christ is Lord, to the glory of God the Father (Phil. 2:9–11).

"The name that is above every name" is God's, and "every knee shall bow, every tongue shall swear" to the God of Israel (Isa. 45:23). This means that the exalted crucified one is identified with God, so that

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his *kenosis* or "emptying" gives us a profound insight into the *kind* of deity God is. As Fee puts it in his commentary on this Epistle, "In 'pouring himself out' and 'humbling himself to death on the cross' Christ Jesus has revealed the character of God himself."[8] The claim of Nancey Murphy and G. F. R. Ellis that "*kenosis* is the underlying law of the cosmos" is related to this insight, and there is a good deal of common ground between the book in which they expound that claim and the present argument.[9]

If the cross does indeed reveal the character of God's own self, then we will expect to see a similar emptying, a similar self-limitation of God, in all divine activity, including the creation and preservation of the universe.

In the event of the cross God acts quite differently from conventional pictures of deity, and is seen as one who does not regard the privileges and attributes of divinity "as something to be exploited" or "grasped" (NIV). The cross is the means by which God saves the world, but it is not simply a temporary stratagem to accomplish some goal on God's part. Christ's "emptying" and "humbling" of self are, as Fee says, an activity which reveals the divine character. As Luther put it: "True theology and recognition of God are in the crucified Christ."[10] Jüngel elaborates on this theme:

> The humanity of this person [Jesus] is extremely relevant to the meaning of the word "God," according to the New Testament view. Therefore, when we attempt to think of God as the one who communicates and expresses himself in the person Jesus, then we must always remember that this man was *crucified*, that he was killed in the name of God's law. For responsible Christian usage of the word "God," the Crucified One is virtually the real definition of what is meant by the word "God." Christian theology is therefore fundamentally the theology of the Crucified One.[11]

The risen Christ is recognized by the marks of crucifixion (Luke 24:39–40; John 20:20). The resurrection does not do away with the "stumbling block" of the cross (1 Corin. 1:23). In a sense, the resurrection makes the cross even more offensive, because it means that the one who is present in the church as its Lord, and who is to be proclaimed by the church to the world, is the crucified.[12] Even more, the cross has cosmic significance. According to the hymn in Col. 1:15–20, the one "in whom" and "for whom" all things were created and in whom "all things hold together" is the one through the blood of whose cross "all things" are reconciled to God.

If the cross does indeed reveal the character of God's own self, then we will expect to see a similar emptying, a similar self-limitation of God, in all divine activity, including the creation and preservation of the universe. Creation, redemption, and sanctification are different works, but they are all actions of the one God, the Trinity, who is revealed in the resurrection of the crucified. Such an identification of the God who is always present and active in the universe with the Crucified One leads to what I have called "chiasmic cosmology." It is based on the image of Christ from the second century apologist Justin Martyr as the one "placed crosswise (*echiasen*) in the universe."[13]

Divine Action

What does this mean for our understanding of God's activity in the world? We should not expect to get a unique theory of divine action in a deductive fashion from the theology of the crucified as sketched in the previous section. But if we look at ideas about divine action in the light of the cross, we can get a reasonably good idea about which approaches are likely to be dead ends and which are worth pursuing.[14]

Barbour has provided a helpful typology of theologies of divine action with accompanying models.[15] These theologies and models are the Classical (Ruler-Kingdom model), Deist (Clockmaker-Clock), Neo-Thomist (Workman-Tool), Kenotic (Parent-Child), Existentialist (no model), Linguistic (Agent-Action), Embodiment (Person-Body), and Process (Leader-Community). I will not deal here with the latter three, which have, from the standpoint of a theology of the cross, some defects.[16]

The first two of these theologies can be quickly rejected. The Bible certainly uses kingship language in speaking of God's relationship with the world, but the God revealed in Christ does not act as the absolute and arbitrary dictator of the world, which is what the Classical view often amounts to. In Christ we see a very different kind of ruler. "I call him king," Chrysostom said, "because I see him crucified."[17] The Deist view, on the other hand, contradicts the belief that God is continually active in the world. The idea of creation's functional integrity

has sometimes been misunderstood as a version of deism, a confusion which I will clarify shortly.

The Kenotic theology of divine action seems to jump out at us from among the other three types which we will consider. Our emphasis on the cross began with the passage from Philippians about the kenosis of Christ. But we should not move too quickly. We must begin with an affirmation that God does indeed act in the world, and in fact that God is involved in everything that happens in the universe. This can be described with a model in which God works with natural processes as instruments, the First Cause acting through secondary causes, which Barbour characterizes as Neo-Thomist. The traditional language of doctrines of providence is that God "concurs with" or "cooperates with" natural processes so that what happens in the world is done by God (thus the distinction from deism is clear) and is done also by natural processes.

The most obvious model for this theology is a human craftsperson, such as a carpenter (cf. Mark 6:3), who makes use of tools or instruments. A human worker however may, through choice or necessity, use tools in an arbitrary way. Nails can be pounded with a chisel and boards ripped apart with a screwdriver. It seems, though, that God does not work in this way. The divine instruments are the basic gravitational, electroweak, and strong interactions of physics, and violations of the laws which describe these interactions (to the extent that we know them), while they may occur, occupy a set of measure zero among physical phenomena.

It appears that God voluntarily* limits *divine action to be in accord with laws which describe physical phenomena, of which God is the Creator, and to which our "laws of physics" are approximations.

Thus it appears that God voluntarily *limits* divine action to be in accord with laws which describe physical phenomena, laws of which God is the creator and to which our "laws of physics" are approximations.[18] What we observe in the universe is the exercise of God's ordinate, rather than God's absolute, power.[19] This is precisely the import of a kenotic theology of divine action. Just as the Second Person of the Trinity "emptied himself" and was willing to forego conventional divine power in his passion and death, God foregoes the power to act arbitrarily in the world.

The connection with the cross becomes clearer when we realize that this self-limitation of God in divine action means that God allows people to understand the works of God while ignoring God himself. God does not demand acknowledgment of his power and glory as a condition for benefitting from those works but "makes his sun rise on the evil and the good" (Matt. 5:45). The fact that natural phenomena can be understood "though God were not given" means, as Bonhoeffer put it, that "God lets himself be pushed out of the world on to the cross."[20] Natural processes function not only as God's "tools" but also, in Luther's phrase, as "masks of God" (*unsers herrn Gotts larven*) which conceal God from our direct observation.[21]

Since we do not observe God as an actor in the world in the same way that we observe physical entities, our understanding of divine action is not of the same sort as our scientific understanding of the world. There is an element of truth in what Barbour calls an Existentialist theology of divine action, that such action is perceived by faith. A strictly existentialist theology of creation such as Bultmann's, in which an individual can affirm only that God is his or her Creator,[22] is far too restricted, but it does call attention to the need for faith as personal commitment in order to see God at work in the world.

The divine concealment is not simply a matter of God playing hide-and-seek with humanity, much less of God not wanting to be involved with the world. It is, in a profound way, an expression of divine grace for it means that we can live in the world as mature adults, can know what is happening, and can act responsibly on the basis of our knowledge. We do not inhabit a nightmare universe in which anything at all might happen at any moment, nor are we like babies in a nursery who are provided with the necessities of life but have no idea from where they come. Creation is so good that we can understand it on its own terms, "from the inside." The fact that scientific investigation can understand the world is a gift which results from the divine self-limitation.

There is, of course, also another side to the story. If God voluntarily limits divine action to that which can be accomplished through natural processes, then God will not (and, as we commonly observe, does not), in the vast majority of cases, intervene miraculously to dissolve blood clots which cause strokes or divert tornadoes from populated areas.

The existence of "natural evil" in the world is thus a consequence of the kenotic character of divine action, and is rooted in the fact that the Creator does not stand aloof from the suffering of the world but participates in it and "became obedient to the point of death—even death on a cross."

A universe which God will preserve and govern by cooperating with natural processes in this kenotic fashion is one which will display the functional integrity described by Van Till. The phenomena that will take place in it will be ones that can be accomplished through natural processes. To explore further what that means, we need to consider how such a world might have been brought into being.

The Origin of the Universe and of Life

The idea of functional integrity leads us to expect that the structures and systems which we presently observe have come to be formed through natural processes, and not by sudden jumps which cannot be explained in terms of scientific laws. As we look farther and farther back in time, we should find evidence of the development of living things, planets, stars, galaxies, atoms, and nuclei, and should be able to understand how these developments have taken place. The fact that we have found extensive evidence of such evolutionary processes on all scales, and that we have been able to achieve a fair degree of understanding of them in terms of known physical processes, encourages theological work in the direction sketched here.

How far can we go along this line? At the outset, we have to recognize that while science can explain a great deal about the universe, it cannot answer the meta-question, "Why is there something rather than nothing?" At that point, one has to decide whether to affirm the existence of something that transcends the universe, or to take the universe as given and not ask further questions, or to remain agnostic. But given that physical reality obeying the types of laws we have found *does* exist, it may be possible to explain the origin even of matter and space-time itself in terms of an adequate quantum theory of gravitation and matter. Whether progress in quantum cosmology will point toward a temporal origin of the universe or to something like the Hawking-Hartle "no boundary" model and an eternal dependence of the universe upon the Creator remains to be seen.[23]

In any case, we are faced with a paradoxical idea of "mediated *creatio ex nihilo*" in which God brings into being the instruments with which God will bring things into being.[24] It is worth noting that this paradox is by no means a modern one. The ancient rabbinic tractate *Pirke Aboth* includes in a list of things created on the eve of the first Sabbath, "The tongs made with tongs."[25]

More is involved here than a logical puzzle. Even in the origination of the universe, God acts through instruments that are simultaneously masks of God. God is willing to be emptied of the credit for creation, so that the Creator is indeed the one "placed crosswise in the universe."

Given that physical reality, which does obey the types of laws we have found, does exist, it may be possible to explain the origin even of matter and space-time itself in terms of an adequate quantum theory of gravitation and matter.

Similar things can be said about the origin of living things. It is true that we do not yet have an adequate theory of chemical evolution, of the emergence of the first living systems from nonliving chemicals. But there is no theological rationale for the idea often expressed to the effect that life must have been brought into being by God's direct and unmediated action. In fact, the first Genesis account of creation points in just the opposite direction, for there plants and animals come into being when God commands the elements of the world, the earth and the waters, to bring them forth (Gen. 1:11–12, 20–21, 24–25). The statement of Ephrem of Edessa on the creation of plants expresses this understanding of the mediated creation of living things held by a number of the church fathers. He said:

> Thus, through light and water the earth brought forth everything. While God is able to bring forth everything from the earth without these things, it was his will to show that there was nothing created on earth that was not created for the purpose of mankind or for his service.[26]

Though it would exceed the scope of the present paper, the question of miracles needs to be part of any thorough discussion of divine action which

takes the Bible seriously.[27] Yet the Bible gives us no reason to think that the origin of life must be understood as a miracle that cannot be explained in terms of natural processes.

The Design of the Universe

The idea of creation's functional integrity has sometimes been seen as in tension with the idea of "intelligent design" in nature.[28] Chiasmic cosmology, however, has a clear picture of God's design for the universe: It is God Incarnate, crucified and risen. Eph. 1:10 tells us of God's "plan for the fullness of time, to gather up all things in [Christ], things in heaven and things on earth," and Col. 1:16 says that "All things have been created through him and for him." God made the universe in order to be personally united with it. Barth said:

> The world came into being, it was created and sustained by the little child that was born at Bethlehem, by the man who died on the cross of Golgotha, and the third day rose again. *That* is the Word of creation, by which all things were brought into being. That is where the *meaning* of creation comes from, and that is why it says at the beginning of the Bible: "In the beginning God made heaven and earth, and God said, Let there be ..."[29]

The world was created *so that* the Word might be made flesh. Does that impose any constraint on what *kind* of world could be created?

It is not for us to dictate how divine Incarnation must have taken place. The cross negates any idea that God's self-revelation must conform to our standards of what is fitting for God. (Cf. 1 Corin. 1:25.) Still, it is hard to see what might be meant by the "personal union" of the Logos, the Word or Reason of God, with a cloud of plasma or a virus. The concept of "person" applies to rational beings, and traditional Christology has held that the human nature of Christ has its personal centering in the divine Logos.[30] Therefore, it does not seem too speculative to say that genuine incarnation would take place in a rational species. Creation with incarnation in view would then imply a world capable of evolution to intelligent life.

Some writers have seen in the so-called anthropic coincidences, the fact that parameters of our universe seem precisely suited for the evolution of life, a justification for the idea that the universe was designed for intelligent life, and therefore that there must be a "Designer." From the standpoint of chiasmic cosmology, it is more significant to see this as supportive of a view of the Incarnation as a *the*anthropic principle.[31] The purpose of the universe is not simply humanity, but humanity indwelt by God, the *theanthropos*. This does not mean that God's ultimate purpose involves *only* our species, for that would contradict the "all things" of Ephesians and Colossians. Through God's sharing of humanity's evolutionary history in Jesus of Nazareth, all creation is assumed by God and therefore can enter into God's final future.[32]

It is in light of the cross and resurrection of Jesus that we see God's purpose for the world, and can speak about the God who raised Jesus from the dead as the designer of the universe. Scientific evidence about the suitability of the cosmos for life and the ways in which life has evolved then helps us to understand how the divine purpose is being worked out in cosmic history.

Conventional religious ideas about design have trouble with the way life has evolved, a way in which natural selection is at least an important component. It is natural to ask how a God who is all-good and all-powerful could create the type of world in which processes involving massive loss, death, and extinction would be involved in the development of life. But things look different if we view evolution from Golgotha. The cross means that God has become a participant in the evolutionary process, and has suffered and died in solidarity with the losers in that process. That does not answer all questions about evil and suffering, but is the point from which an adequate theodicy must start.

The cross means that God has become a participant in the evolutionary process and, in that process, has suffered and died in solidarity with the losers.

Critics of design arguments sometimes point to biological structures which are less than perfect for their supposed purpose, such as the human eye.[33] But if God limits his action in the world to that which takes place through the contingent pattern of natural processes which God has created, there should be no surprise about such apparent "imperfections." In Genesis 1, God sees creation as "very good" but not, in the words made infamous by Dr. Pangloss in Voltaire's *Candide*, as "the best of all possible worlds."

Divine creation and purpose do not require some intrinsic superiority of species which survive or a kind of biological manifest destiny of the human race. Gould in particular has argued forcefully against such ideas.[34] The lack of intrinsic superiority of surviving species and the contingency of the evolutionary process fits in with his own views, but Christians should be clear that it is also consistent with the biblical picture of the way God acts in history. Why did God choose the people of Israel? God tells them that it was not because of any qualities of their own:

> It was not because you were more numerous than any other people that the LORD set his heart on you and chose you—for you were the fewest of all peoples. It was because the LORD loved you and kept the oath that he swore to your ancestors, that the LORD has brought you out with a mighty hand, and redeemed you from the house of slavery, from the hand of Pharaoh, king of Egypt (Deut. 7:7–8).

The choice of this people is central to God's plan, for "from them is traced the human ancestry of Christ, who is God over all, forever praised!" (Rom. 9:5 NIV).[35] ❄

Notes

Biblical quotations are from the New Revised Standard Version unless otherwise noted.

[1] Benjamin Wirt Farley, *The Providence of God* (Grand Rapids MI: Baker, 1988).

[2] Howard J. Van Till, "Basil, Augustine, and the Doctrine of Creation's Functional Integrity," *Science and Christian Belief* 8 (1996): 21.

[3] Ibid., 23.

[4] Colin A. Russell, *Cross-Currents: Interactions between Science and Faith* (Grand Rapids MI: William B. Eerdmans, 1985), 167–8.

[5] Howard J. Van Till, "A Response to *The Creation Hypothesis*", *Perspectives on Science and Christian Faith* 47 (1995): 123.

[6] Dietrich Bonhoeffer, *Letters and Papers from Prison*, enlarged edition (New York: Macmillan, 1972), 360–1.

[7] Van Till, "Basil, Augustine, and the Doctrine of Creation's Functional Integrity."

[8] Gordon D. Fee, *Paul's Letter to the Philippians* (Grand Rapids MI: William B. Eerdmans, 1995), 196. The entire discussion here of verses 5–11 on pp. 191–229 is of value.

[9] Nancey Murphy and G. F. R Ellis, *On the Moral Nature of the Universe* (Minneapolis, MN: Fortress, 1996). The phrase cited here is from their concluding sentence on p. 251.

[10] Martin Luther, "Heidelberg Disputation" in *Luther's Works* 31 (Philadelphia: Fortress, 1957), 53.

[11] Eberhard Jüngel, *God as the Mystery of the World* (Grand Rapids, MI: William B. Eerdmans, 1983), 13.

[12] Charles B. Cousar, *A Theology of the Cross: The Death of Jesus in the Pauline Letters* (Minneapolis, MN: Fortress, 1990), 104.

[13] George L. Murphy, "Chiasmic Cosmology: A Response to Fred Van Dyke," *Journal of the American Scientific Affiliation* 38 (1986): 124.

[14] ____, "The Theology of the Cross and God's Work in the World," *Zygon* 33 (1998): 221.

[15] Ian Barbour, *Religion in an Age of Science* (San Francisco: HarperCollins, 1990), 244. Barbour has modified this scheme somewhat in the second edition, *Religion and Science* (San Francisco: HarperCollins, 1997), 305, but the first version seems preferable to me.

[16] For further discussion, see G. L. Murphy, "The Theology of the Cross and God's Work in the World."

[17] Timothy Ware, *The Orthodox Church* (Baltimore: Pelican, 1963), 233.

[18] George L. Murphy, "A Positive Approach to Creation," *Journal of the American Scientific Affiliation* 32 (1980): 230.

[19] Margaret J. Osler, *Divine Will and the Mechanical Philosophy: Gassendi and Descartes on Contingency and Necessity in the Created World* (New York: Cambridge University, 1994), chapter 1.

[20] Bonhoeffer, *Letters and Papers from Prison*, 360–1.

[21] Martin Luther, "Psalm 147" in *Luther's Works* 14 (St. Louis: Concordia, 1958), 114.

[22] E.g., Rudolf Bultmann, *Jesus Christ and Mythology* (New York: Charles Scribner's Sons, 1958), 69.

[23] For some discussion of these ideas, see Willem B. Drees, *Beyond the Big Bang* (La Salle, IL: Open Court, 1990), especially chap. 2. Connections with the theme of the present paper are made in George L. Murphy, "Cosmology and Christology," *Science and Christian Belief* 6 (1994): 101.

[24] George L. Murphy, "The Paradox of Mediated Creation *Ex Nihilo*," *Perspectives on Science and Christian Faith* 39 (1987): 221.

[25] R. Travers Herford, ed., *Sayings of the Fathers* (New York: Schocken, 1962), 129–31.

[26] Ephrem of Edessa, "Commentary on Genesis" in *St. Ephrem the Syrian: Selected Prose Works* (Washington: The Catholic University of America, 1994), 92. For the views of the fathers, see Ernest C. Messenger, *Evolution and Theology* (New York: Macmillan, 1932).

[27] For a brief treatment see George L. Murphy, "Miracles—Burden or Blessing?" *Lutheran Partners* 15, no. 5 (1999): 33.

[28] E.g., William A. Dembski, *Intelligent Design* (Downers Grove, IL: InterVarsity Press, 1999).

[29] Karl Barth, *Dogmatics in Outline* (New York: Harper & Row, 1959), 58.

[30] For the definition of "person" as "the individual substance of a rational nature," see Anicius Manlius Severinus Boethius, "A Treatise against Eutyches and Nestorius" in *Boethius: The Theological Tractates and The Consolation of Philosophy* (New York: G. P. Putnam's Sons, 1926), 85. A modern discussion of "The Enhypostasis of Jesus in the Logos" is Wolfhart Pannenberg, *Jesus – God and Man*, 2d ed. (Philadelphia: Westminster, 1977), 337–44.

[31] George L. Murphy, "The Incarnation as a Theanthropic Principle," *Word & World* XII (1993): 256.

[32] ____, "A Theological Argument for Evolution," *Journal of the American Scientific Affiliation* 38 (1986): 19.

[33] E.g., Kenneth R. Miller, "Life's Grand Design," *Technology Review* (February/March 1994): 25.

[34] Stephen Jay Gould, *Wonderful Life* (New York: W. W. Norton, 1989).

[35] This translation (or that of NRSV margin) is to be preferred to those which do not ascribe deity to the Messiah. See, e.g., Anders Nygren, *Commentary on Romans* (Philadelphia: Fortress, 1972): 358–9.

John Henry Newman (1801–1890)

A Different Voice from the Eve of *The Origin*: Reconsidering John Henry Newman on Christianity, Science, and Intelligent Design

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Remembered for his role in the Oxford Movement and for his 1845 conversion to Roman Catholicism, John Henry Newman (1801–1890) remains famous for his spiritual autobiography, Apologia pro vita sua *(1864) and his seminal collection of lectures,* The Idea of a University. *Newman's ideas about science and religion have received comparatively little attention, however, despite their inclusion in* The Idea of a University. *In 1855, as Rector of the new Catholic University in Dublin, Newman delivered two lectures: "Christianity and Physical Science" and "Christianity and Scientific Investigation." Although much scholarship treats Newman's thought and Victorian science separately, little has been written about both; and no historian of science and religion has provided a focused study of Newman's 1855 lectures. This paper contributes to such a study. After a brief introduction to Newman and the context of his 1855 lectures, this paper provides a critical summary and analysis of Newman's thought on science and Christianity as presented in those lectures. It concludes by suggesting ways Newman's thought may contribute to contemporary discussions of Intelligent Design theory.*

What a singular break-down of a noble instrument, when used for the arrogant and tyrannical invasion of a sacred territory! What can be more sacred than Theology? What can be more noble than the Baconian method? But the two do not correspond; they are mismatched.

Many a man will live and die upon a dogma;
no man will be a martyr for a conclusion.
—John Henry Newman

Evangelicals who uphold their traditionally high view of Scripture often look to the first chapter of Romans for St. Paul's imprimatur upon the natural theologian's project: "For since the creation of the world God's invisible qualities—his eternal power and divine nature—have been clearly seen, being understood from what has been made, so that men are without excuse."[1] Of course, not all conservative Christians have considered this passage as a mandate to press either natural theology or the design argument into the service of Christian apologetics. Prominent among such dissenters was the controversial Victorian cleric John Henry Newman (1801–1890). As historian Frank M. Turner has observed, Newman even "believed it likely that the study of

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nature without a previously attained religious outlook on the part of the investigator would lead to atheism."[1]

Well then, does scientific knowledge of the created world lead to religious belief or not? If not, why not? If it does, what approximation will that religious belief have to orthodox Christianity? These questions, of course, beg that others be answered first. What, for example, do we mean by science? By theology? How do the two relate? And so on.

Now these questions are very much at the fore of contemporary discussions, in the academy, in the churches, in school boardrooms, and wherever the great conversation continues—so much so, in fact, that historically myopic interlocutors have recently boasted their creation of a new discipline called "Science-and-Religion."[2] They are certainly wrong on both counts. "Science-and-Religion" is neither their creation nor a new discipline. That such a silly mistake can be made at all demonstrates the proposition that far too few invite voices from the past to the table of current debate. This ever-consuming presentism prevents them from considering their predecessors as worthy contributors to the discussion. But I am reminded of Chesterton's plea for "the democracy of the dead" and of Kirk's warning that we imperil ourselves if ever we ignore the "eternal contract" binding us to our ancestors and obligating us to our posterity.[3] In this spirit of mindfulness of the past, I accept with this essay the modest proposal that we invite to the table of discussion a different voice, one from the past, one rarely listened to these days.

Too few Protestant Christians today know the life and mind of John Henry Newman.[4] After all, he was vociferously Roman Catholic by the eve of the publication of Darwin's *Origin of Species* (1859) when he wrote most explicitly about science and religion. But this is no reason for Protestant Christians to dismiss Newman and to close the door of contemporary debates to his ideas. My object is not to force an unqualified rehabilitation of his Victorian voice. Rather, mine is the more modest task of introducing his thought on science and religion to the twenty-first century discussion in the hope that his old ideas might fruitfully season our views of things.

Newman's Life and Thought: Preliminary Considerations

Born into a mildly evangelical, Anglican family during the winter of 1801, John Henry Newman underwent a religious conversion at age fifteen. A studious young pupil at the private Ealing School, he gained admittance to Trinity College, Oxford, from which he took his degree in 1820. He was elected a fellow of Oriel College two years later and then ordained into the ministry of the Church of England in 1824. In 1828 he became vicar of the Oxford University church, St. Mary the Virgin, a position he held until 1842. Ten volumes of sermons resulted from his preaching during these years at St. Mary's.[5]

During these same years, Newman became a major player in the so-called Oxford Movement or Tractarian Movement that gained momentum with the publication of the *Tracts for the Times*, many of which Newman himself wrote. Increasingly attracted to Roman Catholic forms of piety and theology, Newman's most infamous step came in 1841 when he published his *Tract 90* which implied compatibility between the Anglican Thirty-Nine Articles and Roman Catholic theology.[6] Within two years, he had resigned his pulpit at St. Mary's. Then, in October 1845, he was received into the Roman Catholic Church. After a period of study in Rome, Newman was ordained a Roman Catholic priest in 1847.

In 1851 Newman accepted an invitation from Archbishop Cullen to preside over the new Roman Catholic university that was being founded in Dublin, Ireland. The following year as rector-elect of the new Catholic University of Dublin, he delivered a series of lectures on the nature of a university. These

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were the first of many lectures treating university subjects and the nature of liberal education. Ultimately, under significant revision, they would grow into a single volume with the lengthy title, *The Idea of a University Defined and Illustrated, I. In Nine discourses delivered to the Catholics of Dublin, II. In Occasional Lectures and Essays addressed to the members of the Catholic University*. Newman persisted in ongoing revisions of *The Idea of a University* (as the book became widely known) until the year before his death in 1889.[7]

Among the ten lectures and essays on university subjects that constitute the second half of *The Idea of a University*, there stand two that directly address the relationships of science and religion. Both were delivered in the year 1855. The first, "Christianity and Physical Science," was an address Newman delivered to the School of Medicine in November. The second, "Christianity and Scientific Investigation," was a lecture written for the School of Science. These were first published in November 1858 in an anthology titled *Lectures and Essays on University Subjects*. So these reflections on science and religion by a "superb and original" Christian mind appeared for public consumption just on the eve of Darwin's *Origin*.[8] Consequently they give us some insight into thoughtful Christian views on science and religion in the age of Darwin—views that were *not*, however, influenced by Darwin's monumental 1859 work.

Although sizable bodies of scholarship deal separately with Victorian science or with Newman's life and thought—in fact, there is something of a small Newman industry fostered by a community of Newman scholars—very little has been written about Newman's views regarding science and religion.[9] Moreover, with respect to the present concern—Newman's two 1855 lectures on science and religion—only Peter Hodgson's obscure article offers any substantive discussion; and even this is only three pages long.[10] Hence this essay aims at the modest goal of contributing to an understudied dimension of Newman's thought. Though I opened with a teaser revealing Newman's suspicion of the natural theological enterprise, I also noted that certain other questions require prior attention. To those I now turn. What, we may ask, did Newman have to say, in general terms, about Christianity and science?

Newman's Assault on the Conflict Metaphor

Newman started with the simple fact that perceptions, even utterly false perceptions, have, when they are shared widely enough, a certain reality of their own and a genuine power to shape our world of discourse. Newman believed that one particular false, although widely shared, perception demanded his first attention. The perception was a supposed "antagonism" between "Physics and Theology." Newman had detected within both "the educated and half-educated portions of the community" what he called a "surmise or misgiving, that there really is at bottom a certain contrariety between the declarations of religion and the results of physical inquiry."[11] He sought, first, to show that no such antagonism really existed, that it was a "groundless imagination"; and second, he proposed to explain how it could be that such a fallacious opinion could have been held in the first place. In short, he proposed to explain why "Physical Philosophers [as he called natural scientists] and Theologians have quarrelled in fact, and quarrel still" (331).[12]

[Newman] believed that [the] perception of incompatibility between science and religion had damaged human relationships and deterred clear understanding of the right relationships between science and theology.

This task was no mere academic exercise for Newman either. He believed that this perception of incompatibility between science and religion had damaged human relationships and deterred clear understanding of the right relationships between science and theology. It had produced a "certain contempt of Theology" among natural scientists; and among theologians "a disposition to undervalue, to deny, to ridicule, to discourage, and almost to denounce, the labours of the physiological, astronomical, or geological investigator" (322). Newman also hoped that his attempt to dissolve the appearance of tension between science and religion may give positive aid "in attaining clearer ideas than before how Physics and Theology stand relatively to each other" (322).

Newman's first step toward these ends was to offer a "broad view" of the terrain by dividing knowledge into two categories "natural and supernatural." Natural knowledge is knowledge of nature, by which Newman meant "that vast system of things, taken as a whole, of which we are cognizant by means of our natural powers" (323). Supernatural knowledge, on the other hand, is knowledge of

what Newman called "that still more marvellous and awful universe, of which the Creator Himself is the fulness, and which becomes known to us, not through our natural faculties, but by superadded and direct communication from Him" (323).

Here an important epistemological point requires attention. Newman established very early in *The Idea of a University* that knowledge of the supernatural *is* genuine *knowledge*, that theology *is* an authentic "branch of knowledge," and that, "Religious doctrine is knowledge, in as full a sense as Newton's doctrine is knowledge" (31). Among Newman's principle foes stood the opposite doctrine which he referred to as liberalism or modernism and which he expounded in his lecture, "A Form of Infidelity of the Day." According to Newman's description, the liberal would say:

> You may have opinions in religion, you may have theories, you may have arguments, you may have probabilities; you may have anything but demonstration ... It is not that you have not a right to your own opinion, as you have a right to place implicit trust in your own banker, or in you own physician; but undeniably such persuasions are not knowledge (290–1).

Newman attacked this position applied to theology as unsustainable diabolical hogwash.

The prescience of Newman's worry demands acknowledgment too. Nearly a century and a half after his denunciation of this liberal position, we still encounter the same sort of assertion. Consider Stephen Jay Gould who would have readers of his book, *Rocks of Ages*, believe that only science deals with facts, with the "domain of factual inquiry," i.e. with knowledge, and that religion deals only with squishy matters of opinion like ethics and meaning that have no firm grounding in any factual data.[13] Although Gould's picture of science and religion as "Non-Overlapping Magisteria" begs for refutation at this point, the temptation to do so must be resisted in deference to the present concern. That concern is simply to make explicit Newman's vigorous affirmation of the proposition which so many others then and now deny; namely, that real factual knowledge of the supernatural can be had with certitude and that, Gould's assertions notwithstanding, others besides natural scientists can rightly say what counts as real knowledge. So if science and religion are to be distinguished, it is not, insisted Newman, on the ground that religion somehow fails to qualify as *bona fide* knowledge.

It is the case, however, insisted Newman, that theology and science are different *kinds* of knowledge. Theology is "the philosophy of the supernatural world" and science is "the philosophy of the natural" (323–4). In Newman's terms, these were the "two great circles of knowledge," which occasionally may intersect, but rarely do: "The two worlds and the two kinds of knowledge respectively are separated off from each other," he insisted. Therefore, "they cannot on the whole contradict each other" (323).[14] This was probably Newman's mildest expression of the matter. As he developed his argument, his vehemence grew. He spoke of science and theology as "incommunicable, incapable of collision, and needing at most to be connected, never to be reconciled" (324). And if this separation was true of theology and science generally, how much more so, contended Newman, of the distinction between theology and physical science:

> As well may musical truths be said to interfere with the doctrines of architectural science; as well may there be a collision between the mechanist and the geologist, the engineer and the grammarian; as well might the British Parliament or the French nation be jealous of some possible belligerent power upon the surface of the moon, as Physics quarrel with Theology (326–7).

Science and Theology: The "Two Great Circles" of Genuine Knowledge

What were the features of these distinct circles of knowledge that rendered genuine quarrel such an impossibility? Physical science, explained Newman, is "the philosophy of matter." As such, "With matter it began, with matter it will end; it will never trespass into the province of mind." In short, physical science "ascertains, catalogues, compares, combines, [and] arranges" the phenomena which meet the senses so as to determine "the order to which they are subservient," i.e. to determine the laws of nature (324–5). And no more, period. He said: "When it has reached those first elements, principles, and laws, its mission is at an end." For Newman physical science "never travels beyond the examination of cause and effect" (324–5).

But we human creatures want so much more. Very well, replied Newman. Just do not ask it from the scientists. If they have views on other than scientific issues and questions—

> what that ultimate element is, which we call matter, how it came to be, whether it can cease to be, whether it ever was not, whether it will ever come to nought, in what its laws really consist, whether they can cease to be, whether they can be suspended, what

> causation is, what time is, what the relations of time to cause and effect, and a hundred other questions of a similar character (325)

—their answers to such questions are not properly those of physical scientists but of religious men, "not because physical science says any thing different [about these kinds of questions], but simply because it says nothing at all" about them, nor can it do so (325).

Newman sought neither to disparage nor to elevate either science or theology above the other.

Newman recognized an important corollary to this conclusion, that neither the most brilliant scientist nor the most studied theologian had any basis, by virtue of his respective expertise in science or theology, from which to form sound judgments about the facts and truths in the other's field of knowledge. Each when viewed *as scientist* or *as theologian* was as "ignorant as the rest of mankind" on matters in the other's circle of knowledge. Hence Newman identified a great need for self-restraint and for liberal education, in short, for an appreciation of what he called "the philosophy of an imperial intellect" (346–7), an adequate exposition of which would require a separate essay. It must suffice, therefore, to say that Newman sought neither to disparage nor to elevate either science or theology above the other. He knew that failure to accord each its rightful place, but no more than its rightful place, would lead to real problems.

Newman defended the well-ordered University as the representative of the imperial intellect. Such a University, he described, "acts as umpire between truth and truth, and, taking into account the nature and importance of each, assigns to all their due order of precedence" (345). Such an imperial intellect should prevent the improper intrusion of one discipline into another, while simultaneously facilitating the proper contact and interaction between all disciplines. That so many of our universities today have purchased wholesale Newman's "infidelity of the day" should be clear. The methods and modes of the natural sciences have become for many the only acknowledged path to real knowledge. Thus in the modern view we have either knowledge, i.e. natural science, or opinion, i.e. religion, which may be helpful for some folk but which can never be accorded along with science the status of genuine knowledge. Even (perhaps especially) within departments of Religious Studies, many today start with the premise Newman so clearly denounced, that, "Religion is just one of those subjects about which we can know nothing" (291). Therefore such academic practitioners study *about* religion and examine *what* others have claimed as their religious belief, but never presume (in the name of tolerance and diversity) to adjudicate between competing theological claims, as if doing so would be either foolish, impolite, or just epistemologically naive. In such an atmosphere, everyone, scientists included—some with names like Gould, Dawkins, Lewontin, or Crick—feels free to play the theologian by making religious truth claims, whether or not they acknowledge that this is what they are doing.

Newman also recognized that the converse problem emerged whenever theologians sought to derive physical truths from Revelation, especially by forcing Scripture to speak to matters about which it is either silent or unclear. For example, as Hodgson relates, in later life Newman would dismiss the claims of Bible-citing anti-evolutionists on the ground that "such creationists ... are trapped by the superficial meaning of the words, which inevitably leads them to a position that is antithetical both to theology and science."[15] Hence the supposed conflict between science and theology surfaced because, as Newman said, "neither of them has been quite content to remain on its own homestead" (331). It is this kind of disproportion that Newman feared would come from not properly drawing distinctions between the circles of knowledge.

Newman's Methodological Distinction between Science and Theology

Especially important for Newman, in this light, was the restriction of final causes to the domain of theology. "The physical philosopher has nothing whatever to do with final causes," he insisted, "and will get into inextricable confusion, if he introduces them into his investigations" (325). In fact, for Newman, theology was defined as "just what such Science is not. Theology begins, as its name denotes, not with any sensible facts, phenomena, or results, not with nature at all, but with the Author of nature" (326). The distinction he drew seems nearly exhaustive:

> [The Physical Philosopher] contemplates the facts before him; the Theologian gives the reasons of these facts. The physicist treats of efficient causes; the

> Theologian of final. The physicist tells us of laws; the Theologian of the Author, Maintainer, and Controller of them; of their scope, of their suspension, if so be; of their beginning and their end (326).

But as we have seen, all of these differences have not left theologians and scientists contented to remain on their respective homesteads. Newman explained that this reality stems from the fact that each has become so enamored of his own *method* that he seeks to apply it inappropriately beyond its proper sphere. Newman argued that theology is deductive, "advancing syllogistically from premises to conclusion," and that physical science is, "just the reverse," viz. inductive. For the physical scientist, "a vast and omnigeneous mass of information lies before the inquirer, all in a confused litter, and needing arrangement and analysis." The theologian's situation is altogether different: "No strictly new truth can be added," insisted Newman, "to the theological information which the Apostles were inspired to deliver," though it is possible, he said, "to make numberless deductions from the original doctrines" (331). He summarized, then, by contrasting physical science with theology in a list of distinctions. Physical science, said Newman, is "experimental ... richer ... bolder ... progressive ... [and] has visions of the future." Theology, on the other hand, is "traditional ... more exact ... surer ... stationary ... [and] loyal to the past" (332).

Newman argued that theology is deductive and that physical science is inductive.

For Newman, the difference between the respective paths to each kind of knowledge remained central to his critique of science-religion difficulties. Knowledge of theological truths, argued Newman, comes from revelation which is the "direct interference from above, for the introduction of truths otherwise unknown ... gained, not by any research into facts, but simply by appealing to the authoritative keepers of them. ... Faith cometh by hearing" (335). Thus although the natural sciences properly appeal to Baconian and inductive methods, Newman insisted that "it was nothing more than a huge mistake to introduce the method of research and of induction into the study of Theology at all" (336). Here we may ask, what might this "inductive theology" against which Newman protests look like? And why does he hold it in such low regard?

The Critique of Inductive Theology or Newman Contra Paley

An "inductive theology" would require, as does inductive natural science, some collection of phenomena from which to draw generalizations. Newman admits that among so-called inductive theologians "three principle stores have been used": Scripture, antiquity, and nature. When each is made the foundation for an inductive theology, the results are called respectively: scriptural religion, historical religion, and natural theology or physical theology (335, 337). Newman's principle critique of these three inductive theologies rests in his fear of being mislead by a method that never can give with certainty the whole truth. At best it can lead to "a strong probability, not to a certainty, or again, proving only some things out of the whole number which are true" (339). Here he deserves to be quoted at greater length:

> And it is plain that if such investigations as these are taken as the measure of the whole truth, and are erected into substantive sciences, instead of being understood to be, what they really are, inchoate and subordinate processes, they will, accidentally indeed, but seriously, mislead us (339).

Newman briefly applied this critique to both scriptural religion and to historical religion. But he trained his greatest critical guns upon natural theology which he confessed to having long viewed "with greatest suspicion" (340).

While granting that physical theology may claim some merits and that it has rendered "great services" to faith generically conceived, Newman doubted whether genuine Christian faith really owed anything to the work of physicists. To begin with, he argued that the Design Argument owed nothing to Baconianism or modern science. Its force today, he maintained, is no different than is was in ancient Greece. To make the point, Newman deferred to Thomas Macaulay's 1840 essay on Van Ranke's *History of the Popes* from the *Edinburgh Review*:

> As respects natural religion, it is not easy to see that the philosopher of the present day is more favourably situated than Thales or Simonides. He has before him just the same evidences of design in the structure of the universe which the early Greeks had. We say, just the same; for the discoveries of modern astronomers and anatomists *have really added nothing* to the force of that argument which a reflecting mind finds in every beast, bird, insect, fish, leaf, flower, and shell. The reasoning by which Socrates, in Xenophon's hearing, confuted the little atheist, Aristodemus, is exactly the reasoning of Paley's

> Natural Theology. Socrates makes precisely the same use of the statues of Polycletus and the pictures of Zeuxis, which Paley makes of the watch.[16]

Well then, so much for Paley, or (perhaps for that matter) for Michael Behe's "irreducibly complex" bacterial flagellum or, maybe even, for William Dembski's "explanatory filter."[17] According to Newman, it is all "pretty much what it was two thousand years ago" (339). Is it really such a big problem if contemporary design theory is not much different than that of the ancients? In the case of natural theology, Newman the Christian theologian said yes. If it really is the same natural theology for Behe and Dembski that it was for Socrates, then, to use Newman's words, "It cannot tell us anything of Christianity at all" (341). Elsewhere Newman quipped: "The material world, indeed, is infinitely more wonderful than any human contrivance; but wonder is not religion, or we should be worshipping our railroads."[18]

"The material world, indeed, is infinitely more wonderful than any human contrivance; but wonder is not religion, or we should be worshipping our railroads."
—John Henry Newman

Newman deeply feared the hitching of Christian apologetic wagons to any natural theological horses because physical theology taught "exclusively" three divine attributes: the power, wisdom, and goodness of God; but it remained silent regarding divine justice, mercy, providence, et al. Insisting that "half of the truth is a falsehood," and that natural theology scarcely offered that, it remained for Newman "a false gospel" (340–1). Consider Newman's own words:

> What, on the contrary, are those special Attributes, which are the immediate correlatives of religious sentiment? Sanctity, omniscience, justice, mercy, faithfulness. What does Physical Theology, what does the Argument from Design, what do fine disquisitions about final causes, teach us, except very indirectly, faintly, enigmatically, of these transcendently important, these essential portions of the idea of Religion? ... What does Physical Theology tell us of duty and conscience? Of a particular providence? ... what does it teach us even of the four last things, death, judgment, heaven, and hell, the mere elements of Christianity? ... I say Physical Theology cannot, from the nature of the case, tell us one word about Christianity proper; it cannot be Christian, in any true sense, at all ... How can that be a real substantive Theology, though it takes the name, which is but an abstraction, a particular aspect of the whole truth, and is dumb almost as regards the moral attributes of the Creator, and utterly so as regards the evangelical? (341).

Newman did not end with this naming of natural theology's sins of omission. He continued by suggesting that physical theology could be positively evil. "If it occupies the mind," he asserted, "it [tends] to dispose it against Christianity." Natural theology proper can only trade in laws. Accordingly, it cannot contemplate miracles, which, argued Newman, "are of the essence of the idea of a Revelation." In short, the god of physical theology was likely to become an "idol." Powerful? Yes. Good? Yes. Wise? Yes. But no more; and, therefore, concluded Newman, the god of natural theology "is not very different from the God of the Pantheist. ... I really doubt," he ended, "whether I should not prefer that [the natural theologian] should be an Atheist at once than such a naturalistic, pantheistic religionist. His profession of theology deceives others, [and] perhaps deceives himself" (342).

In the final analysis Newman pled for the scientist and the theologian each to respect the other's turf and to remain on his own homestead. He truly believed that natural science afforded no good basis for theology; and that natural scientists were unlikely to produce orthodox theology if they began with their science alone. Conversely, he was deeply committed to the reliability of modern science for finding out how the world worked. Because of his commitment to the unity of all Truth, he also knew that the Christian faith had nothing to fear from the progress of science. The man of Faith "is sure," insisted Newman,

> and nothing shall make him doubt, that if anything seems to be proved by astronomer, or geologist, or chronologist, or antiquarian, or ethnologist, in contradiction to the dogmas of faith, that point will eventually turn out, first, *not* to be proved, or, secondly, not *contradictory*, or thirdly, not contradictory to any thing *really revealed*, but to something which has been confused with revelation (351).

So confident was Newman that truth can never be contrary to truth that he could happily accord the scientist full freedom: "However [the scientist's] line of investigation may swerve now and then, and vary to and fro in its course, or threaten momentary collision or embarrassment with any other department

of knowledge, theological or not, yet if he lets it alone, it will be sure to come home" (357).

Newman Ponders the Intelligent Design Movement

This essay began with a statement of hope that Newman's thought may fruitfully season our views of things. Although it would require another essay to tease out the many ways Newman's thought might find contemporary application, I will indulge in a speculative conclusion regarding one question of present concern to which I have already alluded: How might Newman react to the contemporary Intelligent Design (ID) Movement associated with such people as Phillip Johnson, William Dembski, Michael Behe, and certain Fellows of the Discovery Institute? I think, the answer is, with genuine ambivalence.[19]

The ID Movement is at least three things (perhaps it is several more). First, it is a critique of and protest against philosophical naturalism in science and culture. Second, it is a program for investigating divine action and intelligent causation in the created order; i.e. for reinstating design and final causality in science. Third, it is a studied denunciation of Darwinian evolutionary theory. How might Newman react to each part of this three-fold agenda?

With the anti-naturalism plank, there is good reason to suspect that Newman would find broad, though qualified, grounds for agreement. For example, Johnson's latest contribution to the ID book industry, *The Wedge of Truth: Splitting the Foundations of Naturalism*, includes portions that bear striking resemblance to Newman's ideas and mode of argument. Consider the similarity between Johnson and Newman on the proper limits of science:

> A science which is founded in reality will always remember the fundamental distinction between persons and things, and will never imagine that it can understand the former by methods which are appropriate only for the latter. True science will also remember that only some aspects of reality can be understood through observation and experiments, and so it will never aspire to such an absurdity as a "theory of everything," nor will it attempt to explain thought itself as a product of physical forces. In a word, it will practice the theological virtue of humility. When you find scientists insisting that there are no limits or demanding that all human thought must be restricted to scientific categories, you can be sure that you are in the presence of pseudoscience.[20]

I can hear Newman applauding. Like Johnson, one of Newman's primary protests was against this tendency of some scientists to go off the homestead by uttering heterodox philosophical and theological claims in the name of science. Too often, complain both Johnson and Newman, such utterances qualify neither as real science nor as orthodox theology. But where Johnson calls for the practice of a different type of science—a science that starts from the affirmation of God's objective reality—something he has called "theistic realism," Newman simply wanted science to stay off the theologian's turf.[21] Newman remained content to leave the scientist free to pursue his investigation of nature *in terms of nature alone*, a technically *atheistic* methodological limitation which some ID proponents decry as capitulation to metaphysical naturalism. Newman was satisfied, however, with his separationist view which carefully proscribed the kinds of utterances and claims scientists could rightfully make.

While Newman would sympathize with ID theorists' attacks on metaphysical naturalism, he would reject their attempt to reinstate design in science, and consider their assault on evolution much ado about a red herring.

This stance anticipates Newman's reaction to ID's second plank, the attempt to infer design and intelligence; to reinstate final causes in science. Here Newman would be most unwilling to join forces with the ID movement for reasons spelled out in the previous section. This is an important point of divergence between Newman and the ID theorists, however. Dembski explicitly states that the "burden" of his book *Intelligent Design* is to show that natural and final causes "can operate in harmony without doing violence either to science or to theology." Elsewhere Dembski has argued that "design should be readmitted to full scientific status."[22] Newman would certainly squirm. Here also would surface Newman's distrust of the connection between design theory and Christian apologetics, a connection endorsed by more than one ID leader, including a director of The Discovery Institute and the publishers of *Touchstone* magazine.[23]

Finally, when confronted with ID's anti-evolutionary plank Newman would probably yawn. Although our attention has been directed at his pre-Darwinian utterances, on this point we must

move post-1859. When we do, we find Newman saying this:

> There is as much want of simplicity in the idea of the creation of distinct species as in those of the creation [of] trees in full growth (whose seed [is] in themselves) or of rocks with fossils in them. I mean that it is as strange that monkeys should be so like men, with no historical connexion between them, as that there should be, or the notion that there was no history or course of facts by which fossil bones got into rocks. ... I will either go the whole hog with Darwin, or, dispensing with time and history altogether, hold, not only the theory of distinct species, but that also of the creation of the fossil-bearing rocks.[24]

Unlike ID theorists, Newman was simply uninterested in specified and complex scientific arguments about evolutionary theory. He did not believe this to be the best front upon which to level an assault against the real enemy, metaphysical naturalism. Not that he was either a supporter of Darwin or of any other theory of evolutionary transmutation; he simply did not care much about it and was content to leave the matter to the biologists, whom he expected to stay on their own turf. Newman was sure that God could work as well through secondary causes as he could by immediate fiat. As he wrote in one letter, "Mr. Darwin's theory *need* not be atheistical, be it true or not; it may simply be suggesting a larger idea of Divine Prescience and Skill."[25]

At this point design theorists quickly raise the issue of *evidence*. They might counter Newman's indifference to evolution with a query something like this: "Suppose that biologists cling to Darwinism even if some day the weight of the evidence clearly mitigates against evolutionary theory? Might we then not conclude that such biologists no longer functioned as legitimate scientists, but rather as illegitimate defenders of metaphysical naturalism?" As far as I know, Newman never directly confronted these specific questions. Had he, no doubt he would have conceded the point while insisting that such hypothetical questions could only become real after the evidence did, in fact, weigh against evolution. He did not believe, however, that such a point had been reached. Moreover, Newman's primary contention was that Christian orthodoxy could accommodate biology wherever the evidence ultimately led. "I see nothing in the theory of evolution inconsistent with an Almighty Creator and Protector," he told the Rev. David Brown in 1874.[26] What to do with heretics who defend their naturalism by waving sabers of bad biology might become a real problem somewhere or sometime, Newman would concede; but it was a different problem than whether Christianity could withstand the prospect of evolution's legitimate triumph. He believed that it could. And until the evidence against evolution was in, Newman viewed theologically motivated anti-evolutionism as a waste of time usually driven by hyperliteralist readings of Scripture according to some commonsense Protestant notion of private interpretation.

So while Newman would sympathize with ID theorists' attacks on metaphysical naturalism, he would reject their attempt to reinstate design in science, and consider their assault on evolution much ado about a red herring. The upshot, then, when rating Newman on Intelligent Design remains mixed; apparently one count for, one against, and one shoulder shrug. This ambivalence is important to acknowledge in our day of polarized conversation between parties often bent on dichotomizing for selfish reasons. It is good to grapple with minds who are neither wholly for us nor fully against us; for they may stand among our helpmates. Newman, like many, should be viewed as a sympathetic critic of the ID movement. Were its members, indeed all interested parties, to give his voice their ear, perhaps our views of several things might be fruitfully seasoned and the discussion advanced. ❄

Notes

[1] Rom. 1:20, New International Version. Used by permission of Zondervan Publishing House.

[1] Frank M. Turner, "John Henry Newman and the Challenge of a Culture of Science," *The European Legacy* 1 (1996): 1700.

[2] The primary case that comes to mind was a Templeton Foundation Science and Religion Course Program Workshop hosted in Berkeley, California, by the Center for Theology and Natural Sciences a few years ago. During one of the sessions, leaders suggested that the work with which they were occupied in this field constituted the emergence of a "new discipline."

[3] See G. K. Chesterton, *Orthodoxy* (1908; rpt. San Francisco: Ignatius Press, n.d.), 53; and Russell Kirk, *Prospects for Conservatives* (Washington: Regnery Gateway, 1989), 237.

[4] Hopefully this situation might be changed when evangelicals read the brand new book by James W. Sire, *Habits of the Mind: Intellectual Life as a Christian Calling* (Downers Grove: InterVarsity Press, 2000), which devotes considerable space to the life and thought of Newman (see especially chapters 2 and 3).

[5] There are numerous good sources of biographical information on Newman. The best is the massive authoritative biography by Ian Ker, *John Henry Newman: A Biography* (Oxford: Oxford University Press, 1988). In addition to Ker, I have also relied on other brief but serviceable introductory sketches of Newman's life and thought: See the annotated bibliography, critical essays, and biographical sketch in the Yale edition of *The Idea of a University* edited by Frank M. Turner (New Haven: Yale University Press, 1996); I. T. Ker, "Editor's Introduction," in John Henry Newman, *The Idea of a University* (Oxford: Oxford Univer-

sity Press, 1976), xi-lxxv, and critical notes; Martin J. Svaglic, "Introduction," in John Henry Cardinal Newman, *The Idea of a University* (Notre Dame: University of Notre Dame Press, 1982), vii-xxvii; James W. Sire, *Habits of the Mind: Intellectual Life as a Christian Calling* (Downers Grove: InterVarsity Press, 2000), 29–70; and "John Henry Newman (1801–1890)," *The Catholic Encyclopedia*, on-line at www.newadvent.org/cathen/10794a.htm.

[6] See J. M. Cameron, "John Henry Newman and the Tractarian Movement," in *Nineteenth Century Religious Thought in the West*, vol. II, ed. Ninian Smart, et. al. (Cambridge: Cambridge University Press, 1985), 69–109.

[7] Citations for the three most common editions of *The Idea of a University* have been given already (see note 6 above). For more on Newman's educational thought, see, e.g., A. Dwight Culler, *The Imperial Intellect: A Study of Newman's Educational Ideal* (New Haven: Yale University Press, 1955); and John E. Wise, *The Nature of the Liberal Arts* (Milwaukee: The Bruce Publishing Company, 1947), 138–57.

[8] Sire, *Habits of the Mind*, 34.

[9] Beyond Frank Turner's article on Newman and a culture of science (see note 2 above) only two obscure articles are devoted to Newman's views of science: Peter E. Hodgson, "Newman and Science" *Sapientia* 54 (1999): 395–408; and Stanley Jaki, "Newman and Evolution," *Downside Review* (January 1991). Otherwise, the sparse literature that does mention Newman and science does not have Newman's thought as its primary subject: See J. M. Cameron, "Newman and the Empiricist Tradition," in *The Rediscovery of Newman: An Oxford Symposium*, John Coulson and A. M. Allchin, eds. (London: Sheed and Ward, 1967), 76–96; Walter F. Cannon, "The Normative Role of Science in Early Victorian Thought," *Journal of the History of Ideas* 25 (1964): 487–502; and Joan L. Richards, "The Probable and the Possible in Early Victorian England," in *Victorian Science in Context*, Bernard Lightman, ed. (Chicago: University of Chicago Press, 1997), 51–71.

[10] Hodgson, "Newman and Science," 401–3.

[11] John Henry Newman, *The Idea of a University Defined and Illustrated In Nine Discourses Delivered to the Catholics of Dublin In Occasional Lectures and Essays Addressed to the Members of the Catholic University*, ed. Martin J. Svaglic (Notre Dame: University of Notre Dame Press, 1982), 322. All subsequent quotations from *The Idea of a University* will be taken from this edition and cited parenthetically in the text by page number only.

[12] It is worth mentioning as an aside that John William Draper (1811–1882) would not publish his *History of the Conflict Between Religion and Science* until 1874 and Andrew Dickson White (1832–1918) would not publish his *A History of the Warfare of Science with Theology in Christendom* until 1896. Although Draper and White are sometimes credited with first casting the relationship between science and religion in terms of antagonism, they should not be. The notion was already current nearly two decades before the appearance of Draper's book when Newman took up his pen in opposition to the conflict interpretations.

[13] See Stephen Jay Gould, *Rocks of Ages: Science and Religion in the Fullness of Life* (New York: Ballentine Publishing, 1999). Here Gould distinguishes between *science* which, he asserts, deals with facts and "the factual construction of nature" (54) on one hand, and *religion* (which Gould speaks of in terms of "human purposes, meanings, and values") whose concerns cannot be answered "by factual data of any kind" (55). And since, reasons Gould, religious and ethical principles "can never be inferred from the factual discoveries of science" (5), such principles must be something other than genuine knowledge, something like subjective opinion. Hence Gould asserts that humans navigate between two exclusive "domains," one "ethical" the other "factual" (58). This contention that ethical claims are not matters of fact is one manifestation of the "form of infidelity of the day" to which Newman so strongly objected.

[14] Newman allowed for intersection in these terms: "These two great circles of knowledge, as I have said, intersect; first, as far as supernatural knowledge includes truths and facts of the natural world, and secondly, as far as truths and facts of the natural world are on the other hand data for inferences about the supernatural. Still, allowing this interference to the full, it will be found, on the whole, that the two worlds and the two kinds of knowledge respectively are separated off from each other ..." (323).

[15] Hodgson, "Newman and Science," 405.

[16] Quoted in Newman, 338–9. For the original see Thomas Babington Maculay, *Critical, Historical, and Miscellaneous Essays and Poems* (New York: John W. Lovell, n.d.), 467. For a brief sketch of the history of design arguments and their presence in classical times see William A. Dembski, "The Design Argument," in *The History of Science and Religion in the Western Tradition: An Encyclopedia* (New York: Garland Publishing, 2000), 65–7.

[17] See Michael Behe, *Darwin's Black Box: The Biochemical Challenge to Evolution* (New York: The Free Press, 1996); William A. Dembski, *The Design Inference: Eliminating Chance Through Small Probabilities* (Cambridge: Cambridge University Press, 1998), 36–47; and idem, *Intelligent Design: The Bridge Between Science & Theology* (Downers Grove: InterVarsity Press, 1999), 127–34.

[18] John Henry Newman, in Geoffrey Tillotson, ed. *Newman: Poetry and Prose* (Cambridge: Harvard University Press, 1993),106, quoted by Turner, 1700.

[19] For The Discovery Institute's Center for the Renewal of Science & Culture see www.discovery.org/crsc/index.php3.

[20] Phillip E. Johnson, *The Wedge of Truth: Splitting the Foundations of Naturalism* (Downers Grove: InterVarsity Press, 2000), 155. See also Johnson's *Reason in the Balance: The Case Against Naturalism in Science, Law and Education* (Downers Grove: InterVarsity Press, 1995).

[21] For Johnson's notion of "Theistic Realism" see Johnson, *Reason in the Balance*, 48–50.

[22] Dembski, *Intelligent Design*, 46; idem, "Reinstating Design within Science," *Rhetoric & Public Affairs* 1 (Winter 1998): 503.

[23] See Jay Wesley Richards, "Proud Obstacles & a Reasonable Hope: The Apologetic Value of Intelligent Design," *Touchstone* 12 (July/August 1999): 31–2. See also other articles in this "special issue" of *Touchstone* devoted to Intelligent Design. That the Fellowship of St. James, the publisher of *Touchstone*, has supported the ID movement without tending more carefully to the criticisms of Newman is somewhat surprising given their orientation toward more traditionalist forms of piety and theology.

[24] John Henry Newman, unpublished papers at the Birmingham Oratory, note of 9 December 1863, quoted in J. M. Cameron, "Newman and the Empiricist Tradition," 90.

[25] "Letter to Pusey," in *Letters & Diaries* (Oxford: Oxford University Press, 1973), 25.137, quoted in Hodgson, "Newman and Science," 405.

[26] "Letter to Rev. David Brown," in ibid., 406.

A Time and a Place for Noah

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This paper attempts to place Noah in real time and space. First, it is deduced from both biblical and archaeological evidence that Noah probably lived in Mesopotamia around 2900 B.C., in what archaeologists refer to as the Jemdet Nasr Period. Next, Noah's "world" is examined with respect to the geography, climate, irrigation, natural resources, agriculture, animal husbandry, cities, architecture, religion, pottery, textiles, luxuries, language, numbers, and writing of that time. The biblical Noah is then discussed in the context of the time and place in which he lived – how he was righteous in God's sight, why he built the ark, and how he could have obtained the materials (wood and pitch) for building the ark. It is argued that recent attempts to place Noah in the Mediterranean area much earlier in time make Noah a mythological, rather than a historical, person.

The story of Noah and the Flood in Genesis 6–9 has long been a subject of contention between biblical and secular scholars. Is the story a myth, as most secular scholars claim, or was Noah a real historical person who survived a great deluge? Using a "realistic approach," this paper places the biblical Noah in the context of real time and space. I used the same approach in my paper, "The Garden of Eden: A Modern Landscape," published in an earlier issue of *Perspectives on Science and Christian Faith*.[1]

The following discussion is based on two assumptions:

1. The Bible can be taken at face value; that is, the biblical writer was accurately recording historical events of ancient times. By taking the Bible at "face value," nothing is to be read into the Bible that is not explicitly stated in its original (autograph) text.

2. The scientific disciplines of geology, geography, and archaeology also accurately record the events of ancient times. The archaeology presented in this paper is the result of over a century and a half of fieldwork done in Mesopotamia by many archaeologists.

*ASA Member

A Time for Noah

Biblical Evidence

The Bible specifically dates Noah because it traces the genealogy of Adam to Abraham through the line of Seth (Gen. 5). Abraham is known to have lived about 2000–1900 B.C.[2] Since the Bible states that Noah lived about 1,000 years before Abraham, it places Noah at ca. 3000 B.C. The Bible also follows the line of Cain (Gen. 4:16–24), but since this is not the covenant line, it does not mention specific time intervals between "generations" along Cain's line.

While a "generation" in the Bible does not necessarily mean a direct father-to-son descent,[3] it is still notable that the Bible lists nine "generations" between Adam and Noah (with an average "generation" of about 120 years), but only seven "generations" between Adam (through Cain) and Jabal, Jubal, and Tubal-cain (Gen. 4). This implies (assuming that the length of a "generation" in both genealogical lines is about 120 years) that these three descendants of Cain may have lived three or four hundred years before Noah. The importance of Jabal, Jubal, and Tubal-cain to this discussion is that the Bible mentions their occupations, which can be linked to archaeological evidence.

Biblical-Archaeological Evidence

"And Lamech took unto him two wives: the name of the one was Adah, and the name of the other, Zillah. And Adah bore Jabal: he was the father of such as dwell in tents, and of such as have cattle. And his brother's name was Jubal: he was the father of all such as handle the harp and pipe. And Zillah, she also bore Tubal-cain, an instructor of every craftsman in bronze and iron: and the sister of Tubal-cain was Naamah" (Gen. 4:19–22).

The word "father" in verses 20 and 21 of the King James Version implies that Jabal and Jubal were the first to practice these occupations in Mesopotamia. However, Speiser translates the word "father" as "ancestor," which alternately suggests that these men might have been only the first of their lineage to practice these professions.[4] "Archaic" cuneiform texts from Uruk, dated at ~3100 B.C., may also be relevant to this discussion.[5] The so-called "Professions List" text marks the first mention of a profession by the sign "gal," which means "big" or which may stand for the "head of."[6] This may be a parallel idea for the Gen. 4:20–22 "professions list" – that these three men were at the "head of" their trades, in terms of being one of the first or proficient at their trades.

The Uruk "Professions List" mentions the following occupations as being already established by ca. 3100–3000 B.C.: plowman (farmer), shepherd (sheep and goats), cowherd (cattle), fisherman (fish), smith (worker in metal), weaver (of textiles), and potter (maker of pottery). Since these occupations were already in existence by 3100 B.C., it implies that both Jabal and Tubal-cain must have lived (if they were the first) around or before this time.

Jabal, the "father" of such as dwell in tents and have cattle, is difficult to place time-wise in Mesopotamia. It is known that the domestication of cattle, sheep, and goats happened ~6500 B.C. in areas surrounding Mesopotamia,[7] but when nomadic herding became "big business" in Mesopotamia – in that Jabal could have become the "head of" this trade – is not clear. It is known that nomads occupied the Negev in the Early Bronze Age (ca 3000 B.C.)[8] (Fig. 1), and that these ancient nomads appear to have had a similar lifestyle to that of the modern-day Bedouin, who pitch their tents and move seasonally in order to provide grazing for their domesticated animals.

The musician occupation of Jubal also fits within this time frame. Sumerian characters representing harps have been found on stone tablets from late in the Uruk Period (~3100 B.C.; Table 1).[9] These drawings depict a curved or bow-shaped harp with three strings, a resonator, and a neck. People also played vertical end-blown flutes (pipes) in ancient times. While good pictographs of flutes have been found on Mesopotamian cylinder seals only from the later Akkadian Period (2350–2150 B.C.; Table 1), it is probable that flutes existed long before this in Mesopotamia, since in ancient Egypt the instrument is attested to as early as the proto-dynastic period (ca 3000 B.C.).[10] Following this reasoning, one can surmise that Jubal also probably lived around 3000 B.C. or before.

The most useful (to this discussion) of the three professions named in Gen. 4 is that of Tubal-cain: *"he was an instructor of every craftsman in bronze and iron."* The Bronze Age in southwestern Asia is known to have begun in the fourth millennium B.C., when copper began to be alloyed with either arsenic, antimony, or tin.[11] The earliest sites contain mostly arsenical bronze, and occur with small numbers of iron artifacts. The generally recognized date for the beginning of the Bronze Age in the Near East is ca. 3300 B.C.;[12] thus, Tubal-cain could have lived as early as 3300 B.C. if he was one of the first in Mesopotamia to craft bronze objects. If 300–400 years is subtracted from 3300 B.C. (based on the 120-year average biblical "generation" discussed above), this would place Noah as a historical person around 3000–2900 B.C.

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Archaeological Evidence

Additional archaeological evidence exists for the time of Noah and the Flood in the form of Sumerian cuneiform texts known as the "Gilgamesh Epic" and "King List." Both documents attest to a great flood survived by Ziusudra (or Utnapištim or Atra-hasis, alternate Babylonian names for Noah), who was the "king" of the ancient city of Shuruppak in Mesopotamia (Fig. 1). Gilgamesh was the fifth king of the first dynasty of Uruk following the great flood,[13] and is known to have been a real person who reigned in Mesopotamia around 2650 B.C.[14] Therefore, it is reasonable to assume that the Flood happened sometime before 2650 B.C.—and perhaps at least two hundred years before, since Gilgamesh was supposedly the fifth king after the Flood.

It can be deduced [from archaeological evidence] that the Old Testament Genesis Flood most likely happened ca 2900 B.C. ± 100 years—or almost exactly when the Bible places it in time according to its genealogically-based chronology.

The Sumerian King List mentions ten antediluvian kings, with Ziusudra being the "king" who lived in Shuruppak just before the flood. The mention of Shuruppak is important because the ancient ruins of this city still exist today as the archaeological mound of Fara (also sometimes spelled Farah), which has been partially excavated in modern times. On the basis of pottery types, cylinder seals, and proto-cuneiform tablets found at Fara, it is known that this city was founded in the Jemdet Nasr Period, and that it was a significant urban center during this time.[15] The Jemdet (also sometimes spelled "Jamdat" or "Ǧamdat") Nasr Period dates from ca. 3100–2900 B.C. (Table 1), and was named after the archaeological site of that age (Fig. 1).

At Shuruppak (and also at Uruk), the last Jemdet Nasr remains are separated from the subsequent Early Dynastic I Period by clean, water-lain clay deposited by a flood. This flood clay is nearly five feet thick at Uruk,[16] and two feet thick at Fara.[17] If these deposits do represent Noah's Flood and the division between antediluvian and postdiluvian societies, then a date (the end of Jemdet Nasr time) is established for this historical event.[18] Above these flood deposits, a new era of building and technology was established in southern Mesopotamia starting in the Early Dynastic I Period (Table 1).

From the above archaeological evidence, it can be deduced that the Old Testament Genesis Flood most likely happened ca. 2900 B.C. ± 100 years—or almost exactly when the Bible places it in time according to its genealogically-based chronology.

A Place for Noah

Biblical Evidence

The Sumerian King List mentions Shuruppak as being the "home town" of Noah. The Bible also attests to Noah having lived in the area of Mesopotamia. The Garden of Eden was located in the land of the four rivers of Mesopotamia: Euphrates, Tigris, Pishon, and Gihon (Gen. 2:10–14). Cain went out from Eden and dwelt in the land of Nod, to the east of Eden (Gen. 4:16). The ark landed upon the mountains of Ararat (Armenia), located just north of Mesopotamia (Gen. 8:4). The names of some of Noah's descendants mentioned in Gen. 10 (e.g., Ophir, Havilah, Asshur) represent places bordering Mesopotamia, and Noah's descendant, Nimrod (Gen. 10:8–12), was the founder of Babel, Erech, and Calneh, all cities in the land of Shinar (the biblical counterpart of the cuneiform "Sumer").[19] The "tower of Babel" was located on the plain of Shinar, and may have been the ziggurat of ancient Babylon. Finally, it was Noah's descendant, Abraham, who (almost 1,000 years later) left Mesopotamia (Ur) for the promised land of Canaan.

Archaeological Evidence

As mentioned above, the Sumerian King List designates Shuruppak as the place where Noah (Ziusudra) lived. The high mound of Fara

Table 1. Archaeological Periods in Mesopotamia

~5500–3800 B.C.	Ubaid
~3800–3100 B.C.	Uruk
~3100–2900 B.C.	Jemdet Nasr
~2900–2750 B.C.	Early Dynastic I
~2750–2600 B.C.	Early Dynastic II
~2600–2350 B.C.	Early Dynastic III
~2350–2150 B.C.	Dynasty of Akkad
~2350–2000 B.C.	3rd Dynasty of Ur
~2000–1600 B.C.	Old Babylonian

(Shuruppak) covers about 120 hectares, has a very thick, pottery-shard density (over six feet in places), and dates from the Jemdet Nasr Period.[20] There is no evidence for a settlement at ancient Shuruppak earlier than the Jemdet Nasr Period; therefore, if Noah did live at Shuruppak, he could not have lived there before about 3100 B.C.

Noah's "World"

The following section reconstructs what it was like to have lived in southern Mesopotamia 5,000 years ago during the Jemdet Nasr Period, since this is the most probable time context in which Noah should be considered as a historical person.

Geography. "Mesopotamia," which literally means the "land between the rivers," is the area located between the Euphrates and Tigris Rivers in what is now modern Iraq (Fig. 1). Southern Mesopotamia (below the latitude of Hit) included Sumer and Akkad, which together are referred to as Babylonia, while northern Mesopotamia was referred to as Assyria. Sumer (meaning "reedy land") occupied the southern, marshy part of a great alluvial plain, whereas Akkad occupied the northern part of the plain from about the latitudes of Baghdad to Babylon. North of the latitude of Hit, the alluvial plain ends and the two rivers become separated by a barren limestone plateau.[21] This plateau confines the Euphrates to a narrow valley, but the Tigris passes through the plateau as a wide upland of plow land and pasture.

Southern Mesopotamia is almost completely flat and near sea level, the only elevated areas being occasional mounds on the plain that represent the remains of ancient Mesopotamian cities such as Shuruppak, Uruk, and Ur (Fig. 1). Below the latitude of modern An-Nasiriyah, however, no mounds can be seen, and between this latitude and the pres-

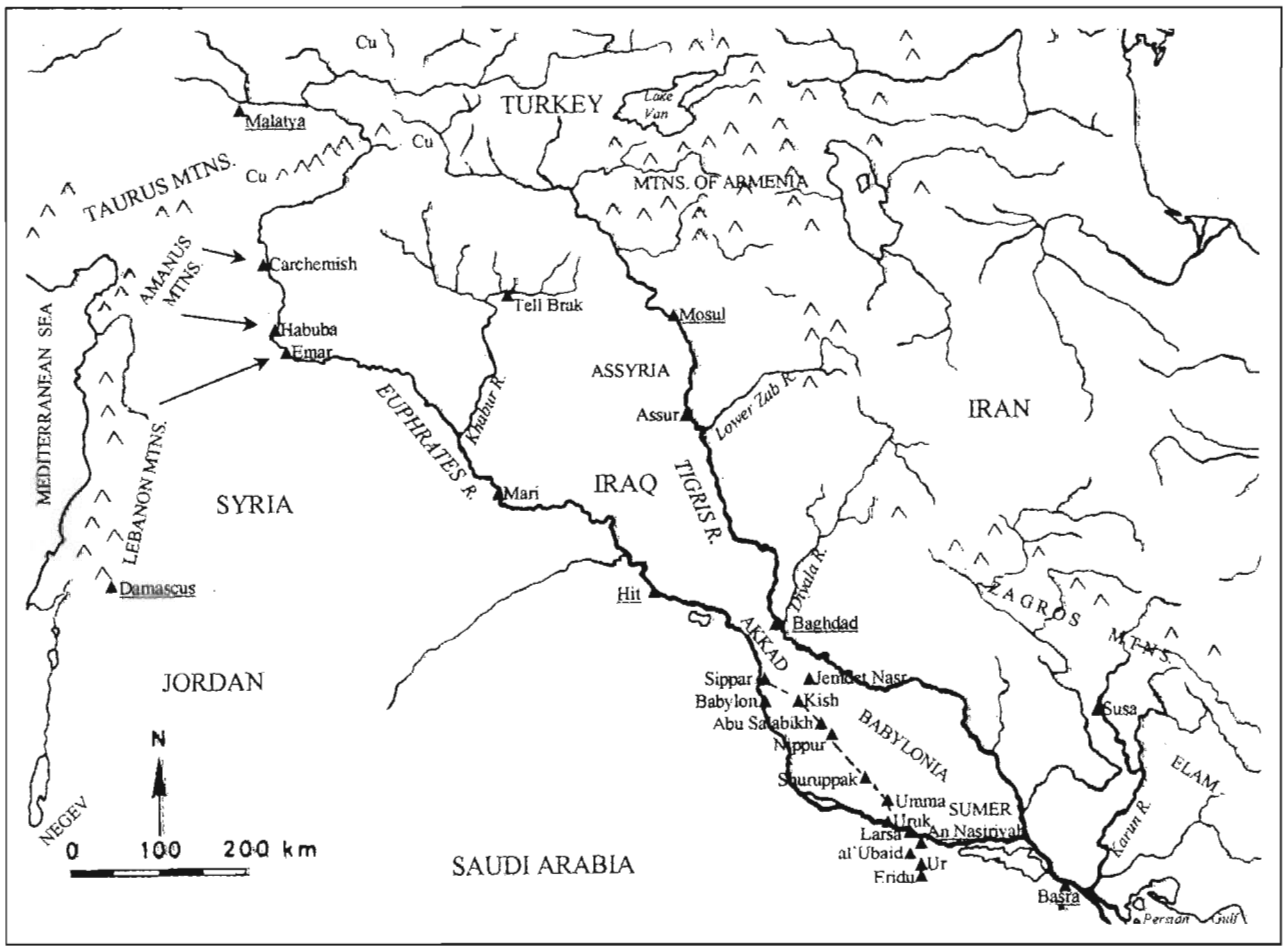

Fig. 1. Map of Near East showing places mentioned in the text. Modern cities are underlined. Cu indicates possible copper source to Mesopotamia. Arrows show the possible movement of timber from mountain sources to the Euphrates. Short dashes from Sippar to Uruk denote past course of the Euphrates River at about 3000 B.C. Base map is from Oates.[22]

ent Persian Gulf is a region of marshes and lakes. The reason for the absence of mounds below An-Nasiriyah may be because the Persian Gulf extended this far inland during ancient times. Geological evidence suggests that the water of the Gulf reached a maximum at about 3500 B.C., when it was approximately six to ten feet higher, and about 150 miles inland from where it is today.[23]

The Euphrates (meaning "that which makes fruitful") and Tigris (meaning "straight" or "arrow") receive their waters (either runoff or groundwater) from the mountains of Iran, Turkey, Syria, and Saudi Arabia (Fig. 1). These mountains enclose the flat alluvial plain, and essentially marked the known "world" of the ancient Mesopotamians. From March to July, when the Tigris and Euphrates are in flood, about 4,000 square miles can become inundated and covered with an almost continuous sheet of water. When these rivers overflow their banks, a deposit of rich soil is left that promotes the fertility of the region.

The two rivers have constantly changed their courses over time. In particular, the Euphrates has continually migrated westward over the last 5,000 years. During Noah's time (3000–2900 B.C.), the Euphrates flowed from Sippar to Kish to Nippur to Shuruppak to Uruk[24] (Fig. 1), and the mounds that now exist in this part of Mesopotamia were built along this ancient course of the river.

Climate. The climate of southern Mesopotamia is very hot and dry, with temperatures that can reach 120°+F in July and August, and with an average rainfall amounting to only a few inches per year. In summer, the rising hot air does not form clouds because of the lack of water vapor, a condition that helps to produce the hyper-arid climate. The only rain comes in winter (December through March) from intermittent storms brought in from the Mediterranean.[25] During the time that Noah lived (ca 3000 B.C.), the climate may have been somewhat moister than it is today;[26] however, there is no evidence to suggest that the basic features of a very hot and dry climate have been significantly different for the past 6,000 years.[27]

The prevailing wind is the *shamal*, or north wind, which comes from the mountains of Asia Minor (Turkey) and Kurdistan (northern Iraq), and which sweeps almost continuously down the valleys of the Tigris and Euphrates from mid-June to mid-September, mitigating the great heat.[28] The southerly and southeasterly *sharqi* is a dry, dusty wind which occurs from March to early June, and then again from late September through November.

Irrigation. Even as early as the Ubaid Period (Table 1), the occupants of southern Mesopotamia built canals to carry water from the rivers to any irrigable land. The irrigation canals built by the ancient Sumerians during Uruk and Jemdet Nasr time consisted of small, multiple, shifting channels, but by ca. 2500 B.C. (Early Dynastic III), the canals had become consolidated into larger and more permanent waterways.[29] The canal system consisted of an intricate network of dikes, parallel and lateral canals, canals tapping water from the rivers, and also of reservoirs and weirs (small dams) to store the accumulated waters and to release them again in the correct season.[30] A large labor force was necessary to keep the canal system functional. The southern Mesopotamian alluvial soil is so deep, soft, and yielding that it is easily eroded by floods. The canals are then filled and choked with this flood silt so as to be in need of constant re-excavation. Another important work was clearing the canals of reeds.

Canals, and the labor force involved in building them and keeping them functional, must have been very familiar to Noah, since his livelihood and that of his extended kin group depended on supplying Euphrates River water via these canals to their crops.

Canals, and the labor force involved in building them and keeping them functional, must have been very familiar to Noah, since his livelihood and that of his extended kin group depended on supplying Euphrates River water via these canals to their crops. During the Jemdet Nasr Period, it has been documented that there was a closely spaced, linear grouping of large towns near Shuruppak along a constructed canal almost ten miles long. The length of this canal suggests that some form of cooperative, federative activity existed among the rulers of the cities along its waterway.[31]

Natural Resources. The natural resources of ancient Mesopotamia consisted of water (from the two rivers), clay (from the alluvial soil), bitumen (mainly from Hit), and reeds (from the marshlands). The area was almost completely lacking in rocks, metals, or high-quality wood. Clay was used for practically everything: clay bricks, clay pottery, clay

sickles, clay tablets, clay seals, and even clay nails. Bitumen was used for cementing bricks, for caulking boats, and for other adhesive purposes. Bitumen was transported down river from Hit as flat, rectangular "cakes" on reed mats or in reed baskets.[32] Reeds were used for a variety of purposes—to strengthen mud bricks, to build small reed boats, to roof houses, and to make baskets and mats.

Except for the resources mentioned above, everything else had to be imported into Mesopotamia from the surrounding highland areas. Known imports into Mesopotamia during Uruk and Jemdet Nasr time were metal, stone (including chert and alabaster), high-quality wood, and "exotic" luxury items such as gold, precious stones, and spices (as mentioned in Gen. 2:12). Items of export were grain, fish, animal hides, textiles, and pottery. The two rivers and connected canals were the vital arteries along which most trade flowed. Overland transportation was by donkey (onager), or (later) by camel.[33]

Jemdet Nasr-style pottery has been found at Tell Brak, suggesting that trade with that area was operative during the time period in which Noah may have lived.

Trade began in a big way in Mesopotamia during the "Late Uruk expansion" period.[34] Uruk-style artifacts and architecture have been found as far away from southern Mesopotamia as southeastern Anatolia (Turkey), the northern Mesopotamian plains, and the Zagros Mountain valleys of Iran. Uruk colonies, such as the one at Tell Brak in northeast Syria (Fig. 1), were sent out from lowland Mesopotamia to establish themselves at critical junctures along trade routes.[35] Jemdet Nasr-style pottery has been found at Tell Brak, suggesting that trade with that area was operative during the time period in which Noah may have lived.

Agriculture. Due to the severe climate characterized by long, hot summers without any rain, and low and extremely variable winter precipitation, agriculture was practical in southern Mesopotamia only near or next to the two rivers. The alluvial clay soil of Mesopotamia is fertile if supplied with water and then allowed to drain so that salts do not build up in the topsoil. In ancient Mesopotamia, cultivation was necessarily confined to cells fed by each canal, separated in many cases from the next cell by desert grazing. Most people lived the stationary life of the farmer, relying on oxen as draught animals for the cultivation of irrigated, salt-tolerant crops such as barley.[36] Clay sickles are a common artifact of early (Uruk) Mesopotamian agricultural sites, but by Jemdet Nasr time, chert-bladed sickles hafted with bitumen were also being used.[37] Metal hoes, picks, and celts (prehistoric axes) were also in use by this time, as were threshing sledges and harrows.

Jemdet Nasr inhabitants of Mesopotamia had a varied and nutritious diet. Meat came from sheep, goats, cattle, pigs, fish, shellfish, and some wild game (such as gazelles).[38] Dairy products from these animals included milk, various cheeses, and ghee (clarified butter). Also, fowl such as pigeons (but not chickens) and small birds and their eggs were eaten. Common vegetables were onions, garlic, peas, and lentils. Common fruits were dates, pomegranates, olives, and figs. The staple food of most Mesopotamians was barley bread, onions, and fish, and the "national" drink was beer made from malted barley. Cereals (barley, emmer wheat, millet, sesame) consisted of roasted grains or that made into gruel or porridge. Cereal grains were also ground (on grindstones) into flour and made into various kinds of bread (both leavened and unleavened). Dome-type ovens (such as have been found at Fara[39]) were used for baking bread; other foods were cooked over an open flame or glowing coals. Wine was drunk, but mostly by the elite since grapevines were grown primarily in northern Mesopotamia and wine had to be imported into Sumer.[40] Fish were dried, salted, or eaten fresh, and were both a staple and export food.

Animal Husbandry. Vast areas of land away from the two rivers and their associated system of canals provided pasture for flocks during much of the year. Animals were also grazed on fallow land, which had the added benefit of contributing manure as fertilizer to the land.[41] A considerable number of cuneiform tablets from Uruk deal with the keeping of animal herds on the outskirts of the city. Of those tablets, twenty-eight deal with sheep, fourteen with goats, and two with cattle.[42] "Archaic" texts from Fara (Shuruppak) also record the keeping of cattle, sheep, and goats during Jemdet Nasr time. Cuneiform signs on such tablets indicate juvenile or adult animals, sex of the animal, and whether the animals were "breeding" bulls or rams, and in the case of sheep, whether they were "wool sheep." Also, these tablets indicate whether the animals were to be sacrificed for temple worship and festivals, and whether they were part of the "royal herds." Sheep were mainly raised for their wool, and goats

for their dairy products such as fermented buttermilk, yogurt, or curds. Every farming village had its flocks of sheep and goats, and these herds were probably one form of measuring wealth. Dogs had also been trained by this time; one Jemdet Nasr seal impression shows two dogs being led by a skirted, big-nosed, human figure who carries the dog leads in his flexed arms.[43]

Cities. Urban civilization first arose in southern Mesopotamia around 3400 B.C., expanding in late Uruk and Jemdet Nasr time. Cities served as nodal points for facilitating and regulating the exchange of goods (both local and long-distance trade), storing surplus food, and defensive purposes. They also served as political, economic, and religious centers. By late Uruk time, cuneiform texts reveal the existence of a rigid, hierarchical division of labor, duties, professions, offices, and titles. "School texts" indicate that some boys (at least those from the elite class) went to Sumerian scribal schools to study writing and mathematics.[44]

Uruk was probably the greatest of the fourth millennium cities. In that area of Babylonia, from ca. 3300 B.C. onward, there was a great increase in the number of settlements that could be considered populated enough to be cities. Tablet fragments from the late Uruk to Jemdet Nasr Periods list at least eighty-eight cities, or areas of cities, that existed then, with Shuruppak being one of them.[45] Each urban center occupied about fifty hectares, while smaller towns and villages occupied much less space.[46] Art from this period shows the pooling of community resources and the management and redistribution of goods to support an elite and to celebrate large community festivals.[47] Sumerian art also shows beatings of those citizens who did not pay their taxes.

Each city with its few miles of surrounding and dependent villages was a political unit unto itself, having its own laws, constitution, ruler, and gods; i.e., it was a "city-state." The office of a Sumerian city ruler was hereditary, and his power was absolute. He was also the "representative" of the city god. The city-states of old Sumer, ruled by local dynasties, were constantly engaged in territorial conflicts, and Sumer is known to have pioneered advances in warfare technology.[48] Cylinder seals from Uruk through Jemdet Nasr time show the binding, clubbing, stabbing, and sacrifice of captives.[49]

Shuruppak was one of the largest cities of Jemdet Nasr time.[50] Undoubtedly, its position on the Euphrates River near the head of four water (canal) courses was at least partly responsible for its emergence and success. As one of the largest cities in Mesopotamia at that time, Shuruppak would have held a relatively large amount of power, and so would have Noah, the "king" of Shuruppak.

As one of the largest cities in Mesopotamia at that time, Shuruppak would have held a relatively large amount of power, and so would have Noah, the "king" of Shuruppak.

Architecture. The buildings of ancient Mesopotamia consisted of houses, public buildings, and temples. Simple huts were built of reeds plastered with mud, but some houses were built with clay bricks. Unbaked bricks were mould-made, and then sun dried on a layer of matting. Some of these bricks (either pierced or un-pierced) were then baked in a kiln. The temples were built by first raising a huge, flat-topped platform known as a *ziggurat*, which was essentially an artificial "mountain" of sun-baked brick. The temple was built on top of the ziggurat. Around the bases of the ziggurats were built street upon street of mud-brick houses.

Ziggurat temples were typical of Sumerian and Babylonian architecture for over thirty centuries, from the Ubaid Period almost to the time of Christ. Two types of brick were used in temple construction—baked and unbaked. The baked bricks were usually used for the exterior of the temple, while the unbaked ones were used where they would not be visible. Some temples were coated with a gypsum plaster or covered with small colored clay cones,[51] and their facades were ornamented with niches and pilasters. Walls of the temple were thick, and the masonry good. Bonding of the bricks was accomplished by using bitumen and layers of reeds. The roofs of temples consisted of wood and reed matting with a layer of clay on top.[52] The Sumerian cubit was the unit of linear measurement, and the temples were built from the outside in.[53] Also, temples were always built so that their corners were oriented to the points of the compass.[54] Precious objects (such as gold and jewelry) were sometimes placed under the foundation of a temple prior to its being built.

From the Ubaid Period onward, higher and more elaborate ziggurats were built. This was accom-

plished by piling one story upon another in a stair-step like pattern, with the volume of each story less that the one below it. At least thirty-three ziggurats in twenty-seven different cities are known from the Mesopotamian area (sometimes a city would have more than one ziggurat).[55] During the Jemdet Nasr Period, ziggurats usually had only two or three stories, but in time they increased in both mass and height. The ultimate ziggurat was the one in Babylon, which at its zenith had seven stories (with a temple on top of the last story) and was 295 ft. high and 295 ft. square at its base.[56] This temple was rebuilt and renovated a number of times. It is reported that Nebuchadnezzar (604–567 B.C.) covered the upper temple with blue enameled brick, and painted each of the seven stories a different color. All eight towers (seven stages and one temple) could be climbed by means of a spiral staircase, which ran around the outside of the temple.

The purpose of the ziggurat and temple tower was to be a link between heaven and earth—a "high place" or sanctuary, which was supposedly the habitation of a god or gods. The idea of a ziggurat was that the god could leave his or her dwelling place and descend down to man, or man could raise himself up to the level of the gods. Gen. 11:4 records this intention: *And they said, Come, let us build us a city and a tower, whose top may reach unto heaven; and let us make us a name, lest we be scattered abroad upon the face of the whole earth.* The temples were built for the worship of pagan deities.

Religion. The inhabitants of Mesopotamia were polytheistic and worshiped a pantheon of gods. At the head of this pantheon stood An, sky god; Enlil, wind or storm god; Enki, earth and water god; Utu, sun god; Nannar, moon god; and Inanna, mother goddess or "lady of heaven."[57] While all of these (and other) gods were recognized and revered by the inhabitants of Sumer and Akkad, in addition each city had its own god and goddess whom they regarded as their special patrons and protectors.

The temple and temple priests played a central role in the life of the citizens of Mesopotamia. The cultivation of fields in the regions of a city was conducted largely under the supervision of the temple priests.[58] The temple was also involved in trading matters and undoubtedly organized and financed a great amount of commerce.[59] Temple priests may have also acted as "bankers" between private citizens engaged in commerce.

There were two elements to Sumerian religious worship: offerings and sacrifices.[60] Offerings of food, drink, and oil were placed on tables before divine images, and a banquet was held to which human worshipers, the gods, and even the dead could attend. Sacrifices were made on special altars or on the roof of the temple by a qualified priest, who cut an animal's throat while reciting an incantation. As shown by pictures on cylinder seals, it was also the duty of the priest's attendants to execute or sacrifice captives.

While almost all Sumerian cities contained at least one temple, interestingly, no major temple complex has been found at Shuruppak, Noah's home city.

While almost all Sumerian cities contained at least one temple, interestingly, no major temple complex has been found at Shuruppak, Noah's home city.[61] More will be said about this subject later.

Pottery. Archaeologists use pottery, cylinder seals (containing a particular style of cuneiform writing), and the carbon-14 method to date Mesopotamian artifacts and the sites where these artifacts occur. Most important of these techniques is the recognition of specific-age pottery types. For example, beveled-rim bowls are diagnostic for Uruk-age vessels. These occur in massive quantities at Uruk-age sites and were apparently mass-produced on a potter's wheel.[62] Polychrome-painted bowls were their direct successors in the Jemdet Nasr Period. Both the Uruk beveled-rim bowls and the polychrome Jemdet Nasr bowls seem to have been made in standard sizes, perhaps because they were used as vessels for distributing rations to workers laboring on public works such as temples and canals.[63]

Pottery made in the Jemdet Nasr Period was wheel-made, but the firing was not well controlled, as can be seen in over-fired and soft pieces common to that age.[64] Handles are usually pierced lugs, but simple loops also occur, as do twisted handles. Spouted jars were also a popular vessel of this time period. Types of clay used were either light red or light gray. The light-red clay and a burnished slip were used almost exclusively for polychrome ware. Paint was applied in geometric-designs; however, the aesthetic sense of this decoration was not highly developed, as overcrowded and unbalanced designs are a common feature of Jemdet Nasr pottery. Many jar types found at both Jemdet Nasr and Shuruppak (Fara) were painted plum-red all over, or from the shoulder of the bowl upwards.[65]

Textiles. Textile manufacturing was one of Mesopotamia's primary domestic and export industries, and a large amount of spindle-whorl artifacts attest to the importance of weaving and textiles in the life of the inhabitants. Linen (made from flax of the flax plant) and wool (mainly from sheep) were the principle fibers used in weaving. At first, flax was the primary material, but by the late fourth millennium a fundamental shift from flax to wool took place for the majority of textile production.[66] Wool came to dominate flax because it was more efficient to produce than linen. Wool was the cloth of the common person, while linen became a luxury item fit for dressing kings and divine images (idols).

Spindle whorls were used to spin either flax or wool thread. Ground looms, bone and copper needles, awls, and weights were other implements used in textile production. Plucking of either wool or flax was done with a comb. Looms used during the late fourth millennium were horizontal ground looms, where two women weavers would crouch on either side of the loom.[67] The warp was placed lengthwise in the loom and stretched between two poles.

Designs on cylinder seals from Jemdet Nasr time show bearded men with hair piled back into a bun, held in place by a headband. The majority of human figures are depicted naked, although some men are shown wearing "skirts" (long kilts) below the waist (probably made of fleece), but with their torsos bare.[68] The women wore one-piece cloaks, which passed under the right arm and fastened at the left shoulder. They wore their hair in braids, dressed up on their heads.

Luxuries. Because the natural resources of Mesopotamia were limited, any "exotic" commodities had to be imported from beyond Mesopotamia. Among these imported items were high-quality wood, metals, stone, jewelry, and other luxury items.

By Jemdet Nasr time, beads were commonly worn as necklaces, bracelets, anklets, and girdles. Beads were made out of shell, bone, clay, rock crystal quartz, carnelian, lapis lazuli, agate, and alabaster (a white variety of gypsum). Chalcedony in any form was fancied by the ancients and has been found in Mesopotamia in archaeological levels dating from about 3500 B.C. onward.[69]

Also during Jemdet Nasr time, fine vases of porphyry, granite, and alabaster turn up in the archeological record; some of these vases were inlayed with shell, red jasper, and mother-of-pearl. Glass was used as a glaze for beads and other items, but glassware using the core technique did not make its appearance until about the middle of the second millennium B.C.[70]

Administrative texts from Uruk dating to Jemdet Nasr time give an account of metal objects that were imported into Mesopotamia. Metals used by the Mesopotamians were gold, silver, copper, and bronze. Gold appears suddenly in the archaeological record of Mesopotamia in the Uruk Period (ca 3500 B.C.), for example, at Uruk in layers underlying the White Temple.[71] The gold that reached Mesopotamia was probably mined at Mahd adh Dhahab in Arabia, the closest gold mine to Mesopotamia.[72] Gold occurs at Mahd adh Dhahab mostly as electrum (gold mixed with silver), so silver could have also come from this source.

Silver was used in Mesopotamia before 3000 B.C., but after ca. 3000 B.C. it became the standard currency, replacing barley ...

Silver was used in Mesopotamia before 3000 B.C., but after ca. 3000 B.C. it became the standard currency, replacing barley, which had been the standard before this time. Mesopotamians recorded the price of everything from timber to barley in silver by weight in shekels (1 shekel = about one-third of an ounce).[73] Beginning about 3000 B.C., silver was cast into "ring money." Ring money consisted of coiled silver, some of which resembled bedsprings and others of which resembled slender wire coils ranging from one to six shekels in weight. The largest silver coils weighed almost exactly sixty shekels, and the smallest from one-twelfth to two and one-half shekels.

Copper began to appear regularly in Mesopotamia beginning in the Uruk Period.[74] Copper vessels are fairly numerous in graves of Jemdet Nasr time, and several flat bowls of copper have been excavated at Fara (Shuruppak).[75] The source of copper for Mesopotamia was probably Anatolia (Turkey) (Fig. 1).[76]

Bronze began to be used extensively in Jemdet Nasr time, and the appearance of bronze at these sites signals the beginning of the "bronze age" in Mesopotamia.[77] Bronze is copper alloyed with arsenic, antimony, or tin, usually in proportions of from 1:7 to 1:10—alloys which not only make bronze malleable like copper, but which also allow it to be cast from molds.[78]

Language. The language spoken in Mesopotamia before about 2500 B.C. was Sumerian—a very difficult and obtuse language that has no known relatives, living or dead.[79] Sumerian tablets represent what most scholars believe is the world's oldest written language, probably predating Egyptian hieroglyphics by several hundred years. The Sumerian language flourished for at least 1,500 years, and even after it was eclipsed as a spoken language by other languages, it still continued to be studied and written by Babylonian scribes until the first century B.C. as a scholastic exercise (like Latin is today). Noah probably spoke Sumerian, since Sumerian is believed to have been the most likely language spoken in southern Mesopotamia in the Jemdet Nasr Period.[80] Clay tablets found at Jemdet Nasr and Uruk display a semi-pictographic writing which probably represents the Sumerian language.[81]

The possibility that before ca. 2500 B.C. all of Mesopotamia spoke one language (Sumerian) may have been the foundation for the statement found in Gen. 11:1.

The possibility that before ca. 2500 B.C. all of Mesopotamia spoke one language (Sumerian) may have been the foundation for the statement found in Gen. 11:1: *And the whole earth was of one language and one speech.* After about 2500 B.C. (or about the time of Peleg and the tower of Babel), other languages such as Old Akkadian and Old Babylonian (Semitic languages), "overtook" the ancient Sumerian, and by 2000 B.C., it had become dead as a spoken language.[82] The oldest historical indications of the Semitic language in Mesopotamia are the names of scribes found in the archives of Fara (Shuruppak) and Tell Abu Salabikh, dated to ca. 2600–2500 B.C.[83]

Numbers. Cuneiform writing arose in Mesopotamia around 3500–3100 B.C., primarily for the purpose of recording numbers and commodities. How certain signs and tokens used in this earliest writing for grain and field measurements came to represent abstract numbers is fundamental to the understanding of the development of mathematics.[84] Exactly when this happened is not known, but certainly it had occurred by the end of the Uruk Period (Table 1). It is known that as early as the end of the fourth millennium, proto-literate Sumerian scribes had established a well-developed system of numbers and measures.[85]

Even as early as the Ubaid Period, Mesopotamian architects building temples were familiar with certain geometric principles. The square was one of the most important elements of Ubaid architectural design, and triangles also played a significant role. Types of triangles used in designing Ubaid temples included the 3:4:5 and 5:12:13 triangles, and the 1:2, 1:4, and 8:5 isosceles triangles.[86] In this regard, it is intriguing that mathematics, particularly geometry, appears to have preceded the advent of writing. A 72-cm cubit (28.8 in) was the standard unit of linear measurement in Ubaid time, and precise multiples of this 72-cm cubit were used in laying out floor plans for temples and other buildings. Later cubit measurements used in the Near East were smaller: 52 cm (20 in), 45 cm (18 in), and 30 cm (12 in).[87]

The Mesopotamians were quite sophisticated in the mathematics they used. Besides geometry, their capacity to work with very large and very small numbers can be traced back to proto-literate (Uruk and Jemdet Nasr) time.[88] Economic "archaic" tablets from Uruk show an advanced accounting system where cuneiform ledgers contain single entries, subtotals, and one final total.[89] Weight and bulk of barley grains were connected to weights and measures in these accounting systems; also, Sumerian weights were used to weigh wool-fleece and other commodities. Later in time (<2500 B.C.), Mesopotamian scribes were the first to compile mathematical tables and to arrive at logarithms and exponential values from their calculations of compound interest. More than a thousand years before the time of the Greek scholar Pythagoras (~500 B.C.), the theorem attributed to him had been derived by Mesopotamian mathematicians.[90] The Babylonians also ascertained the number for pi (π), but interestingly, they did not have a special numerical sign for zero.

Proto-Sumerian inscriptions, such as those found at Uruk, used a sexagesimal numbering system. Along with the numbers 60 and 10 on which the sexagesimal system is based, the number 6 was also used in a special "bi-sexagesimal" system. Examples of the Mesopotamian sexagesimal system are still with us in the form of the 60-minute hour, the 60-second minute, and the 360° circle, with 60-minute degrees and 60-second minutes. The Sumerian sexagesimal numbering system (counting in 10's or 60's) is also a precursor of our own decimal system (counting only in 10's).

It has recently (in the 1970s and 1980s) been discovered that the Mesopotamian numbering system is not as straight forward as previously supposed.[91] It is now known that the arithmetic values of the numeral cuneiform signs were changeable depend-

ing on the context involved. For example, even in a single text, the same Sumerian cuneiform number sign can be read either as ten or six, depending on the context.[92] This discovery warrants the utmost caution in interpreting the true arithmetic value of numbers presented in the early chapters of Genesis, which were probably ultimately derived from the Mesopotamian cuneiform.

The ancient Semitic scribes who first wrote down the story of Genesis probably computed in sexagesimal units, since this was the system used at that time. Certain numbers such as *sossos* (60), *neros* (600), and *saros* (3600) are known to have occupied a special or sacred place in Babylonian mathematics and astronomy.[93] The Sumerians believed that each of the gods was represented by a number; for example the number 60, sacred to the god An, was their basic unit of calculation.[94] The same sacred view of certain numbers may also apply to Genesis; for example, Noah was 600 (60 x 10) when the Flood began (Gen. 7:6), and in Gen. 6:3, *"the days of man shall be a hundred and twenty years"* (60 x 2).

Mesopotamian numbers through the end of the patriarchal age should be viewed differently than later numbers in the Bible, which do have a solid historical and literal base.

What is especially significant about the Mesopotamian (and also early Hebrew) numbering system is that their concept of numbers was not the same as ours. Numbers and dates were not necessarily to be taken literally—sometimes they were to be taken symbolically.[95] For example, Enoch's total years of 365 corresponds exactly to the days in a solar year and is surely related in some symbolic way to his unprecedented relationship with God.[96] And the number 500, which was Noah's age at the birth of all three of his sons (Gen. 5:32), is plainly a round figure, as is his age of 600 at the onset of the Flood (Gen. 7:6). It is likely that Babylonian sexagesimal algebra, and the conversion between the sexagesimal system and later decimal-based systems, were factors affecting the biblical life spans recorded in the early chapters of Genesis.[97]

How the numbers of Genesis should be interpreted today in light of the Mesopotamian sexagesimal and symbolic numbering system is highly speculative. It can only be said that Mesopotamian numbers through the end of the patriarchal age should be viewed differently than later numbers in the Bible, which do have a solid historical and literal base.

Writing. The Mesopotamians were the first civilization in the world to develop writing. This process began ca. 3500 B.C., and arose primarily for the purpose of recording commodities. The method of writing was to impress chopped-off reeds into wet clay in order to indent a series of wedge-shaped marks or pictograms. These wedge-shaped writings became known as *cuneiform* (meaning "having the form of a wedge").

The basic elements of the earliest writing system included counters, bullae, cylinder seals, and clay tablets.[98] Counters (tokens) were clay pieces, 1–3 cm in size, consisting of different shapes (cones, spheroids, discs, cylinders, pyramid-like tetrahedrons). Each configuration represented a particular kind of trade item; for example, cones represented grain, disks were animals, and a sphere with a pierced hole in it stood for a unit of land measure.[99] Counters represented commodities that needed to be accounted for.

Bullae were "envelopes" of clay containing counters within them, which functioned essentially as shipping envelopes. Once a transaction was agreed upon, the envelope containing the counters was sealed and embossed on its exterior with a two-dimensional replica of the three-dimensional token shapes within. Opened bullae indicated the receipt of goods, and allowed for the checking the bullae's contents against the record written on the outside of the bullae. This accounting method thus prevented inventory from being stolen. Clay seals were also used on doorways as a means of controlling access to storerooms.[100]

Cylinder seals were used to seal clay bullae and left a negative impression or design when rolled over the clay. These designs marked a relationship between the seal owner and sealed object, and thus designated ownership and authorized a transaction by an official who had the right to bear and use the seal. The forms of these designs changed over the years, so different seals represent different ages. Along with pottery types and carbon-14 dating, cylinder seals are another method that archaeologists use for dating different archaeological periods in Mesopotamia. In Jemdet Nasr time, the tools of the seal cutter were the drill and cutting wheel.[101]

Clay tablets were the next step in the development of writing, making their appearance in the archaeological record at the end of the Uruk Period (~3100 B.C.). Clay tablets contained summary information on their surfaces and served as a means of cross checking the movement of goods. Clay tablets functioned as the "paperwork" of the day, recording transactions such as the issuance of rations, receipt of goods, and division of fields. Cylinder seal impressions are found on the earliest clay tablets, but eventually transaction information was conveyed solely by means of wedge-shaped characters (cuneiform) written directly on the tablets. Individual wedge marks denoted a certain amount of allotted grain (such as barley), and these wedge shapes originated from the same shapes, and had the same meaning, as the counters themselves.[102]

Seven sites in Iraq have yielded a wealth of cuneiform tablets: Jemdet Nasr, Nippur, Fara (Shuruppak), Umma, Uruk, Larsa, and Ur.[103] Uruk and Jemdet Nasr tablets contain the earliest Mesopotamian script, which is termed either "archaic" or "proto-Sumerian" because it was the precursor to later Sumerian "real" writing. Archaeologists and philologists alike view the development of "real" writing at the end of the Uruk Period in Mesopotamia as one of the most momentous developments in human history.

We can by no means assume that all of the accounts and incidents mentioned in the book of Genesis were dependent on oral tradition before the time of Moses.

The writing system at Uruk appears to have developed with great rapidity. Out of more than 5,000 clay tablets found at this site (dating to ca. 3100 B.C.), 85% of all the texts are economic records, while only 15% are lexical (language) texts.[104] After this, increasingly extensive use was made of the phonemic value of the cuneiform signs in order to write grammatical elements. Only 300–400 years after the first lexical texts, short dedicatory inscriptions begin to appear on items donated to the temples, and approximately six hundred years after the first lexical texts, literary, religious, and historic texts appear. It is only around 2500 B.C. that an old habit is abolished: from then on the signs—rather than occupying a random position in a text—begin to follow the sequence of the spoken language.[105] Beginning at about 2500 B.C., the first royal inscriptions with long narratives of the king's deeds can be found on cuneiform clay tablets—such as the narrative known as the Gilagmesh Epic, believed to have been written around 2450 B.C. about a real king Gilagmesh who lived two hundred years earlier at around 2650 B.C. Antediluvian tradition in literary texts also appears on Tablet W-B 62 of the Sumerian King List, which has been dated to the end of the third millennium B.C.[106]

Thus, the period starting about 2500–2450 B.C. would have been the earliest that the first chapters of Genesis could have been written down. This first non-oral biblical text could have included the Creation Story to the Flood to about the time of Peleg and the tower of Babel. According to Speiser,[107] the mention of Accad in Gen. 10:10 points to the early writing of Genesis, as that city—while important at one time—had lost its preeminence as far back as the end of the third millennium. Also, the mention of gold in Gen 2:11–12 fits with an early date, as by the Early Dynastic III Period (~2500 B.C.), the use of gold had increased significantly, as recorded by the gold-laden Royal Tombs of Ur. The Genesis writer obviously knew of gold being imported from Arabia (Havilah), and also of trade coming from the highlands of Iran along the Gihon (Karun) River (Gen. 2:13) (Fig. 1). It is likely that the Genesis writer was a Semitic scribe, as a good proportion of the scribes who wrote the early Sumerian literary tablets bear Semitic names.[108]

The importance of this discussion on writing (and numbers) to our understanding of the Bible is that we can by no means assume that all of the accounts and incidents mentioned in the book of Genesis were dependent on oral tradition before the time of Moses. On the contrary, there is evidence that these accounts were copied from written documents handed down from the earliest time of literary writing. In Genesis there are both historical and geographic aspects of the text that date to a more primitive age—"old words" which had disappeared from the living language before the time of Moses.[109] A plausible scenario is that the descendants of Noah who were scribes wrote down the early portions of Genesis on cuneiform tablets, and these (or copies) were taken by Abraham from Ur to the promised land of Canaan. These texts (in some form or other) were then passed down to Abraham's descendants and copied by Moses. This could be why "old words," and possibly the sexagesimal numbering system, were retained in the Mosaic version of the Old Testament—the strict code of scribes was to meticulously copy texts word for word; they would not have been allowed to change even a single item of the original sacred writings.[110] According to this view, Moses was the sacred "historian"

author of Genesis, who bridged the period between the patriarchal age and the period of the law.

Who Was Noah?

First, Noah was probably a farmer—or at least he was the head of a clan of farmers. Gen. 5:29 states: *"And he* (Lamech) *called his name Noah, saying, This same shall comfort us concerning our work and toil of our hands because of the ground which the Lord has cursed."* Also, Genesis 9:20 says: *"And Noah began to be a farmer, and he planted a vineyard."* Both of these verses imply that Noah was a farmer, or at least knew how to farm.

Second, Noah was probably a lineage head or one of the "elite" class. The Sumerian cuneiform tablets list Noah (Ziusudra) as the antediluvian "king" who lived in Shuruppak just before the great flood, but these tablets date from a later time when there were kings reigning in Mesopotamia (there is not a Sumerian word for "king" in Jemdet Nasr time, so a "kingship" type of rule may not have been set up yet).[111] "Elites" in Jemdet Nasr time were considered to be the heads of geographically well-situated families who were able to mobilize consistently large supplies of agricultural labor through the ties of kinship.[112] In any case, Noah had to have been a very wealthy man in order to have purchased the "gopher wood" and bitumen (pitch) needed for building the ark. Only a powerful and educated ruler would have had access to that amount of wealth, or would have been able to negotiate the necessary trade agreements to procure these items. Also, Noah would have had to have hired expert boat builders working under his direction in order to build the ark. Did Noah pay for the wood, bitumen, and laborers with trade goods (such as barley), or with silver ring money? The Bible does not say, but any of these are possibilities considering the currency of the time.

Third, Noah was a man of God. Gen. 6:8 says: *"But Noah found grace in the eyes of God* [literally, "won favor," not grace]."[113] *"These are the generations of Noah: Noah was a just man and perfect in his generations, and Noah walked with God."* The implication is that other men in Noah's time were wicked. This interpretation is reinforced by Gen. 6:5: *"And God saw that the wickedness of man was great in the earth, and that every imagination of the thoughts of his heart was only evil continually."* Also, Gen. 6:11 says: *"The earth was corrupt before God and the earth was filled with violence."*

From the context of the Mesopotamian civilization that existed during the time in which Noah lived, how do these Bible passages make sense? There seems to have been constant warfare between neighbors of competing city-states, with rulers violently killing captives. There was stealing of other men's property so that an accounting system had to be set up. There was the beating of citizens who did not pay their due amount of barley (taxes) to support the temple system. And, there was worship in "high places" of false pagan gods and their images, rather than the worship of the true God. But Noah "walked with God." This phrase is applied in the Bible only to Enoch and Noah, and denotes the most confidential communication with a personal God—a walking as it were by the side of God.[114] It seems that Noah and his family were the only ones left from the godly line of Seth who were worshipping the true God rather than the false temple gods of the time. In this regard, it is important to again note that no temple compound has been found at Shuruppak (Fara), Noah's home city.

Noah passed down his worship of the true God to his sons and their wives and kept them apart from the sinful worship of false gods.

Noah was also a just man—perfect in his generations (age). "Ziusudra," the Sumerian name for Noah, means "the very wise one," and Ziusudra is introduced in the Sumerian narratives as a pious king.[115] Noah may have been part of a federation cooperating in canal building. Noah was a comfort to others, as Gen. 5:29 states: *"Noah shall comfort us concerning our work and toil of our hands ..."* The "us" in this verse may refer to the people who lived under his jurisdiction—his extended family or kin group and also any others who worked for him tilling the ground. The implication is that Noah was a kind and benevolent man—not cruel, as were other city-state rulers of that time.

Finally, Noah passed down his worship of the true God to his sons and their wives and kept them apart from the sinful worship of false gods. That Noah's sons and daughter-in-laws were true children of the living God is evident from Gen. 7:13. *"In the very same day entered Noah, and Shem, and Ham, and Japheth, the sons of Noah, and Noah's wife, and the three wives of his sons with them, into the ark."* The worshippers of the true God were spared from the ravages of the Flood.

What had caused the people of Noah's day to become corrupt in God's judgment? Gen. 6:1–2 gives the reason: *"And it came to pass, when men began to multiply on the face of the earth and daughters were born unto them, that the sons of God* [i.e., the godly line of Seth] *saw the daughters of men* [i.e., the ungodly line of Cain] *that they were fair, and they took them wives of all whom they chose."* The godly line of Seth—the ones whom had been entrusted with carrying on the worship of the true God—had intermarried with women who worshipped pagan gods, and by doing this, their children had become part of the temple-worshipping culture.

Noah and the Ark

"Make thee an ark of gopher wood; rooms shalt thou make in the ark and shall pitch it within and without with pitch. And this is the fashion which thou shall make it of: the length of the ark shall be three hundred cubits, the breath of it fifty cubits, and the height of it thirty cubits" (Gen. 6:14–15).

Why did Noah make a giant boat, the ark? Because God instructed him to do so. God told Noah exactly how long, wide, and high to make the ark and how it was to be constructed—it should have a door in its side, a window, and it should contain three stories (Gen. 6:16). The Bible also says that the ark was made of "gopher wood" and caulked with pitch, both inside and out. But where and how did Noah get these materials? Shuruppak, Noah's home city, did not possess these natural resources. The date palm was the only large tree native to southern Mesopotamia, and this wood is of limited value as building material. For a boat the size of the ark, a source of high-quality timber was needed. Noah would have had to have imported both the wood and pitch (bitumen) needed for making the ark.

The bitumen would not have been that difficult to obtain. The center of bitumen production in Mesopotamia was (and still is) at Hit, located along the Euphrates River about eighty miles west of Baghdad (Fig. 1). Bitumen at Hit occurs in "lakes" where lines of hot springs are welling up along deep faults.[116] Even today, bitumen is packaged into reed baskets at Hit and floated down the Euphrates in boats. Bitumen has been used in southern Mesopotamia since the Ubaid Period, but the bitumen industry only became well established by ca. 3000 B.C.—or by the time that Noah lived.

Obtaining high-quality wood would have been a far more difficult task, as timber would have had to have been imported from a great distance. Precious wood is known to have come into Mesopotamia from three main sources—from Elam (now western Iran), from the Amanus-Lebanon Mountains (now Syria), and from Anatolia (now western Turkey, near Carchemish) (Fig. 1). Sumerian trade was based mostly on shipping along the Euphrates River, and large numbers and types of boats are mentioned in Sumerian texts.[117] Exactly what kind of timber was used for building the ark is not known, as "gopher wood" is an "old," pre-Hebraic word that has not been successfully translated by scholars, so that its botanical identification is uncertain.[118] Probably the "gopher wood" of Gen. 6:14 was either cedar or cypress, with cedar perhaps being the best candidate, since cedar is a straight wood, ideal in the making of large boats.

It is known that trade had already become established with the Amanus Mountains by Jemdet Nasr time, and the transportation of cedar trunks up to 100 feet long from that area has been documented.[119] The Lebanon-Amanus region was a rich source of timber to Mesopotamia in ancient times, and many Mesopotamian kings sent expeditions to fetch its famous cedars. To make the journey to Mesopotamia from the Amanus Mountains, the timber usually joined the Euphrates at Carchemish, Emar, or Habuba (Fig. 1).[120] Or, if the timber came from the Anatolian highlands, it could have been shipped to the area of Malatya and then floated down the upper Euphrates. The export of timber into Mesopotamia could help explain the Uruk-Jemdet Nasr "enclaves" (colonies or trading posts) found along the banks of the upper Euphrates in both Syria and southern Turkey,[121] and it could also help explain the deforestation of these areas beginning in Uruk time.[122] Wood cut down in mountain forests could have been moved across the snow in winter, or by ox-cart along wagon roads to a suitable trading enclave on the Euphrates River or one of its tributaries. Then it could have been consolidated into larger rafts and floated down the Euphrates River to Sumer at the time of the spring flood.[123]

A major difficulty from an archaeological perspective is the stated size of the ark in Gen. 6:15. Large riverboats did go up and down the Euphrates in ancient times, but documented vessels were not nearly as large as the ark is claimed to have been. Small boats made of reeds and caulked with bitumen were common as a means of travel from Ubaid times onwards, and small sailing craft (probably with sails made of linen) were also used on the rivers and along the Persian Gulf by the fourth millennium B.C.[124] It is recorded that Pharaoh Snefru (ca 2600 B.C.) had a ship constructed of Lebanon cedars, which was about 100 cubits long (~170 feet long, using the Egyptian cubit).[125] But the ark was

supposedly much bigger than this and was built three hundred or so years before this time.

If one supposes a 72-cm Sumerian cubit (28.8 in), which could have been the Mesopotamian unit of linear dimension still used in Noah's time, then this would have made the ark 700 ft long, 120 ft wide, and 70 ft high—in length, more than two football fields placed end to end, or almost the tonnage of the *Titanic*. Using a 45-cm cubit (18 in), as specified in a King James Version footnote, it would have been 450 ft long, 75 ft wide, and 45 ft wide. If the given dimensions apply to the whole boat, and not just to its maximum dimensions, then the ark can be visualized as a rectangular barge or cargo ship, three stories high, and possibly having a flat bottom as is characteristic of river boats.

Either cubit value puts the ark beyond the ship-building technology of Jemdet Nasr time. Also, the size of wooden ships is limited to about 300 feet due to their inherent-strength instability above this size.[126] Two possible explanations for this dilemma present themselves. First, it may be that the dimensions of the ark given in Gen. 6 are of symbolic nature, the symbolism of which is now lost in antiquity. Second, it may be that the dimensions of the ark were never converted from a sexagesimal system into a decimal-based numbering system. If one arbitrarily divides the ark dimensions by either ten or six, one comes up with a size more compatible with boats known to have existed in Jemdet Nasr time. This is not to say that the Bible is wrong. It is to suggest that the *autograph* (original) documents were correct, but that the original numbers of Gen. 6 are not part of a numerical system that we recognize today.

Conclusion

The above discussion can be applied to two recently proposed theories concerning Noah and the Genesis Flood. It is the hypothesis of Morton[127] that Noah's Flood was an event that occurred in the Mediterranean basin when it was a desiccated desert—"the Mediterranean Flood," as Morton calls it. The problem with Morton's hypothesis is two-fold. First, the Bible says that Noah lived in Mesopotamia, not in the Mediterranean area. The place is wrong, but the timing is even more wrong! The geological flooding of the Mediterranean basin with seawater happened in Late Miocene time.[128] Not even hominids existed in the Late Miocene (~10–6 million years ago), let alone a man who had the technology to build a boat the size of the ark.

Another theory that has recently become popular with the press is that of Ryan and Pitman, who hypothesize that Noah's Flood was an actual deluge that took place around 5600 B.C. in the area of the Black Sea.[129] These authors propose that an inundation of the Black Sea may have been the source of the ancient Sumerian (Gilgamesh Epic) and biblical (Genesis) flood stories, and they also propose that a change from hunter-gatherer societies to farming may have been catalyzed by a great migration of peoples to escape the Black Sea flood. Very recently, undersea explorers have discovered beneath the Black Sea a Neolithic site (approximately 12 feet by 45 feet, and containing stone tools) that existed by a freshwater lake before the inundation of the Black Sea area with seawater.[130] Despite the popularity of Ryan and Pitman's theory, it faces the same problems (albeit less so) as Morton's: it puts the Noachian Flood in the wrong place and at the wrong time. Noah lived in Mesopotamia, not in the area of the Black Sea. And could prehistoric humans—barely out of the Stone Age—have constructed a boat the size of the ark? With what—stone tools?

It was only about 3000 B.C.—within the framework of the first civilization in the world with the technology to do so—that Noah's ark could have been built. The theories of Morton and Ryan and Pitman put Noah into the realm of mythology, not history. One has to understand history before one can understand the Bible, as God has always interacted with men and women in *real* history. ❄

Notes

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Books Received and Available for Review

This is a partial list of the books available for review. Please contact the book review editor if you would like to review one of them or receive a copy of the complete list. Richard Ruble, Book Review Editor, *Perspectives on Science and Christian Faith*, 212 Western Hills Drive, Siloam Springs, AR 72761. richard@tcainternet.com

Connie Barlow, *The Ghosts of Evolution: Nonsensical Fruit, Missing Partners, and Other Ecological Anachronisms*, Basic Books, 220 pp., 2001
George Barlow, *The Cichlid Fishes: Nature's Grand Experiment in Evolution*, Perseus Pub., 335 pp., 2000
Eric Chaisson, *Cosmic Evolution: The Rise of Complexity in Nature*, Harvard Univ. Press, 275 pp., 2001
Eric Davidson, *You Can't Eat GNP: Economics As If Ecology Mattered*, Perseus Publishing, 250 pp., 2000
Frank Fischer, *Citizens, Experts and the Environment: The Politics of Local Knowledge*, Duke University Press, 336 pp., 2000
Arthur Gibson, *God and the Universe*, Routledge, 376 pp., 2000
Walter Gratzer, *The Undergrowth of Science: Delusion, Self-Deception, and Human Frailty*, Oxford University Press, 328 pp., 2000
Paul Halpern, *Pursuit of Destiny: A History of Prediction*, Perseus Publishing, 250 pp., 2000
Andrew Newberg, et al, *Why God Won't Go Away: Brain Science and the Biology of Belief*, Ballantine Books, 200 pp., 2001
Greg Pahl, *The Complete Idiot's Guide to Saving the Environment*, Alpha Books, 350 pp., 2001
Terence Penelhum, *Christian Ethics and Human Nature*, Trinity Press International, 115 pp., 1999
Calvin Redekop, ed., *Creation and the Environment: An Anabaptist Perspective on a Sustainable World*, John Hopkins University Press, 265 pp., 2000
Jonathan L. Reed, *Archaeology and the Galilean Jesus: A Re-examination of the Evidence*, Trinity Press International, 253 pp., 2000
Michael Ruse, *Can a Darwinian Be a Christian? The Relationship Between Science and Religion*, Cambridge Univ. Press, 242 pp., 2001
Joseph Silk, *The Big Bang*, W. H. Freeman and Company, 492 pp., 2001
Daniel Smith-Christopher, ed., *Subverting Hatred: The Challenge of Nonviolence in Religious Traditions*, Orbis Books, 178 pp., 1998
Russell Stannard, ed., *God for the 21st Century*, Templeton Foundation Press, 194 pp., 2000
Peter Torbay, *Creation Myth*, Upublish.com, 296 pp., 2000
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Patrick Wall, *Pain: The Science of Suffering*, Columbia University Press, 184 pp., 2000
Margaret Wertheim, *The Pearly Gates of Cyberspace: A History of Space from Dante to the Internet*, W. W. Norton, 332 pp., 1999

Transitional Forms and the Evolution of Phyla

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The claim is often made in Christian circles that there is no evidence for phylum level evolution. Evidence, in the form of morphological similarities, is presented showing that transitional forms connecting phyla do exist. Specific morphological connections are examined which unite the lobopods, arthropods, brachiopods, molluscs, and annelids. By examining these lineages, evidence arises indicating that the Cambrian Explosion was not very explosive. In contradiction to many apologetical claims, it occupied a period of nearly 100 million years. This paper discusses the causes of the rapid differentiation and apparent abundance of Cambrian animals, adding to the evidence that the Cambrian does not represent the creation event. For some Christians to equate the Cambrian Explosion with the creation event ignores the massive evidence of animals appearing gradually beginning in the Precambrian and continuing into the Cambrian. The creation of life on earth must be much earlier than the early Cambrian.

One of the most common claims among Christian apologists, of both the young-earth and old-earth schools, is the claim that there is no evidence for macro-evolution, or evolution between the phyla. Duane Gish, a young-earth creationist, presents that position when he writes:

> Evolutionary theory is, of course, dead, as long as the two huge gaps between single-celled organisms and the complex invertebrates and between complex invertebrates and fishes continue to exist. The total failure to reduce these gaps, let alone close them, in spite of an intense search by thousand of paleontologists during more than 125 years, establishes beyond doubt that the required transitional forms will never be found. The fact that the gaps between all higher taxa, such as families, orders, classes, and phyla, are systematic and almost always large, is simply additional confirmatory evidence for creation.[1]

Ray Bohlin writes in a recently released book:

> The origin of the different types of invertebrate animals such as the sponges, mollusks, echinoderms like the starfish, arthropods like crustaceans, and others all appear suddenly, without ancestors, in the Cambrian period.[2]

Other authors, like Davis and Kenyon,[3] Vos,[4] Wise,[5] and Johnson,[6] say essentially the same thing. One would think that with such near unanimous agreement that there could be no doubt about the lack of transitional animals during the Precambrian/Cambrian transition when the major phyla appeared on earth. However, data developed over the last five years have clearly demonstrated that there are transitional fossils between the major phyla.

We intend to demonstrate that (1) the phyla are not morphologically isolated from other phyla, (2) there are transitional forms, (3) the Cambrian Explosion, far from being a record of the instantaneous creation of life, was part of a 100-million-year long gradual development of diversity, and (4) the causes of this increase in diversity are consistent with natural causes rather than Divine.

*ASA Member

Definitions

One must define what phyla is before one can know if there are transitional forms between them. A phylum is often defined as a major body plan type, a bauplan. Vertebrates share many traits, among them a spinal cord enclosed in a vertebral column. Mollusks do not have a backbone or spinal cord. Thus they are not vertebrates. The number of phyla varies from taxonomist to taxonomist but generally hovers around thirty to thirty-five.[7]

Phyla are not the absolutely static categories that many apologists think. In fact, the use of phyla as static categories depends upon a circularity that most apologists seem not to recognize. An animal found either on earth today or in the fossil record must be placed into a phylum by the taxonomist. Taxonomists are reluctant to define a new phylum for a specimen which does not fit into any of the existing phyla. Because of this, there is a tendency to shoehorn problematical fossils into one of the existing phyla. Thus, one cannot say that because the animal was not placed in a "transitional" phylum, that there are no transitional forms. Since many problematical fossils that give evidence of either incipient phyla or transitions between the phyla have been difficult to classify, they have been placed in different phyla by different authors. *Wiwaxia*, an animal we will examine below, has been classified both with the annelids and with the mollusks, and indeed shares traits with both groups.

An example of a possible modern incipient phylum concerns a deep-sea sponge found recently. It is classified among the Porifera, an existing phyla, in spite of it having a unique body plan. Vacelet and Boury-Esnault write:

> Our results raise fundamental questions about the validity of characteristics used to distinguish the phyla of lower invertebrates. A sponge is defined as a "sedentary, filter-feeding metazoan which utilizes a single layer of flagellated cells (choanocytes) to pump a unidirectional water current through its body." Except for being sedentary, the cave Asbestopluma and presumably all Cladorhizidae lack these basic sponge attributes. In an extreme environment where active filter-feeding has a low yield, cladorhizids have developed a mode of life roughly similar to that of foraminiferans or cnidarians. Their feeding mechanism relies on passive capture of living prey and on transfer of nutrients into the body through intense cell migrations, the analogue of cytoplasmic streaming in foraminiferan pseudopodia. This may be compared to the emergence of macrophagy in abyssal tunicates, also accompanied by a reduction of the filtering system although in Cladorhizidae the result is more extreme, with a main body plan different from Porifera and resembling no other modern anatomical design.
>
> Such a unique body plan would deserve recognition as a distinct phylum, if these animals were not so evidently close relatives of Porifera. Their siliceous spicules show clear similarities to several families of poecilosclerid Demospongiae.[8]

Such a shoehorning of the Cladorhizidae into Phylum Porifera hides the obvious transitional nature of this creature. The morphological connection between it and the sponges is the spicules. Were they to be lost during subsequent evolution, one would have little reason to place this animal with the sponges. However, anti-evolutionists can currently claim that there are no intermediates among the phyla, simply because this incipient phylum was placed into its parent phylum.

We need to define what a transitional form is. Only one anti-evolutionary author I have read, who speaks about transitional forms, bothers to define the term.[9] A transitional form is one that shares traits between two or more phyla. As noted above, there is a tendency to place a form into one or another taxon. This hides the fact that a given form shares traits with another group. Therefore, when evaluating the claim that a specimen represents a transitional form, one cannot use the fact that it has been placed in one taxa rather than in an intermediate one. It is very difficult to classify such an animal

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because it does not quite fit the definition of either group. Thus, it is simply not valid to insist that the animal be classified in one or the other predefined group and then claim that there are no transitional forms.

Transitional forms are not transitional between modern living members of two phyla but are transitional between the two phyla when they were evolved.

Due to the vagaries of fossilization, it is not expected that we will ever find animals which are on the direct line between the two groups, and if we do find an animal on the direct line, it is not clear that we would recognize it as such. Rather what we have in the fossil record are animals that are close to the line of descent. Nevertheless even these animals will show many of the traits that were involved in the actual line of descent between the two phyla. Even if we found the individual animal that is on the direct line of descent between two groups, we would not have any way of knowing it. We must treat all transitional forms as if they are near to the actual line of descent. One cannot determine what a transitional form should look like by examining modern forms. This is as useless as trying to tell what your grandfather looked like by averaging your looks and your cousin's looks. It simply will not work. Finally, in evaluating a potential transitional form, it must be understood as being transitional between the phyla as they existed *at or near the time of the their appearance.* Transitional forms are not transitional between modern living members of two phyla but are transitional between the two phyla when they were evolved.

One other feature of phyla needs to be noted. The phyla were defined over a century ago based on extant (living) animals. Subsequently, all fossil creatures were placed into present phyla. This is like trying to classify the parts of a tree by fitting every part into a classification derived from only examining the very tips of the branches—hardly a satisfactory way of doing things. Just as the branches of a tree arose from the roots and trunk, modern phyla arose from ancient life, not vice versa.

The Cambrian/Precambrian boundary has often been used by apologists as the point in time when God created life. In 1979, Gish wrote:

> Not a single, indisputable, multicellular fossil has ever been found in pre-Cambrian rocks! Certainly it can be said without fear of contradiction that the evolutionary ancestors of the Cambrian fauna, if they ever existed, have never been found.[10]

This was not true then and is not true today. The plain fact is that Precambrian multicellular fossils were found in 1947 by R. C. Sprigg. He classed some of them among the worms, sponges, and jellyfish, making them clearly ancestral to the Cambrian creatures.[11] This discovery occurred twenty-two years before Gish wrote that erroneous statement.

DeHaan and Wiester make the same error as Gish in claiming:

> The Cambrian explosion refers to the geologically sudden appearance of multicellular animals during the geologic period called the Cambrian.[12]

Indeed, multicellularity appears in the fossil record 1.7 billion years ago, long prior to when these gentlemen claim and long prior to the Cambrian explosion.[13] The emergence of multicellularity had nothing to do with the Cambrian explosion.

Other authors, such as Robinson,[14] Davis,[15] and Johnson,[16] while apparently not mistaking the Cambrian explosion with the appearance of multicellularity, do claim that the Cambrian animals appeared out of nowhere. Such views of the fossil record are simply false. The Cambrian/Precambrian boundary is no longer viewed as marking an instantaneous appearance of life or multicellularity. Grotzinger, et al. write:

> Once held as the position in the rock record where the major invertebrate groups first appeared, the Precambrian-Cambrian boundary now serves more as a convenient reference point within an evolutionary continuum. Skeletalized organisms, including Cambrian-aspect shelly fossils, first appear below reference point within an evolutionary boundary and then show strong diversification during the Early Cambrian. Similarly, trace fossils also appear first in the Vendian, exhibit a progression to more complex geometries across the boundary, and then parallel the dramatic radiation displayed by body fossils.[17]

Among the phyla now found from the latest Precambrian are Porifera (sponges),[18] Mollusca,[19] Annelida,[20] Cnidaria,[21] and Arthropoda.[22] And thirteen phyla appear after the Cambrian. These are Bryozoa, Angiosperms, dinoflagellates, diatoms, nannoplankton, bryophytes, ferns, ginkgoes, psilophytes, sphenopsids, cycadeoids, lycopods, and conifers. The Cambrian "explosion" is getting less

explosive. It is not the place in the geologic column where God created life. That occurred much earlier with the creation of the first cell.

The Fossil Record

As seen in Table 1 (compiled from various sources), the earliest accepted worm burrows are found in rocks dated to 680 million years ago. They are horizontal and shallow in orientation as if the worm was scavenging the organic material in the shallowest sediments. There have been controversial reports of worm burrows as far back as one billion years ago. In any event, worms appear long before the Cambrian, and this fact falsifies several recent statements by apologists. At Doushantuo, China, larvae of segmented worms have been found dating between 570–520 myr ago.[23]

Table 1. Cambrian Chronology
(Except where otherwise noted, data from ref. 55)

Million Years Ago (myr)	Event
495	End of Cambrian
511	Wheeler Formation Fauna
518	Burgess Shale Formation
520	First Hemichordates
523	Kaili deposits
526	First Wiwaxia found in Mount Cap Formation
527	First trilobite[30]
530	Chengjiang fauna—stem groups deuterostomes, first Ctenophores
531	First Cephalochordates, first chordates
533	Sirius Passet fauna priapulids, first annelids
534	First brachiopods, first molluscs
535	First arthropods
536	First Lobopodians/Anomalocarians
537	First nematodes, Halkieriids and echinoderms
538	Abundant Shelly fossils
541	Skeletonized foraminifera[31]
543	Small shelly fauna
545	**Cambrian/Precambrian Boundary-Cambrian above/Precambrian below**
546	Cloudina stem group ecdysozoans
548	First stem group lophotrochozoans
550	Advanced Ediacaran fauna—Spriggina [trilobite precursor]
553	First anthozoan
555	Kimberella (first mollusc forerunner)[32]
560	Earliest fungi, earliest stem-group cnidarian
563	Mistaken Point faunas
568	End of ice age?
571	First sponge (Doushantuo)?[33]
591–610	Varanger-Marinoan glaciation
610	Oldest Ediacaran fossils Mackenzie Mountains, Canada[34]
680	Oldest accepted worm tracks[35]
1700	Oldest multicellular fossils[36]

Because worm-like animals appear to be the earliest active, multicellular animals, it is reasonable to believe that they are the evolutionary ancestors of all phyla. Are there any connecting links between the worms and other phyla? It appears that there are. A fossil lobopod, *Aysheaia pedunculata* is basically a worm with "legs," or more properly, lobopods. The word lobopod is used in two ways: to reference a particular kind of animal leg and to refer to a group of animals possessing such legs. The lobopods consist of muscles surrounding a blood-filled cavity. The lobopods are soft and pliable, and are used as organs of locomotion. *Aysheaia* has spikes on its legs that are used to grasp prey. *Aysheaia* is a member of the phylum, Lobopoda.[24] While there is nothing that looks like an arthropod in *Aysheaia*, the lobopods will be used to show a connection to the arthropods through something like the next animal, *Anomalocaris*.

The Arthropods

Anomalocaris was first described by Charles D. Walcott in 1912,[25] contrary to what one recent apologetical book claims.[26] Unfortunately, the only feature described was the claw of an arthropod. *Anomalocaris* had lots of claws. It was not until 1985 that the entire animal was known.[27] *Anomalocaris* was a meter long predator of the Cambrian seas.

By 1998 specimens were known that showed more features. *Anomalocaris*, the animal with an arthropod claw, also had lobopod legs.[28] Other early Cambrian arthropod relatives, like *Opabinia*, also were discovered to have lobopod legs.[29] In addition *Anomalocaris* had other traits connecting it to arthropods. It had a tail fan and flap-like projections that perform several purposes: protection, propulsion, and respiration. Conway Morris suggests:

> Of these, perhaps the last was the most important. Imagine that in due the flaps seen in *Anomalocaris* were modified. The leading edge now formed an elongate bar and behind it the structure was transformed in a series of trailing filaments. This, of course, would be reminiscent of the gills that arise

> above the walking legs of many arthropods. Thus, if the lobopod limbs were transformed into jointed appendages and the flaps into gills, then one could envisage, at least in broad outline, the transformation between an animal similar to *Anomalocaris* and a fully fledged arthropod.[37]

Thus, these early arthropods, like *Anomalocaris*, are transitional between the lobopods and the arthropods.

Anomalocaris also has one trait that connects it further back to the worms. Its mouth is worm-like. Collins notes of the Anomalocarids:

> [their] "circum-oral sclerites"[radiating teeth] indicate that the anomalocarids "were related to aschelminth worms rather than to arthropods." Studying other specimens of the same Chengjiang species, Ramskold described the abdominal appendages in greater detail as "three or more [postoral] limb pairs modified into large gnathobases which form part of the masticatory apparatus," and "trunk limbs" with "small, jointed clawed endopods" and "exopods ... modified into large lateral flaps."[38]

Having some traits in common with worms and lobopods is exactly what one would expect of a transitional form. What we see in the fossil record is first worms, then lobopods, then animals with lobopod and arthropod appendages with a worm-like mouth and possible incipient arthropod gills. Finally, we see the true arthropods. This is a transitional series.

Trilobites, contrary to popular understanding of the fossil record, do not appear at the beginning of the Cambrian. They appear in the Atdabanian stage, 15 million years *after* the beginning of the Cambrian.[39] Nor do they spring out of nowhere. Precambrian precursors to the trilobites include *Spriggina* and *Bomakellia*. *Bomakellia* and a trilobite can be seen in Figure 1 and 2. Obviously the claim that there are no possible precursors to the Cambrian animals is simply wrong.[40]

Fig. 1. Cambrian Trilobite

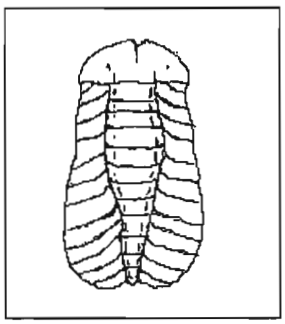

Fig. 2. Precambrian Bomakellia

The Brachiopods

When we turn to the brachiopod phylum we also find an interesting precursor which is never discussed in apologetical literature. The 525-myr-old animal, *Halkieria evangelista*, from the Sirius Passet formation of Greenland, is a perfect transitional form between worms and the brachiopods. The animal has a flattened body with a soft, rubbery underside, like a slug. It moved across the ocean floor by means of this slug-like bottom. Its upper surface was protected by scales, called sclerites, which were hollow and had a stem which was inserted into the back making a chain-mail type of armor. The scales were arranged in three broad zones with a different shaped scale in each zone. The sides of the animal were covered with knife-shaped scales, the edges of the belly had sickle-shaped scales, and the back had palm-shaped scales. These three zones of scales will become important when we discuss the origin of the annelid (worm) phylum.[41]

One curious feature of the *Halkieria* is the fact that there was a shell at each end of the animal, on the back side. The posterior shell was nearly identical to the shells of the earliest Cambrian brachiopods, like *Obolella*.[42] It is postulated that when attacked, *Halkieria* curled up between the two shells for protection.[43] As predation increased, eventually the animal remained between the two shells and took up a sessile life. There is one very primitive brachiopod today, *Neocrania*, which early in life does crawl across the ocean bottom as the halkieriids did.[44] Eventually, as it matures, *Neocrania* folds itself in two and secretes a shell, like other brachiopods.

Even among extant members of different phyla, there are often strikingly complex, individual features that both possess which tie them together as descendants of common ancestral taxa. For example, brachiopods have chitinous bristles that protrude into the surrounding water from each of the valves. The microscopic texture of these bristles is identical to that of the bristles of the annelid worms. The hypothesis that God created all the animals at the Cambrian/Precambrian boundary fails to account for this similarity. But the place of *Halkieria* in the evolution of both the brachiopod phylum and the annelid phylum explains this similarity.

The Molluscs

Over the past three years, new information has come to light concerning a possible relative of the halkieriids, which also sheds light on the origin of mollusks. *Kimberella* is a 555-myr-old Precambrian

creature, which was bilaterally symmetric. It is known from the White Sea region of Russia and Australia. *Kimberella* had a strong nonmineralized shell and crawled along the water bottom on a muscular slug-like foot.[45] While no specimens show signs of the characteristic mollusc feeding apparatus, the radula, radula markings have been found in strata containing this possible mollusc ancestor. It is not surprising that the radula is not found with *Kimberella*, as it is not found with most mollusc fossils.[46] All of this information strongly implies that mollusc ancestors were alive prior to the Cambrian explosion at 545 myr ago.

Over the past three years, new information has come to light concerning a possible relative of the halkieriids, which also sheds light on the origin of mollusks.

Like *Kimberella*, *Halkieria* possesses bilateral symmetry and a soft-sole underside. It, too, is believed to have been an algae grazer.[47] Besides giving rise to the phylum of the brachiopods, *Halkieria* appears to be close to the lineage leading to two other phyla, the molluscs and polychaete worms through a related animal similar to *Wiwaxia* (although *Wiwaxia* itself lived too late to be the actual ancestor). *Wiwaxia* is connected to the halkieriids by many traits. Like the halkieriids, it had a soft slug-like sole upon which it moved, and sclerites that possessed identical microscopic structure and were arranged in the same three zones as seen on the halkieriids. In both *Halkieria* and *Wiwaxia*, the sclerites were hollow. Many paleontologists believe that these connections prove a close relationship.

But *Wiwaxia* takes things one step further. It is the earliest known animal to possess the radula, the characteristic feeding mechanism of the molluscs.[48] *Wiwaxia* shows other connections with the most primitive molluscs, the aplacophorans. To quote Conway Morris:

> It is generally accepted that the aplacophorans, a rather obscure group well understood only by a handful of specialists, are our best glimpse of the likely appearance of the most primitive molluscs. These animals look like some sort of spiny worm because, in contrast to other molluscs, which have a shell of some sort, in the aplacophorans the surface is coated with numerous calcareous spicules. Many zoologists believe that the shells of the other molluscs originated by the fusion of these spicules.[49]

Thus, an animal similar to *Wiwaxia*, could easily have fused its scales to form the shells of the earliest molluscs.

The Annelids

Wiwaxia appears to shed some light also on the origin of the annelid worm phylum. The polychaete annelid worms are spiny or hairy looking creatures. The "hairs" are called chaetae, and they are mineralized. The microscopic structure of the wiwaxian scales is identical to that of the notochaetae of the annelids showing a connection between the two.[50]

One other connection between these two creatures, and the halkieriids, firms up the suggested phylogeny. At least one specimen of *Wiwaxia* (USNM199936) had a structure on one end resembling a brachiopod shell, which Conway Morris and Peel interpreted as a vestigial shell.[51] This is reminiscent of *Halkieria*'s posterior shell and connects *Wiwaxia* with *Halkieria*. But the polychaete annelid, *Canadia*, shows that it also has a posterior plate made of chitin, called a sternaspid, continuing the similarity in this chain. Conway Morris and Peel state:

> In any event, the similarities of the shield with the posterior halkieriid shell may not be convergent, and the possibility of sternaspids being primitive should be investigated. In particular, although the evidence is slender there is quite a strong similarity between the sternaspid plate and the putative shell in *Wiwaxia*.[52]

Once one sees these connections, one simply cannot return to the blithe statements so often seen in the apologetical literature, like that of Rana who wrote:

> Fossils previously found in Yunnan province (at sites discovered nearly 100 years ago) and in the Burgess Shale deposits of the Canadian Rockies tell us that all animal phyla (more than 70) ever to exist in Earth's history appeared "at once" about 540 million years ago. (Some 40 phyla have since disappeared and not a single new one has appeared.)[53]

Such statements display the fact that the author has neither studied the data concerning the history of life since the Cambrian nor the paleontological evidence from the Cambrian/Precambrian boundary. Knowledge of this time period has improved tremendously over the past fifty years. Lazarus J. Salop, in 1983, wrote:

> Progress in Precambrian geology has been exceptionally great, indeed, quite striking for geologists of the older generation; only some 30–40 years ago the Precambrian appeared as an uncertain and even mystic prelude to geologic evolution. Even the very name-Precambrian-means some indivisible unit in the early history of the Earth, the beginning of which is poorly known.[54]

The knowledge gain has accelerated exponentially since Salop wrote that, but when it concerns the Cambrian explosion, apologists remain stuck in the world of fifty years ago.

What Caused the Cambrian Explosion?

There are several schools of thought on the cause of the Cambrian explosion. We will look at some of them. The first is the most widely held view among the Christian community. It is that God created the living creatures in a geological instant of time early in the Cambrian. As we have seen, the animals do not all appear at the same time within the Cambrian. Many animals and phyla appear before and after the Cambrian. Thus, this view is contradicted by the data at hand. Does this mean that God did not create the animals? No. It does mean that God did not do it in one blinding flash of creativity.

One basic fact explains the supposed "sudden" appearance of animals in Cambrian strata. It is the appearance of hard shells on animals where none had existed before. This imparted a much greater possibility for fossilization than had existed before. Soft flesh does not fossilize easily but hard shells do. Various theories have been advanced to account for the widespread acquisition of hard skeletons among the taxa during the Cambrian. Probably a synergistic combination of the various factors emphasized by these different theories acted to effect the evolutionary change. We will briefly look at four theories: the detox theory, the biolocomotory theory, the predation theory, and the biogeographic theory.

The detox theory of the Cambrian explosion postulates that organisms deposited excess phosphorus in external shells under selection pressure to rid themselves of its toxic effect. Conway Morris writes:

> It is certainly not immediately clear how this break-up of the super-continent might change the balance and distribution of food supply in the oceans. But perhaps there are some clues. The interval marked by the Cambrian "explosion" is also a time when quite unusual amounts of sedimentary phosphate were being deposited in the shallow shelf seas that rimmed continents. These regions are now found in such places as Australia, South China, and Kazakhstan. Precise estimates of the total volume of phosphate that accumulated in the geological interval are not easy to obtain. Nevertheless, the fact that some of the world's most important mines that extract this phosphate, largely to provide agricultural fertilizer, are situated in rocks of Cambrian age gives a crude indication of the massive quantities of phosphorus that must have been deposited.[55]

One basic fact explains the supposed "sudden" appearance of animals in Cambrian strata. It is the appearance of hard shells on animals where none had existed before.

The detox theory postulates that the organisms in their attempts to rid themselves of phosphorous, deposited it in external shells. This view is supported by the unique make up of Cambrian exoskeletons. Lipps and Signor write:

> Some Cambrian arthropods had cuticles which were unique in the history of the phylum: they were composed of calcium phosphate. This is of particular interest in view of the common occurrence of phosphatic shells in other phyla in the Cambrian. There are no recent arthropods with a cuticle composed entirely of calcium phosphate, although a phosphatic component is present in some cuticles (e.g., the crab Cancer), especially in their outer part.[56]

Robert Carroll relates variations on the theme of skeletons forming because of the metabolic handling of calcium and phosphorous. He states:

> Tarlo argued that bone originally developed not for protection, but as a phosphate reserve. Phosphate is both a vital component for energy storage and transfer in all vertebrates and a substance that may be available in fluctuating amounts in the natural environment. The amount of phosphate is frequently a limiting factor in population growth. Superficial bone in some Paleozoic fish shows changes in its extent that are thought to be seasonal and may correspond to the periodic deposition and resorption of phosphate. Bone also acts as a calcium reserve in all vertebrates.[57]

The biomechanical locomotor theory simply takes note of the fact that muscles can be more efficient if they have something against which to exert their force. Without skeletons, animals would have moved slowly in a wormlike fashion. Skeletons

allowed animals to move more rapidly and thus provided the selective pressure to favor skeletal development.

The predation theory is the oldest of the views and was first proposed by Albert Gaudry in 1883. This view advocates that the rise of predation provided a selective pressure in favor of defensive protection. He wrote:

> The majority of animals found in the Paleozoic, and especially in the Silurian, appear to have been better suited to defense than to attack, as if, in the early days of the world, these creatures (which are rare today) had had a greater need to be protected.[58]

This view is supported by the lack of evidence for predation until the very latest Precambrian. Boreholes, drilled into the calcified tubes of *Cloudina*, are the first unambiguous evidence of predatory behavior.[59]

From this time on, animals seemed to change their morphology and behavior in manners consistent with the idea that they were trying to avoid predators. Worm burrows, which had been shallow and horizontal changed to vertical as the animals buried themselves in the ocean floor as if to escape possible predators.[60] Other animals built "stone walls" or shells around themselves. The shells rapidly grew thick across many taxa allowing the animals to survive. This massive investment in defensive armor had the unintentional by-product of allowing animals to become fossilized. It is this fossilization that led earlier researchers to remark on the "sudden" appearance of animals—an appearance which is now known to be a progressive appearance of more and more complex animal life forms extending from 700 million years ago to 500 million years. And it was not just metazoans that became skeletonized at this time. Apparently microscopic foraminifera became skeletonized, also. Culver argues that this fact is only consistent with predation as a cause of the sudden skeletalization of major parts of the biosphere. He writes:

> Discussions concerning the appearance of skeletonization near the base of the Cambrian [about 550 Ma (million years ago)] are often restricted to metazoans and take little account of the acquisition of hard parts by protists at the same time. For example, hypotheses relating the evolution of skeletonization to increases in body size and to detoxification of excess calcium in metazoans do not apply to protists and hence are weakened by the appearance of testate protists in the Early Cambrian. However, this appearance is not inconsistent with the hypothesis, applicable to both metazoans and protists, that the initial function of skeletons was to protect the organism, primarily against predation. The presence of agglutinated foraminifera in the Lower Cambrian, probably Atdabanian Stage-equivalent strata, of the Taoudeni Basin, West Africa is reported here. These specimens extend considerably the known geologic range of several genera, they represent the earliest known unequivocal foraminifera, and they further remind us that protists as well as metazoans should be considered in accounting for the origin of skeletalization.[61]

The biogeographic theory revolves around geologic changes that occurred during the last stage of the Precambrian. A global continent, called Rodinia, began to rift and break apart. As Hagadorn and Waggoner state:

> Rifting of the supercontinent Rodinia occurred in the late Proterozoic, separating the Cordilleran margin of Laurentia from east Gondwanaland. This rifting may have begun 150–200 million years before the Cambrian, or possibly much later, in the Vendian.[62]

The change of environment caused by this event may have played a role in the Cambrian explosion, causing animals to exploit new habitats or as noted above, causing an influx of phosphorous to the oceans requiring animals to excrete it in the form of exoskeletons.

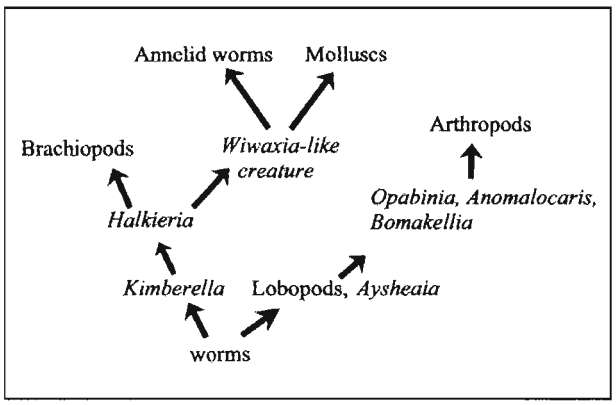

Fig. 3 Phyla level transitions. Transitional forms (italic font) are placed between the phyla (Roman font). Suggested evolutionary relationships marked by arrows.

Conclusion

Figure 3 shows the relationships between the various transitional forms we have discussed. The transitional forms (italics) are placed between the phyla (Roman text) that they connect. The morphological connections we have seen clearly show that

phyla level transitional forms exist. Apologists have an obligation to include these forms in their apologetical views. Furthermore, the Cambrian Explosion cannot be equated with the creation event. As we have seen above, the diversification of animals began in the late Precambrian and continued into the Cambrian. The entire period of this diversification took over fifty million years. Indeed, worm tracks are found 120 million years prior to the Cambrian. It is true that the most rapid part of the diversification took around ten million years, but that ten million years was part of a longer period of diversification. It is inconsistent for Christians to pay attention to one part of this period as if it were the creation event, when, in fact, species were appearing over a much longer period of time. It is time for Christian apologists to catch up with the information from the last century. ❋

Notes

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Book Reviews

Environment

THE LAND THAT COULD BE: Environmentalism and Democracy in the Twenty-First Century by William A. Shutkin. Cambridge, MA: The MIT Press, 2000. 262 pages. Hardcover; $27.95. ISBN: 026219435X.

Shutkin is founder and president of New Ecology, Inc., and cofounder and former executive director of the environmental justice organization, Alternatives for Community & Environment. He is lecturer in the Department of Urban Studies and Planning at MIT and adjunct professor of law at Boston College Law School.

The first four chapters are a critique of the elitism of environmentalism and an extension, called civic environmentalism that includes consideration of humans as well as wilderness and spotted owls. Shutkin comes down hard on the legal and technical command and control (top-down) structure adopted by all mainline environmental organizations. The next four chapters are case studies: Boston's Dudley Neighborhood, Oakland's Fruitvale Transit Village, rural Colorado, and suburban New Jersey. The final chapter is a projection of a new model of environmentalism.

There are six core concepts that jointly amount to a definition of civic environmentalism: democratic process, community and regional planning, education, environmental justice, industrial ecology, and place (physical and emotional space). The intent of democratic process is to make planning decisions bottom-up rather than top-down. This implies the informed involvement of all stakeholders.

It is worth recalling here that Aristotle thought that democracy was only suitable for small groups; mid-sized groups would be governed by an oligarchy and large ones by a monarchy. It is not clear to me that decisions should be made on the strength of a majority vote, which involves winners and losers; it would seem preferable that decisions be made by consensus. Environmental justice has a severely limited application. By this is meant only that it is unjust that low income and racial minorities be the recipients of the most of the pollution. The wealthy can buy their way out. In this context, one thinks immediately of the aquifers, including the Ogallala, which have been depleted by irrigation demands. World wide the water table is retreating mainly due to irrigation pressure.

What is the limit of justice? Fundamental to industrial ecology is the internalization of environmental benefits that are currently externalized (ignored). This will obviate the absurdities of accounting for national well being using a measure like the GNP. It will also require that a value be placed on those environmental benefits that are currently "free." There is also the obligation that producers accept total responsibility for any product over its entire life cycle.

This book has some strange omissions. First, and perhaps not surprisingly since the focus of the book is on the United States, there is no reference to any of the outstanding documentary work of the WorldWatch Foundation. For example, Shutkin did not give enough attention to the issues of regional population growth, water scarcity, and meretricious consumption. Mainline environmentalism is very much restricted to the Western world, but civic environmentalism purports to broaden the lens greatly and it should not be parochial.

Second, I was disappointed not to find some discussion of E. F. Schumacher's position. He devoted much of his life to developing an economic system for a smaller world, that is, one in which regions, usually bioregions, are largely self-supporting.

Third, I missed any discussion of the Natural Step, which inveighs against any buildup of material either from the earth's crust or from human production. Shutkin complains that environmentalism has not produced an ethical system to justify itself, but the Natural Step is such an ethic, and it is highly elaborated and systematic. In his defense, he did offer two systems with similar goals: industrial ecology, or complete product life cycle producer responsibility; and "The Hannover Principles."

Finally, there was no discussion of enlisting the people of faith into the movement. This, in my opinion, is fatal to civic environmentalism, because without some theologically justified support in the form of the ground of being, any progress will evaporate when it becomes inconvenient.

In spite of its limitations, this is a useful book mainly for its challenges to mainline environmentalism; the criticism of the governmental regulatory structure is withering. Shutkin is not the first to recognize that there are problems in the movement, but he has done an excellent and well-informed job of documenting them. Agencies such as the EPA have the mandate to control pollution, one pollutant at a time, not prevent it. Civic environmentalism is a partial answer to some of the problems.

Reviewed by Braxton M. Alfred, Biological Anthropology, University of British Columbia, Vancouver, BC V6T 2E9.

Erratum

In *PSCF* 52 (December 2000), p. 276, second column, third line from the bottom, the sentence should read: "... a like energy in the human heart urges ..."

We apologize for the error.

THE ENVIRONMENTAL PENDULUM: A Quest for the Truth about Toxic Chemicals, Human Health, and Environmental Protection by R. Allan Freeze. Berkeley: University of California Press, 2000. 309 pages. Paperback; $19.95. ISBN: 0520220471.

Freeze gives a highly readable account of the problems associated with toxic waste prevention, remediation, and environmental regulation. He writes in a way that makes it easy for lay readers to understand fairly complex technical subjects, and furthermore to enjoy reading about them. Each chapter has a useful summary of points made, and the conclusions of the whole book are summarized at the end. A glossary of acronyms (especially for non-American readers who might not understand some of the regulatory organizations), and technical terms would be useful additions.

The main theme of the book is that environmental regulations concentrate too much on expensive clean-up operations of sites with low risk and divert funding that could be used for more serious social and environmental concerns. Freeze supports regulation to prevent the worst abuses from short-sighted industry interests but believes that they need to be fine tuned. The book is free from polemic, while still making it clear from the first chapter that all the players in the environmental game are pursuing their own agendas and must take responsibility for pollution on the one hand, or over-regulation on the other. This includes industry, the media, politicians, environmental groups, and local NIMBY (Not In My Back Yard) activists.

The second chapter describes the industrial process and the author makes a number of salient, but disturbing, points that must be considered by anyone concerned about the environment. The first of these is that waste is an unavoidable part of industry at all phases of manufacture, and therefore anyone who purchases manufactured goods is part of the problem. The second is that leachate control systems, no matter how well designed, will fail long before the leachates become inert. The third point is that conflict between industry and environmentalists is inevitable. The industrial economic interests result in letting future generations worry about cleaning up their mess, since future costs are heavily discounted. Environmental costs, however, always have to be paid in full.

The third chapter summarizes the known human health effects of commonly used chemicals, and how these are experimentally tested, using animal "models." Freeze discusses the efficiency of environmental remediation and other public spending projects, in terms of lives saved per dollar spent. The health risks associated with pollution is several orders of magnitude lower than those associated with drinking, smoking, or driving a car. The author concludes that the legal minimum allowable levels for many contaminants are far too strict, and that much public money may be better spent improving road safety, or providing clean needles to drug addicts.

The final two chapters discuss the regulatory and legal system in the United States. As such they may not be of much interest to readers from other countries. Freeze sees regulation as a zero-sum game, and points out how cumbersome and expensive it is for both protagonists in the conflict. The strong point of the book is the well-presented technical explanations. Freeze has also done a service in pointing out the consequences of pollution generated by a consumer society, and the high costs of cleaning it up. The problems of litigation and regulation, and the flaws in a legal system based on adversarial conflict are also clearly set out.

However, given that Freeze sees the problem so clearly, his solution—more of the same, with a bit of fine-tuning—is rather disappointing. This book would be improved by a discussion of the effect some of the green economic initiatives (such as a dismantling of the power of corporations, and a more restorative justice system) might have on pollution prevention and control. Freeze also does not distinguish between voluntary and involuntary risks, and how this should affect public and industry spending priorities. Taking drugs and driving a car, e.g., are both voluntary activities by people who should know the risks involved. Only human health aspects are mentioned, yet frequently it is animals that suffer the most and gain the least from our human lifestyle. Animals not only suffer health effects through human waste products, but they are routinely "sacrificed" in tests to determine the safety of our own pollutants.

These flaws are fairly minor, however, and do not detract from the main strength of the book This book will be useful to anyone interested in the stewardship of our environment, but especially to North American readers. It will be especially beneficial to engineering and geological lay people wishing to know more about technical aspects of water pollution.

Reviewed by Michael Morris, Ecology and Environmental Science Laboratory, Shibaura Institute of Technology, Fukasaku 307, Omiya, Saitama 330-8570, Japan.

Ethics

GOOD CARE, PAINFUL CHOICES, 2d ed. by Richard J. Devine. New York: Paulist Press, 2000. 268 pages. Paperback. ISBN: 0809139243.

Devine is a Vincentian priest who teaches medical ethics at St. John's University. This is the second edition of a book that was published only four years ago. Since the field of health care is developing very rapidly, a new edition that would address the issue of cloning and present the current state on AIDS treatment, reproductive technologies, and euthanasia had become necessary. The reader recognizes immediately that this very readable book is up-to-date. Six of the thirteen chapters contain references more recent than the middle of 1995. Several references are from 1998.

The chapters include basic moral issues, the beginning of life, illness and disease, the end of life, and health care. Each chapter stands alone so that it is not necessary to read the book from cover to cover to find information on a specific topic. Each topic is addressed from five points of view; the first is that of the medical-scientific community. Frequently, the first paragraph defines the term, but, in a few cases, a history of treatment begins the presentation. Next is a discussion of what research teaches, followed by an explanation of the different available treatments. All of the information is well documented, and technical terms are defined in a lay reader's vocabulary. Relevant publications are referenced in the notes that follow each chapter. The presentation is thorough and is aimed at the "ordinary person."

In the second section, Devine summarizes what the law has to say on the subject. All court decisions through 1998 appear to be included. Again the presentation is factual and in terms an ordinary person can understand.

The third section is devoted to the socio-cultural framework in which Americans view the subject. Devine addresses each subject from various perspectives that pervade our society such as interventionism, feminism, hedonism, equality, respect for life, importance of privacy, and importance of family. Again, sources for his factual statements, primarily polls and quotes from the popular press, are presented in the text or in the notes.

In the fourth section, Devine reviews the formal teaching of the Roman Catholic Church on the issue. For the most part, these sections lead off with a quote or series of quotes from statements made by the American Catholic Bishops or by the Pope. However, in a few chapters (for example, the chapter on abortion), Devine also includes a summary of early Church teaching as well as some theological commentary.

Finally, Devine engages in some moral reflections. If readers expect to find a conclusion in which the author either states his position or makes a recommendation, they will be disappointed. In these final sections, Devine raises more questions than he answers, in contrast to the earlier sections in which the reader has experienced Devine as a lecturer, clearly presenting all the instruction needed. It is evident that Devine understands the most important factor in good teaching: since human beings do not act on the basis of the mind alone, the heart and soul must be hooked if behavior is to be affected. Congruent with this desire to affect behavior, Devine ends each chapter with a set of study questions. These are open-ended questions intended for group discussion.

In summary, this is a well-organized, tightly knit, and comprehensive book which enables readers to find all the necessary information in one place and to come to their own conclusions based on a thorough understanding of the factual and moral dimensions of various decisions. Anyone reading this book would learn many interesting and useful facts and would be challenged to subject his or her answers to moral scrutiny. Hopefully some reader will respond by vocalizing a biblically based theology of medical care that would provide guidance to evangelical ministers and lay people who face these issues or who counsel others who do.

Reviewed by Elizabeth M. Hairfield, Professor of Chemistry, Mary Baldwin College, Staunton, VA 24401.

BODY AND SOUL: Human Nature and the Crisis in Ethics by J. P. Moreland and Scott B. Rae. Downer's Grove, IL: InterVarsity Press, 2000. 345 pages, index, endnotes. Paperback. ISBN: 0830815775.

Moreland (Ph.D., University of Southern California) is professor of philosophy at Talbot School of Theology, Biola University. He has written for many philosophical journals and written or edited twelve books. Rae (Ph.D., University of Southern California) is associate professor of biblical studies and Christian ethics at Talbot School of Theology. He has authored *Embryo Research and Experimentation* (Crossroads) and *Brave New Families: Biblical Ethics and Reproductive Technologies* (Baker).

This book is divided into two parts: Part One (six chapters) addresses the metaphysics of human personhood; Part Two (four chapters) reflects on the ethical consequences of human personhood. Endnotes are used extensively throughout the text, so use of a bookmark is encouraged for ready reference to the notes while reading.

The main point of this work is to offer a view of human personhood that is both scripturally supported and philosophically defensible. Moreland and Rae offer a version of Thomas Aquinas' dualism which they call "Thomistic substance dualism" as an alternative to the physicalist world view prevalent in modern ethical discussions. Part One dives very deeply into technical philosophical discussion exposing the fallacies of physicalism and the defensibility of Thomistic substance dualism in a scientific age. The authors forewarn the lay reader to skip this section if desired because one can quickly become bogged down in the metaphysical language of philosophy. They have, however, produced a first-rate academic argument that contributes new clarity to the foundation for a Christian ethic of personhood.

Part Two takes Thomistic substance dualism and applies it to the thorny ethical issues of reproductive technology, cloning, and abortion. Understanding what a person is from the dualist perspective develops a consistent and scriptural ethic in these issues. Much of the current ethical confusion is due to the clouding of categories; Moreland and Rae pierce through the fog.

My impression of this book is best communicated as an analogy. In the 1980s, the U.S. Navy needed fire support for Marines ashore that was unavailable from any ship in the inventory. The Navy re-commissioned the old battleships with some minor modern improvements like Tomahawk missiles. These battleships quickly established supremacy over southern Lebanon for the Marines. Thomistic substance dualism is like those venerable

battleships: an aged dreadnought re-commissioned with stunning results and some minor modernization. Its salvos have blasted a hole in the ethical battlefield with the sheer weight of their force. I recommend this book to any reader interested in bioethics. Those with little or no philosophical training can simply take the authors' advice and skip the technical chapters, but one learns how to appreciate the artillery with even just a little knowledge of ballistics.

Reviewed by David Condron, Aerospace Engineer, Woodbridge, VA 22192.

Faith & Science

MY FAITH AND GENESIS by Daniel Heinrichs. Published by the author: Daniel Heinrichs, 103-333 Vaughan St., Winnipeg, MB R3B 3J9. 157 pages. Paperback; $10.00.

Heinrichs is a longstanding member of ASA. Now in his eighty-first year, he has recorded the fruits of his scholarship and long life. Concerning Genesis he writes: "I feel that many views expressed read far more into Genesis than is justified. Genesis had to be understandable to the people who first received it, and it was written within the culture of the time." Furthermore, says Heinrichs, my view on Genesis takes cultural factors into consideration and "is closer to the truth than many of the complicated articles usually published in ASA."

Heinrichs' book is divided into thirty-six brief sections with only the last section on Genesis. Other topics considered include many theological ones, such as monotheism, the Bible, the church, suffering, Israel, heaven, and hell. The book includes some empirical material based on research with a dash of personal observation and opinion added. Heinrichs' purpose in writing this book was "to make a simple statement of faith and to attempt to gain an insight into God's plan for the human race ..." The book is available from the author.

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

SCIENCE AND RELIGION IN SEARCH OF COSMIC PURPOSE by John F. Haught, ed. Washington, DC: Georgetown University Press, 2000. 137 pages, essay endnotes, index. Hardcover; $49.95. ISBN: 0878407693.

This collection originated as papers delivered at the 1997 symposium "Cosmology and Teleology." Haught, Director of the Georgetown Center for the Study of Science and Religion, invited a distinguished array of experts in science and religion to address questions of cosmic purpose.

In his introduction, Haught notes that the sense of cosmic purpose expressed in our cultural and religious myths has been challenged by claims that modern science offers little warrant for teleological notions but rather supports the pessimistic conclusion that we live in a "pointless" universe. Yet some would argue that our current scientific knowledge and understanding of the universe is "remarkably consonant" with a religious sense of cosmic purpose. As to "whether the cosmic visions of the world's great spiritual traditions can be reclaimed in an age of science," these essays offer various views and common themes.

The first two essays present scientific perspectives. Andrei Linde, in "Inflationary Cosmology and the Question of Teleology," surveys big bang and inflationary theories. He concludes that our "domain" of the universe does not reproduce its original design and thus "cannot carry any message from the creator whatsoever." Yet, he adds, we cannot fully comprehend the universe until science considers its relationship to consciousness and considers ultimate questions it has been unwilling to face.

In "Darwin and the Teleology of Nature," Francisco Ayala argues that Darwin discovered a teleological process within nature inherent in the interplay of mutation and selection—creative and directive, though not conscious—and distinguished by the criterion of utility. Appropriate to biology but not to physics, Darwin's model preserves teleological explanations without recourse to an external agent or a vital force.

The essays that follow examine three older religious cosmologies. In "Islamic Cosmology: Basic Tenets and Implications, Yesterday and Today," Seyyed Hossein Nasr reviews medieval Muslim cosmology and its contributions to questions of purpose. Thanks to its holistic integration of theology and cosmology, Islamic thought escaped the bifurcation of Cartesian dualism and the reductionism which, in Nasr's view, has impoverished Western understanding of the universe.

This critique of reductionism is taken up by Anandita Niyogi Balslev in her essay, "Cosmos and Consciousness: Indian Perspectives." She emphasizes the holistic approach to cosmos and telos that pervades ancient Indian thought, with its claim that there is an intimate and integral relationship between the universe and consciousness, between the natural and the moral orders. "We cannot escape the law of karma any more than we can escape the law of gravity" (quoting A. L. Basham).

This claim of a relationship between the moral and natural orders appears in another eastern tradition, as Mary Evelyn Tucker explains in "Cosmology, Science, and Ethics in Japanese Neo-Confucianism." The two seventeenth- and eighteenth-century thinkers she surveys, Kaibara Ekken and Miura Baien, both pioneers in Eastern scientific method and cosmology and its ethical implications, did not impute purpose to the cosmos in any material, modern sense, but they did see the cosmos as meaningful, and inviting harmony between humanity and nature.

With "Cosmic Directionality and the Wisdom of Science," the reader returns to modern cosmology. Brian Swimme argues that the universe gives plenty of evidence

not of random development but of different kinds of directionality: expanding differentiation, autopoesis, and interrelatedness. Stressing our crucial role in affecting the future course of biotic evolution, Swimme outlines the purposeful (ethical) steps he believes we must consciously take to leave a healthy and biologically rich planet for our children.

In his essay, "Information and Cosmic Purpose," John Haught argues that the hierarchical vision of the universe rejected by reductionistic scientism can be validated by information theory, which offers a way of thinking about order and meaning that is also consonant with the Taoist concept of wu wei and with kenotic theology. The notion of an underlying though elusive patterning element that becomes evident in discontinuous levels of hierarchy while not disrupting the continuous development of nature "allows us to hold simultaneously a belief in evolutionary science and a trust in cosmic meaning."

In the final essay, "Is there Design and Purpose in the Universe?" Owen Gingerich asserts that the answer lies in a faith enriched by the astonishing coherence one encounters in the fine tuning of the universe which has allowed the evolution of conscious beings who can behold it in wonder. In the contingency and freedom that characterizes the universe, Gingerich sees a world "organized with purpose, direction, a pervasive sense of movement toward higher organization, but not necessarily with a total blueprint."

These eight essays are informative, interesting, and clear. And one may discern an overarching theme: to make sense of the universe, one must look at it holistically. Reductionistic materialism precludes this very notion; but a holistic approach brings matter and consciousness together and finds moral purpose through a conscious reflection on this universe enriched by the wisdom of the world's religions. Recommended.

Reviewed by Robert J. Schneider, Distinguished Professor of General Studies, Berea College, Berea, KY 40404.

History of Science

FAITH AND REASON IN THE 19th CENTURY, vol. 2 of **Christianity and Western Thought** by Steve Wilkens and Alan G. Padgett. Downers Grove, IL: InterVarsity Press, 2000. 436 pages, index. Hardcover; $24.99.
ISBN: 0830817530.

Wilkens is associate professor of philosophy and ethics and Padgett is professor of theology and philosophy of science at Azusa Pacific University. Wilkens is a trained theologian with an interest in philosophy, while Padgett is a trained philosopher with an interest in theology. This book is a sequel to Colin Brown's *Christianity and Western Thought*, vol. 1, which surveys the history of the interactions between philosophy and Christian theology from ancient times up to the Age of Enlightenment. Wilkens and Padgett are also at work on a third volume that will survey the developments of twentieth century philosophy. Once completed, *Christianity and Western Thought,* in three volumes, should become the premier text of philosophical history written from a conservative Christian perspective.

Although Wilkens and Padgett clearly indicate in the preface of their book that they are writing from a Christian perspective, they go on to explain:

> This is not a book of apologetics, and it does not have as its primary function the criticism of ideas and systems that are contrary to the Christian faith. Rather, we seek to fairly explain the philosophical arguments and conclusions of great thinkers that have influenced our culture.

They also state that "to write this from a Christian perspective means that we are Christianly interested in the work of these thinkers, their view of God and religion, and their impact upon theology as well as philosophy and culture."

This approach follows the lead of Brown, who states in his introduction to volume one that the aim of his book is:

> Not to present a defense of Christianity against all comers. Rather, it is a historical sketch, written to help students – and anyone else who might be interested – to get a better grasp of the love-hate relationship between philosophy and faith that has gone on for close to two thousand years.

In addition to these kindred approaches to the subject matter, there are other similarities between the two volumes. Both volumes include an extensive section of endnotes that includes references to both secondary source material and translations of primary resources. Relevant quotations from translations of primary sources are interspersed throughout the text of both volumes. The arrangement of the subject matter is also similar. Individual philosophers are introduced with a brief overview of their family background, education, vocations, and interactions with other philosophers and philosophical systems of thought. These biographical summaries are followed by a presentation of the major aspects of each person's approach to the relationship between philosophy and theology. Critiques of these ideas are then offered by pointing out the inherent weaknesses and inconsistencies of each philosophical system. Both volumes include a final chapter entitled "Retrospect and Prospect" that not only includes helpful summary statements, but also provides a smooth transition to the next volume in the series.

Though the two volumes are similar in style, there is one major difference between them. While Brown surveys the field of philosophy from Pythagoras in the sixth century B.C. to Immanuel Kant in the eighteenth century, Wilkens and Padgett write a similar number of pages on the philosophical developments of a single century! Wilkens and Padgett, therefore, are able to go into more

depth in their treatment of individual philosophers and their systems of thought. They also are able to include lesser known individuals and movements that would get passed over in a survey with a broader time frame. A unique feature of volume two is the inclusion of the development of the social sciences into their own distinctive disciplines.

Volume two begins where volume one leaves off, with the agenda-setting influence of Kant and ends with Sigmund Freud who, according to Wilkens and Padgett, is an important transitional figure between the nineteenth and twentieth centuries. Philosophical systems extensively covered include rationalism, romanticism, idealism, dialectical materialism, nihilism, existentialism, positivism, pragmatism, confessionalism, liberalism, and Darwinism. Individual philosophers and theologians discussed include Coleridge, Schliermacher, Hegel, Strauss, Compte, Fuerbach, Marx, Kierkegaard, Nietzsche, Mill, James, Ritschl, Darwin, and Weber along with some lesser known figures. Intersections between developments in philosophy and Christian theology during the nineteenth century are highlighted throughout the book.

This book can easily be used as a text in any college or seminary class that seeks to cover the intellectual world of the nineteenth century from a Christian perspective. Like volume one, the material is presented in a clear and concise manner that is easily accessible for ministers, scientists, and anyone else who may be looking for a readable desk reference work on the history of the relationship between Christianity and Western thought. Anyone who already owns a copy of Brown's volume one will definitely want to purchase a copy of volume two. Wilkens and Padgett hope to finish volume three, which will survey twentieth century philosophy, by the end of 2002. Once this trilogy is complete, the breadth of coverage and the readability of the material included should make it a standard reference and text for years to come.

Reviewed by J. David Holland, Biology Instructor, Springfield College in Illinois, 1500 N. Fifth Street, Springfield, IL 62702.

DARWIN'S WORMS: On Life Stories and Death Stories by Adam Phillips. New York: Basic Books, 2000. 148 pages. Hardcover; $20.00. ISBN: 0465056768.

Charles Darwin had a lifelong fascination with earthworms. In November 1837, the same month that he finished revising the diary of his voyage on the Beagle, he read a paper at the Geological Society of London on how "every particle of earth forming the bed from which the turf in old pasture land springs has passed through the intestines of worms." In his last book, *Formation of Vegetable Mould through the Action of Worms* (1881), Darwin returned to his unsung subterranean heroes and celebrated their inexhaustible work that makes the earth fertile. Worms not only prepare the ground for plants and seedlings, over time they bury and preserve objects that do not decay. They preserve the past and create conditions for future growth; they bury to renew; digest to restore.

Sigmund Freud had a lifelong antipathy to biography. In 1885, when he was twenty-nine and well before he had established his reputation, he burned all of his professional papers and notes in part to confound future biographers. In 1936, he wrote to his would-be biographer: "Anyone who writes a biography is committed to lies, concealments, hypocrisy, flattery and even to hiding his own lack of understanding, for biographical truth does not exist ..."

Biography, in Freud's mature thought, was "a monument to the belief that lives were there to be known and understood, rather than endlessly redescribed." Moreover, it was a function of Freud's concept of the "death instinct" to make narrative coherence impossible by spoiling the connections we or other people might make of our lives. Human lives do not have a shape; they cannot be plotted; and they are not reducible to a coherent story. Freud was interested in how our lives tend to resist our stories about them.

In *Darwin's Worms*, British psychotherapist and writer Adam Phillips uses Darwin's fascination with worms and Freud's hostility to biography to view mortality, extinction, and death from the perspective of those have "removed God from the big picture." Phillips is especially interested in how both Darwin and Freud viewed destruction as conserving life. Aging and death for them become not alien but integral to life. Phillips suggests that both Darwin and Freud were drawn to consider "losses that could be survived—or even seen to be sources of inspiration" the fossil record, half-remembered dreams, and childhood memories. They frequently returned to the theme of the impermanence of natural phenomena. Life for them, Phillips contends very convincingly, was about "what could be done with what was left, with what still happened to be there." They redescribed scenes of loss from a secular viewpoint in order to show why people and animals do not give up. They tell us that the only life is the life of the body; consequently, death is "of a piece with life." Darwin's opportunistic worms, then, present us with a new vision of heroic nature. Phillips' closing message is that we must not be dismayed by our mortality, but live with our own deaths.

Phillips has written an interesting and very readable essay on the theme of loss in Darwin and Freud. But on the matter of there being nothing between humanity and nature, I find him not only unconvincing, but much too glib. One need not be any less appreciative of the thankless labors of earthworms to suggest that the removal of God from the modern world was generally a far more traumatic and disturbing matter than Phillips lets on. While Darwin and Freud focused on worms and death instincts and did battle against creationists and biographers in order to celebrate how death in the natural order conserves life, many others were disoriented, even devastated, by the collapse of religious truths. To my mind, A. N. Wilson's recent *God's Funeral* gives a much more nuanced and sober picture of the loss of faith in the Victorian era. Undoubtedly, this was not Phillips' objective. He has written a secular inspirational book of sorts, one that wants to convince contemporary readers that they are not trapped or diminished in a world of continuous loss.

And I must concede that if, in fact, modern Western humanity attended "God's funeral" in the late nineteenth century, then Phillips is correct: we are not fallen creatures, but simply creatures. And the project of re-conceptualizing both life and death becomes absolutely essential.

Reviewed by Donald A. Yerxa, Professor of History, Eastern Nazarene College, Quincy, MA 02170.

Natural Sciences

MEAN GENES by Terry Burnham and Jay Phelan. New York: Perseus Publishing, 2000. 146 pages. Hardcover; $23.00. Paperback; $13.00. ISBN: 07382012304.

"It's in the genes, Stupid." This may be the title of the banner displayed by authors Burnham and Phelan when advertising their new book, *Mean Genes: From Sex to Money to Food Taming our Primal Instincts*. This book observes the world through a Darwinian lens as it examines tough issues like love, adultery, family, violence, greed, and the primal instinct. It is, according to the Introduction, "an owner's manual for your brain."

Interjecting many biologically sound examples to support their premises, the authors show their extensive knowledge of both Darwinian exegesis and biological definitions. Burnham is an economics professor at Harvard's Kennedy School of Government and Phelan is a professor of biology at UCLA. They fully decompose each area of interest (compartmentalized into chapters titled "Debt," "Fat," "Drugs," "Risk," "Greed," "Gender," "Beauty," "Infidelity," "Family," and "Friends and Foes") so that the reader is offered evidence about why each characteristic exists and, more importantly, what people can do to improve life.

The authors' goal is to use scientific studies to aid the premise that a human is "actually two things: a personality who has likes, dislikes, desires, and dreams. But inside a man's body is also a machine, [a] brain, that process[es] commands and acts on those dislikes, desires, and dreams." In the end, the authors conclude that in most cases the brain usually wins, because an individual is predisposed to certain failings based solely on genetic influences. These mean genes are, according to Burnham and Phelan, "masters of the visceral" and control our lives through satisfaction, pain, and pleasure.

In stating their case, the authors rely heavily on findings from the animal kingdom. This approach reveals some fascinating facts about the characteristics of numerous animal species, such as the gray squirrel that hoards its food. The squirrel is genetically inclined to hoard food while the human species struggles to save even a minuscule amount. Additionally, the authors claim that humans are products of a mammalian heritage that thrives on a genetically inclined feel-good attitude, to spend now instead of saving for a future.

Numerous examples of transferable lessons are replete in this thought-provoking book. For instance, the natural tendency for humans to fulfill their appetites is based upon a world where plentiful food was inconceivable. Therefore, if individuals belong to an industrialized world where food is readily available, obesity becomes prevalent. Stories of an Australian social spider as her actions relate to family values, to the bizarre realities involving spiders that break off their genitalia after copulating, to certain frog species that "continue individual bouts of mating for several months" are included as means to understand the underlying reasons for people's behaviors and to outline steps that can be taken to tame primal instincts and to improve the quality of life.

Evolution by natural selection is a powerful tool for understanding behavior. Using this tool reveals many aspects of human life that can be understood and the authors of this interesting book readily expose these issues as they reveal humankind's struggles for self-improvement. In the end, *Mean Genes* is the first book that converts the modern Darwinian revolution into practical steps for better living. Author Robert Frank of Cornell University correctly concludes on the back cover of this very instructive guide that "Burnham and Phelan not only unmask the devil inside us, they hand us the tools to disarm him."

Reviewed by Dominic J. Caraccilo, Lieutenant Colonel, US Army, 1212 Whisperwood Drive, Columbus, GA 31907.

IN SEARCH OF DEEP TIME: Beyond the Fossil Record to a New History of Life by Henry Gee. New York: The Free Press, 1999. 267 pages, endnotes, index. Hardcover; $26.00. ISBN: 068485421X.

Gee is chief science writer for *Nature*. He received his doctorate in zoology from Cambridge University, where he studied vertebrate paleontology. There he became personally acquainted with "a den of subversives intent on fomenting academic revolution." Those subversives were engaged in developing a new way of understanding natural history radically different from the "establishment" lines-of-descent approach, a way that became known as cladistics.

In Search of Deep Time is an unabashed apologetic for the new way: "cladistics is the best philosophy for the scientific understanding of the history of life as we unearth it from Deep Time." Gee asserts that the very concept of Deep Time (i.e., geological time, where the time units are intervals of millions of years) makes any attempt to construct a story of life on earth inherently futile: "Deep Time can never support narratives of evolution." This conclusion drives cladists to seek a pattern to natural history "free from subjective, untestable stories," a pattern less authoritarian, more tentative, and more modest in its goals and claims than the conventional view, a pattern that leads to some unorthodox conclusions about evolutionary relationships.

Chapter 1 establishes the case that the fossil record is too sparse to permit the construction of anything like the evolutionary history of a species. It goes on to show what is possible: one can construct a cladogram, a branching chart showing the closeness of relationship of two or more species, extant or fossil, on the basis of shared characteristics.

Chapter 2 illustrates how applying cladistics to particular taxa may lead to unorthodox conclusions. As regards fossil fishes and primitive extant fishes, "*Acanthostega* tells us that whatever limbs with digits evolved for, they did not evolve for walking on land ... On the evidence ... tetrapods evolved limbs before they came ashore for reasons unconnected with walking on land." Gee cites cladistic analyses of conodonts, echinoderms, and giant sloths that produce equally surprising results.

Chapter 3 is philosophical. While affirming Darwin's basic hypothesis, it warns against constructing a natural history for an extant species based on the present function of a structure: "Scenarios about adaptation contain a logical non sequitur: that the adaptation of a structure for a particular purpose necessarily tells you anything about how that structure evolved."

Chapter 4, entitled "Darwin and His Precursors," actually deals as much with those who followed Darwin and contributed to the Modern Synthesis: Dobzhansky, Mayr, Simpson, and Romer. Gee finds these men largely responsible for constructing the establishment view of evolutionary history, a view leading to "children's stories" of adaptation and descent that only cladistics can correct.

Chapter 5 introduces the heroes of cladistics, the "Gang of Four" fossil fish specialists whom Gee came to know as a graduate student in London. Gee tells the story of how cladistics was developed, argued for, strengthened by new genomic studies, and ultimately accepted in areas of biology outside paleontology (where the fight goes on). Chapters 6 and 7 apply cladistics to two questions in natural history of great current interest: the relationship between birds and dinosaurs, and the relationships between humans and the various hominids.

In Search of Deep Time is written from a secular perspective. Chapter 4 affirms non-teleological Darwinian evolution and narrates how one particular hypothesis of Darwin (concerning nectar-eating moths and orchids in Madagascar) was tested and confirmed by Nilsson, thus proving Darwinism. Readers of *PSCF*, whatever their own views on evolution, will find Gee's argument here weak and simplistic. I got the impression that Gee assumes that Darwinian evolution is so well accepted that almost anything will do to prove it. Apart from the unquestioned naturalism, the book is not anti-religious. It simply takes no notice of religion at all.

A Christian interested in natural history would find this book a profitable and enjoyable read. Gee writes for the non-specialist. For those who have only the vaguest notion of cladistics, it provides an understandable explanation of what cladistics is, what cladists seeks to do, and some of the more unorthodox conclusions cladists have reached. Gee includes enough anecdotal material to maintain reader interest. Christian readers will resonate with Gee's warning against the authoritarianism of establishment views: "Paleontology read as history is additionally unscientific because, without testable hypotheses, its statements rely for their justification on authority, as if its practicioners had privileged access to absolute truth ... The assumption of authority is profoundly, mischievously, and dangerously unscientific."

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

DOOMSDAY: The Science of Catastrophic Events by Antony Milne. Westport, CT: Praeger Publishers, 2000. 208 pages, notes, bibliography, index. Paperback; $55.00. ISBN: 0275967476.

On the heels of certain apocalyptic predictions pertaining to the advent of the third millennium (2000 A.D., Y2K), Milne's recent book is addressed to an audience inundated with (if not, at this point, incredulous to) doomsday literature. An "eschatology" for scientism, *Doomsday* enlivens certain fears that may have subsided following a notably uneventful New Year. The message of *Doomsday* is clear: cause for concern about a catastrophic end is not over yet.

As perhaps revealed by the subtitle, Milne espouses a view of intellectual history that categorizes modern scientists into two groups: uniformitarians, those who believe that nature is relatively stable; and catastrophists, those who do not. Catastrophe theory, according to Milne, explores the dynamics of discontinuous phenomena poorly described by the conceptual apparatus of classical physics: the bursting of a bubble, the state transition from ice to water, and turbulence. But do not be deceived; the engaging rhetoric of this book does not lie in technical expositions of recent developments in mathematics or theoretical physics. In fact, there is none of this. "But catastrophe theory deals, as its name implies, with much more fundamental, even violent, macro changes" (p. 27).

The first chapter, "The Legends of Catastrophe," summarizes various myths and legends pertaining to both the world's creation and destruction, from ancient times to current. The second chapter, "The First Catastrophists," presents an equally cursory (though nonetheless very interesting) account of a shift from uniformitarianism to catastrophism in the science of the seventeenth through nineteenth centuries. Though most of this chapter concerns geology and paleontology, Milne also considers biology.

Milne is not concerned here with detailing the development of any one field, but the paradigms of the scientific community in general. Darwin's *Origin* "seemed to be offering the biological cousin of uniformitarianism" (p. 21). Milne here notes the contributions of key scientists—William Buckland, William Whewell, Rev. Thomas Burnet, John Ray, Leibniz, Newton, John Woodward,

William Whiston, Buffon, Laplace, Cuvier, Lyell, Adam Sedgewick, Jean Louis Agassiz, and Darwin—all in eleven pages.

I found the first two chapters to be the most captivating in their presentation of catastrophe as an ideological construction underlying the interpretation of natural phenomena. They are primarily anecdotal, though this feature contributes to their appeal. In fact, historical vignettes may be found throughout the book, such as one of George Green, the nineteenth-century Nottingham miller who developed differential equations (p. 26); or, of Daniel Whitmire's and John Metese's Planet X theory in which a tenth solar planet returns in its orbit every fifty-two million years, intersecting the comet cloud and explaining the Great Dyings of approximately every twenty-six million years in earth history (p. 139).

The remaining chapters treat the origin of the universe, seismology, evolution, the death of the dinosaurs, climate change, floods and natural disasters, cosmic-collision theories, and the death of our sun and of the universe as a whole. Milne often refers to chaos theory, but fails to explain clearly even its primary suppositions. For example, Milne writes, "The term 'chaos' means chaos in a mathematical or abstract sense. But it can also mean conventional social disorder and mass panics: fears of deadly rays from the sun and food poisoning are reminiscent of earlier collective fears that ought to have disappeared from today's world" (p. 154). Milne conflates the ramifications of chaos theory and popular connotations of chaos. Furthermore, by failing to delineate mainstream scientific theory from "fringe" science, Milne may confound more than he clarifies.

Doomsday is intended for a popular audience. Most citations of scientific research are from *The Times, Discover Magazine, New Scientist*, and similar periodicals, though occasional reference is made to journals, such as *Proceedings of the National Academy of Sciences* and *Nature*. Such facile treatment is not scholarship. However, Milne does provide an entertaining collection of stories from science, presented from a particular point of view for the enjoyment of a casual reader; here he produces a satisfactory contribution.

Reviewed by John Drake, University of Notre Dame, Notre Dame, IN 46556.

Origins

EXTINCT HUMANS by Ian Tattersall and Jeffrey H. Schwart. New York: Westview Press, 2000. 247 pages. Hardcover; $50.00. ISBN: 0813334829.

Tattersall, curator of the American Museum of Natural History, and Schwartz are well-known writers in the area of anthropology, and have written numerous books. *Extinct Humans*, they say, came about as part of their effort to personally study all the hominid fossil material and reclassify it. After reading the book, one is disappointed that so grand a goal is scarcely accomplished.

The book's chapters are divided along the lines of current hominid classification. The Australopithecines, *H. habilis, H. erectus, H. ergaster*, Neanderthals and anatomically modern *H. sapiens* are each in their turn given a chapter. Discussed in each chapter are reasons why the authors believe that an entirely new hominid classification is due. They dismiss all similarities between the fossil hominids and argue for separate species for almost every specimen in the world's museums. They argue that many more genera must be introduced to explain this amazing hominid morphological diversity.

To understand their argument one must know a bit of anthropological history. Prior to 1950 almost every fossil was given a unique genus and species name. This resulted in an inability to understand any of the evolutionary trends in human evolution. At the 1950 Cold Spring Harbor Conference, Ernst Mayr argued that all hominids, from *Australopithecus* to modern man should be placed in the same genus. Paleoanthropologists would only go along with him to the tune of two different genera, leaving *Australopithecus* in its own genus.

Along with this consolidation came the view that no more than one biological species occupying the same ecological niche could exist at any one time. This restricted any specimens to fit into a chronological sequence of species. Tattersall and Schwartz believe that consolidation by Mayr and others was wrong. They propose to split the human lineage into multiple species genera, but they made no proposals along this line in their book. Inconsistently, they claim that humans of the past were to be placed in multiple species, but then fail to explain why modern humans today all fit into a single species. Like hippies of the sixties, they rage against the current situation and yet make no suggestion for how to change it.

Their methodology appears less than scientific as they discount numerical morphometrics (the science of multidimensional analysis of shapes) and instead use all sorts of qualitative terms to describe the fossils, such as "puff," and "puff out," which seem to be their favorites. They claim that morphometrics is wrong because people have not properly decided which measurements to make. Yet, once again, they give no clue as to what measurements they would make. They use microscopic and extremely minor variations in skeletal anatomy as the basis for separating two otherwise very similar fossils. They admit, in a moment of weakness, that if one applied this method to modern human skeletal material that "... you'd never be able to tell if we constituted our own species or not" (p. 197).

For a book that claims to be scientific, it is odd that there are no footnotes to the primary scientific literature. Many of their conclusions are just those, conclusions with no scientific argumentation. In arguing that Neanderthals and humans did not interbreed, they dismiss the 24,000-year-old Neanderthal/human hybrid, found in

Portugal in 1998, with the simple statement that it does not stand up to scrutiny.

They dismiss Neanderthal symbolic and musical abilities by never mentioning the flute made by Neanderthals found in Croatia (that flute looks amazingly like the lower flute Tattersall and Schwartz show in Fig. 122, p. 241). They selectively cite genetic data that supports their view of the origin of modern man but never mention other data that would contradict their assertions. They argue that the evolution of new hominids had to occur in small populations, but then inconsistently rule out any important human evolution in the fringes of the hominid world, Europe and Java, where those populations would have been isolated. They have all new hominid variants arise in Africa where the population was the largest and least isolated.

It is the omitting of such data, selective citation, cursory dismissals of important facts, and the lack of footnotes that make this book appear to be an apologetic rather than a serious scientific examination of the issues. Indeed, this is the most aimless and confusing book on anthropology I have ever read. One would better spend the $50 on a good steak dinner.

Reviewed by Glenn R. Morton, Aberdeen Pouch, c/o Kerr McGee, 16666 Northchase, Houston, TX 77060.

WHAT'S DARWIN GOT TO DO WITH IT: A Friendly Conversation about Evolution by Robert C. Newman, John L. Wiester with Janet and Jonathan Moneymaker. Downers Grove, IL: InterVarsity Press, 2000. 147 pages, illustrations, photographs, notes, bibliography, index. Paperback; $9.99. ISBN: 0830822496.

What's Darwin Got to Do With It is a fun and educational book quite unlike most Darwinist or Creationist volumes on the market today. The contributors pose two imaginary professors in a debate between the merits of Darwinism versus Intelligent Design.

Newman is a professor of New Testament at Biblical Theological Seminary in Hatfield, Pennsylvania, and coauthor of *Genesis One and the Origin of the Earth.* Wiester is an instructor in biology at Westmont College in Santa Barbara, California, and author of *The Genesis Connection.* Jonathan Moneymaker is a teacher, curriculum designer, and writer. Janet Moneymaker is a cartoonist and illustrator. Together, these four theorists combine their talents for debate on this age-old query.

This quaint, illustrated adventure leads to the meeting of Professor Teller and Professor Questor, two biologists who challenge each other's views regarding the question of origins. Each page gives arguments pro and con for each theory, providing the reader information upon which to make a decision about each theory's merits.

The authors imaginatively present two viewpoints: one viewpoint says we are made in the image of God, who designed us for a purpose and wants us to experience life to the full. Contrariwise, "others say we are byproducts of an impersonal and mindless process that cares nothing for us." Thus, there are two major creation stories in our culture. One story is theistic, asserting that a preexisting intelligence created and designed the universe. The other story is materialistic, asserting that only matter-energy has always existed and that life owes its origin to a process of undirected evolutionary change from molecule to humanity.

Both theories are well presented. In the end, the reader is challenged to reconsider the strengths and weaknesses of each hypothesis. *What's Darwin Got to do With It* is an enjoyable and intellectually stimulating adventure. I recommend it, especially to those who enjoy whimsy and visualization.

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CREATION, EVOLUTION, & MODERN SCIENCE by Ray Bohlin. Grand Rapids, MI: Kregel Publications, 2000. 192 pages. Paperback; $10.00. ISBN: 0825420334.

A plethora of topics relevant to the creation/evolution controversy is covered in Bohlin's new book. Bohlin is the executive director of Probe Ministries, an organization dedicated to addressing societal issues from a Christian perspective. This is his second book; the first was the widely acclaimed *The Natural Limits to Biological Change,* coauthored with Lester Lane.

This book is divided into four parts covering evolution, intelligent design, evolution and society, and evolution and the Bible. In the first part, the standard anti-evolutionary arguments are advanced: There are said to be no transitional forms, the Cambrian explosion is too explosive, chance will not work, information requires intelligence, etc. There are no new arguments presented. The intelligent design section discusses the possibility of alien civilization, Phillip Johnson's strategy to avoid telling people *how* the Bible fits with science, and irreducible complexity. The last two sections cover such topics as sociobiology, the Papal statement on evolution, how to speak with our children about evolution, and a chapter on why we believe in creation.

Most conservative Christians will feel quite at home with this book. This conservative Christian does not. The biggest flaw in the book lies in its outdated scholarship and failure to get simple observational facts correctly related to the reader. In the first section, like a mantra, the claim is made over and over that all the phyla (save one) first appeared in the Cambrian strata (pp. 23, 41, 48, 51, etc.). This simply is not true. There are almost one hundred million years of macroscopic life forms found in the rocks beneath the Cambrian that are related to and are transitional to Cambrian forms, but are unmentioned by Bohlin. He does not cite Conway Morris's 1998 book. Since Morris is the world's foremost expert on the Cambrian explosion, one would expect a citation to him. These

problems may result from Bohlin's use of a 1985 reprint of a 1972 vertebrate paleontology book by Stahl as his only source of paleontological information. This outdated book must say all the right things as Johnson also used it in *Darwin on Trial*. Nowhere does Bohlin acknowledge the fact that five phyla are now found in the pre-Cambrian including sponges, molluscs, worms, jellyfish, and arthropods. Thirteen phyla are first found in the geologic column after the Cambrian. Bohlin also mistakenly states that the Cambrian period is only five to ten million years long (p. 50). The most widely accepted Cambrian chronology is that of Gradstein and Ogg (1996) and they list the Cambrian as lasting for fifty million years.

Of Cambrian animals, Bohlin claims that *Anomalocaris, Ottoia, Wiwaxia, Hallucigenia* and *Opabinia* have just become familiar to paleontologists during the last twenty years (p. 49). This is not true. All but *Hallucigenia* were described by Walcott in 1911–1915, and *Hallucigenia* was described in 1977. He erroneously claims that these animals are placed in single species phyla. Within the past five years, general consensus has settled on all these as members of modern phyla with *Anomalocaris* and *Opabinia* being arthropods, *Hallucigenia* being a lobopod, *Wiwaxia* being an annelid, and *Ottoia* has always been placed in the modern priapulid phylum. Getting facts wrong like this will not be noticed by most readers, but Bohlin's claims are definitely wrong. He claims that the modern coelacanth, discovered in 1938, has remained the same for one hundred million years (p. 38). Once again, this simply is not true. The 4.5-foot-long bones of the modern fish are never found as fossils. Indeed, the modern fish is unique among the coelacanths for its size. It simply is not the same animal.

When it comes to anthropology, the claims are equally outdated or false. He claims that anthropologists are only able to work with casts, never the original material (p. 30). One wonders where he gets these erroneous ideas. Michael Day in *The Guide to Fossil Man* laments the fact that there is so much handling of the original material that many of the valuable specimens are scarred and scraped by the calipers used to make measurements.

Most disappointing is that a person of Bohlin's obvious talent has insulated himself from the scientific data. In his technical chapters, 56% of his references are to creationist or nontechnical sources and the average age of the scientific articles he cites is 1988, ancient by scientific standards. By using such restrictive sources, Bohlin leaves himself open to the charge that he really has not examined the modern scientific literature and thus mistitled his book. This is substantiated when he discusses the Cambrian explosion. *Time* magazine accounts for ten of his fifteen references. If one wishes to discuss modern science, one should refer to the modern scientific literature, not news periodicals. Bohlin's book has fallen very short in scholarship.

One final comment. In the chapter entitled "Why We Believe in Creation!" not a single scientific reason is given. All the reasons are theological. Indeed, he feels that God would never use a cruel method like evolution where animal eats animal. He cites Jesus advocating mercy to others as evidence that evolution is contrary to his character. Bohlin does not explain one major contradiction. If Jesus wanted animals to be kind to animals and us to be kind to animals, why did Jesus rip those fish apart and feed them to the 5,000? Why did Jesus himself eat fish if he was against cruelty to animals?

With all of these factual errors, failures of scholarship, and logical puzzles, parents should be wary of using it with their children. Unfortunately, as Bohlin told me, a bad review here may help his sales. I fear he is correct.

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Philosophy & Theology

THE ELUSIVE MESSIAH by Raymond Martin. Boulder, CO: Westview, Press, 1999. 236 pages. Hardback; $25.00. ISBN: 0813367050.

Martin, a philosophy professor at the University of Maryland, has distinguished himself as a teacher and writer. In addition to winning teaching and scholarly awards, he has written *Self Concern, The Past Within Us,* and *Self and Identity.*

This book is about the quest for the historical Jesus, which has shown a burst of activity in the past two decades. Underlining the currency of the topic was a two-hour presentation by the ABC network on the current status of the quest. Implied in this quest is the assumption that the New Testament documents are untrustworthy. In view of this, what might this quest mean to Christians? Martin addresses his comments primarily to ordinary people, not to scholars. While he does not take a position on who is right about Jesus ("I have no particular religious or antireligious beliefs"), he does critique the methods used to arrive at conclusions and offers Christians suggestions on how to respond.

Christians have three basic responses to the secular quest for the historical Jesus, says Martin: (1) the only faith response; (2) the faith seeking understanding response; and (3) the only reason response.

In this debate, there are two camps: conservatives who subscribe to traditional portraits of Jesus and liberals who take a highly revisionists approach. Martin believes that when the experts agree, we accept their conclusions; when they disagree, we should suspend judgment. Since we are amateurs, "most of us have no business even having an opinion" (p. 94).

Martin could have expressed himself more accurately. For instance, he says that "historians agree that many of the words" (p. 13) and deeds "attributed to Jesus in the New Testament are not actually his words" (p. 14). Or

"Scholars agree that many parts of the Gospels ... were copied" (p. 15). He meant to say "many" historians and scholars.

In addition, Martin sometimes misrepresents a scholar's view. For example, he claims that Luke Johnson believes that "it is only the present that matters" (p. 154), when in fact Johnson believes no such idea. (What Johnson believes is the love his wife showed him in the early years is not disturbed by any interpretation he might lay on it in the present. Likewise, Johnson's argument is that the different interpretations Christians legitimately place upon Jesus does not negate their agreement that he is the Savior).

Martin's misunderstanding of Johnson leads him to the false conclusion that Johnson is inconsistent when he says that Christians should base what they believe about the resurrection on the Gospels. When Johnson says that the community of faith should have a say in the interpretation of the Gospels, it seems obvious he is speaking of the historic, orthodox group of Christians who have accepted the Gospels at face value. Therefore, to Johnson there is only one community of faith, not many, as Martin implies there should be (p. 160). Martin also confuses essential Christian faith (belief in the resurrection) with nonessential (belief about the date of the Gospel of Thomas). Through the centuries, orthodox Christians have affirmed the bodily resurrection of Jesus, an essential of salvation (Rom. 10:9–10). Their different views on many other issues, such as the dates or authors of books, in no way affects their essential core of beliefs which in the twentieth century were called the fundamentals.

Perhaps I am being a little too hard on Martin. Overall, he deals with the subject quite objectively, even-handed, and even sympathetically to the traditional view. However, his suggestion that Christians adopt a multiperspectivalism approach will not be welcomed by evangelicals. Multiperspectivalism advocates that non-experts "suspend belief among all kinds of expert interpretations, including religiously inspired ones ..." and "take a more relaxed, multiperspectival view that spans the gap between narrowly naturalistic interpretations and more expanded approaches" (p. 196).

What are the implications of Martin's suggestion? Multiperspectivalism enjoins Christians "not to assert the superiority of the perspective of their religious faith over that of secular reason" (p. 200). I doubt that many evangelicals could take such an approach since they are convinced that their "perspective" is accurate and will lead to salvation.

In summary, this is a helpful book which gives the current state of affairs about the search for the historical Jesus. Martin has done an excellent job of familiarizing himself with the various scholars and their views. He lucidly shares his research with helpful analysis and commentary.

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

TRUTH DECAY: Defending Christianity against the Challenges of Postmodernism by Douglas Groothuis. Downers Grove, IL: InterVarsity Press, 2000. 280 pages, index, appendix. Paperback; $12.99. ISBN: 0830822283.

Groothuis, an associate professor of philosophy at Denver Seminary, pays tribute to Francis Schaefer and Carl F. H. Henry who taught him "to love the truth and understand the times." He is well qualified to address this topic.

The Enlightenment movement began in Europe in the seventeenth century and grew to fruition in the eighteenth. The dominant conviction of the movement was that right reasoning could lead to truth. Truth, of course, meant *reality*. The philosophical view known to us as "modernism" arose from the application of reason alone to test the prevailing world view of Roman Catholicism, as well as other past philosophical views of medieval times. Ancient dogmas were jettisoned as reason scrutinized them. Protestant Liberalism is the outgrowth of the modernist world view.

Postmodernism is the philosophical view that rejects the modernist concept of objective truth. It asserts that *truth* is a relative term and is produced by a particular human population or culture at a particular time. Reality is what the community accepts as reality. Reality is what is useful for the community. There is no "yardstick" or standard to judge between the views of *truth* held by one culture compared to that of another culture. To quote Groothuis: "Postmodernism, broadly understood, has disposed with truth and has replaced it with truths. Some take this as liberating, even for Christian endeavor. I take it to be very bad news philosophically, ethically, apologetically and theologically. The burden of this book is to show why" (p. 11). Groothuis makes the astute observation that "postmodernism is modernism gone to seed."

Groothuis hopes to spark national debate on two topics: (1) the value of postmodernism for Christianity; and (2) the truth of Christianity in relation to both modernism and postmodernism. In chapter one, Groothuis states: "Truth decay is a cultural condition in which the very idea of objective, absolute and universal truth is considered implausible." He defines *truth* as "what represents or corresponds to reality." He also deftly uses the law of contradiction to refute some postmodern concepts and uncover the unreasonableness of postmodern assertions. Groothuis quotes postmodernist Richard Rorty extensively and demonstrates how strongly he has been influenced by John Dewey and Friedrich Nietzsche

In the chapter on "Postmodernist Challenge to Theology," I think Groothuis is at his best. He ably defends propositional theological truths found in Scripture, as well as the view that "God does speak in ways which we can understand." He reminds us that Christianity is a *revealed* religion, not one dreamed up by human reflection. I found the chapter on "postmodernism and apologetics" extremely interesting since I enjoy participating in this debate. Some readers may be surprised that Groothuis believes Newbigin and Kenneson (contemporary Christian apologists) are weak in defending the

objective, empirical facts of Christianity in dealing with unbelievers.

Groothuis is widely read in his field and presents his views in a professional manner. His writing style is lucid and concise. It would be helpful to have a dictionary handy when reading some portions of the book. I highly recommend the book to ASA members.

Reviewed by O. C. Karkalits, Dean, College of Engineering and Technology, McNeese State University, Lake Charles, LA 70605.

Social Sciences

AFTERWARDS, YOU'RE A GENIUS: Faith, Medicine, and the Metaphysics of Healing by Chip Brown. New York: Riverhead Books, 2000. 400 pages. Paperback; $13.95. ISBN: 0573227765.

Journalist and freelance writer Chip Brown provides an entertaining, informative, and thought-provoking exploration of the relationship between spirituality and healing. Written in a relaxed and conversational style, this work is largely autobiographical and represents a personal journey spread over several years. At the heart of Brown's journey is the struggle to find a path between the "physical-materialist and the idealist-transcendentalist positions" on healing (p. 282). However, in spite of his many years spent exploring, the author never appears to lose his skepticism. This is unfortunate because the resultant detachedness, which some might see as an attempt at objectivity, detracts from the spirit of openness that one would expect from a genuine explorer and gives the book an unfinished quality.

As his personal story unfolds, Brown introduces the reader to important figures in the history of holistic healing, such as Franz Anton Mesmer and Abraham Flexner. Similarly, Brown's recounting of his interviews with present day healers like Barbara Brennan and Shelby Hammitt give us good insight into the people as well as their methods. Brown spent extended periods as a patient and a student of many of these individuals, attending one on one sessions and group seminars all over the United States. In a few spots, Brown describes how healers were able to bring about significant physical or psychological changes in him, even if these were short lived, and it was these experiences that motivated him to keep searching.

If I understand Brown's point in this book, I think it is that healing is a process and, more importantly perhaps, a process of doubt. In this regard, he cites a lesson he learned from reading V. S. Naipul's *A Bend in the River* that beliefs can be shaken but faith is the result of being shaken (p. 379). Our belief in the physical-materialist world of modern scientific medicine can be shaken by its failure to meet our needs, and our faith in more idealist-transcendentalist alternatives can emerge as our needs are met in different ways. However, for Brown, there are no absolutes. You are never completely healed. Rather, healing is a lifelong process through which you come to terms with the self and the environment in which you live. Complacency and acceptance are the real sources of illness. It is questioning and searching that heals.

This is an interesting and enjoyable book for those who are on their own voyage of discovery and who, if only for the sake of knowing that they are not alone, would like to learn the details of someone else's struggles and triumphs. On a technical note, I hope that my copy, which was missing pages 247 through 278, does not reflect broader quality control problems at the publisher.

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

THE AMERICAN PARADOX: Spiritual Hunger in an Age of Plenty by David G. Myers. New Haven, CT: Yale University Press, 2000. 414 pages, bibliographic notes and index. Hardcover; $29.95. ISBN: 0300081111.

Myers is John Dirk Werkman professor of psychology at Hope College in Holland, Michigan. He has published extensively in professional journals but is most well known for his best-selling textbooks, *Psychology* and *Social Psychology*. His clear, readable style and devotion to accuracy has produced books geared to a general audience, such as *The Pursuit of Happiness: Discovering the Pathway to Fulfillment, Well-Being, and Enduring Personal Joy*. He has made major contributions to the study and practice of integrating psychology and faith with books, including *The Human Puzzle: Psychological Research and Christian Belief* and *Psychology: Through the Eyes of Faith* with Malcolm A. Jeeves.

His current work mobilizes values-based social science research to shape social policy. After providing a clear statement of his values orientation and the importance of objective evidence in informing policy debate (a model statement for ASA members desiring to be forthcoming about the impact of values on their scientific work), he describes the current state of society while detailing his vision for the future. The communitarian philosophy he espouses balances the respect for personal rights common to individualistic societies with the respect for the larger social good characteristic of collectivist cultures. This philosophy provides a common perspective from which to view many characteristics of contemporary society.

Myers examines American society with regard to attitudes toward sexuality, marriage and children, the effects of violence, socially irresponsible affluence, the pervasiveness of individualism, the negative impact of the media, the possibility of character education and the potential positive impact of faith.

Although the title suggests a paradox between spiritual hunger and economic affluence, it is only paradoxical if you assume, as Job's comforters did, that spiritual health should equate with financial success. Also, the discussion of spiritual hunger is largely limited to the last chapter.

One of the recurrent threads throughout Myers' works is an appreciation of yin and yang, the dialectic of thesis, antithesis, and synthesis. In this book, that theme is expressed as a naively optimistic attitude toward bi-partisanship that assumes that Dan Quayle and Hillary Rodham Clinton are actually on the same page due to superficially similar, but vaguely stated, goals. For example, Myers lists Pat Schroeder, William Bennett, Marian Wright Edelman, Gary Bauer, Bill Bradley, Jack Kemp, Louis Farrakhan, and Bill McCartney as supporting the concept of the nuclear family. It seems that Satan is in the specifics.

A similar simplification occurs in Myers' reading of the increased attention given to spirituality in contemporary society as indicative of openness to communitarian religion. This is particularly ironic since the form of spirituality popular in today's society is quite individualistic in contrast with communitarian religious practice.

The editing could have been much tighter in many sections, such as when imaginative turns of a phrase are used repeatedly and when a torrent of statistics are occasionally released making the argument difficult to follow. Readers familiar with Myers' writings will recognize much of the content here from previous works. The parts that are new, such as the social policy recommendations, are, in many cases, not fully developed (and in some cases are undercut by Myers' lack of confidence, e.g., "I am just a social scientist").

There are also sections, including those on media and work, that call for an examination of the ramifications of technology. Myers writes approvingly of the Canadian approach of suppressing materials that "subordinate, degrade or dehumanize women." However, if pornography and other negative media influences are soon delivered by the Internet (which is relatively immune to regulation), some of Myers' recommendations regarding changing the balance between First Amendment rights and social responsibilities, will no longer be practical. The web's movement toward even greater individualism also does not bode well for a communitarian philosophy. On the positive side, as Myers notes, technology may allow more parents to work from home—returning us, in many ways, to the child rearing advantages of an agrarian economy. In any case, technology will soon render many of these policy recommendations irrelevant.

This book provides a deeply researched communitarian critique of many social trends but, although Myers remains optimistic regarding the future of American society, most of the social policy recommendations discussed seem either impractical or ineffectual.

Reviewed by Rick Froman, Associate Professor of Psychology, John Brown University, Siloam Springs, AR 72761.

Letters

On God, Science, and *Perspectives*

The September 2000 issue of *Perspectives on Science and Christian Faith* left me in a somewhat exasperated state. It seems to me that we are reworking the same issues in the relationship between science and religion as we were when I first subscribed to our Journal many years ago. It is almost boring. At the ripe age of 81 years, I look back at a lifelong interest in both, religion and science and am amazed that our leaders have advanced so little in understanding both.

I believe that God is the creator of the cosmos, and hence has established all the natural laws that comprise the various fields of knowledge that are open to our intelligence: mathematics, astronomy, all the areas of science, health, weather, communication, gravity, functioning of the human mind, etc., etc. That is, God has set in motion the whole cosmos and put the controls on it which keep it functioning properly as we experience it today. It is all the work of God.

Obviously this means that everything the scientists tell us describes God's handiwork and how it functions. Of course, scientists make mistakes, they still are far from possessing the ultimate truth, they interpret findings from their own presuppositions, and they frequently change their views. It is only a few years ago when they scoffed at the notion of shifting continents, and at the suggestion that the magnetic pole could reverse polarity. We have similar problems in interpreting our Christian faith. How does God control the cosmos, and what are his purposes in what he does? These are difficult questions for puny humans, and may be forever beyond human comprehension.

Some of the articles get tied up with the philosophical questions about what God can do and what he cannot do. They extend into questions like "Can there be death before sin?" I think that God had a good laugh at our periodical while he was perusing it over a cup of coffee during his morning break, in heaven. Of course, I know he is a rational God, but I suspect he plays a few jokes on us when he is tired of our puny philosophizing, when we try to restrict his abilities according to the limits we set on what he can do. Our wise philosophers are poor at defining God and putting limitations on what he can do.

Although our contributors are learned in science and in philosophy it seems they are still not able to understand the language of the Bible, especially Genesis. Genesis is not a treatise on science not is it a record of history, although it is more reliable in these areas than any contemporary pagan writings. As soon as the serpent talks with a human voice in Genesis 3 we know that we are dealing with a fable because we know that serpents do not talk. Also, when we compare the two creation accounts in Genesis 2 and 3 we realize that God is revealing the truth to us through paradox. As I have studied the literature of five different languages, I am clearly aware that truth is revealed through paradox, and if we study God's Word carefully we find that God uses this method throughout the Bible.

I shall end with a note on suffering. If we could go through life without suffering, especially unjust suffering, we would end up as spineless jellyfish. Evil and suffering force us to use our ability to choose, by means of which we create our character and personality, and rise above our animal nature. Through them God fashions us for the purposes He has in mind for us after we graduate from this earth.

Please excuse my language, I know it has been too harsh at times, but sometimes I just rebel at what I hear among "educated" Christians.

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Behe and Intelligent Design Theory

In Michael Roberts article (*PSCF* 51 [December 1999]: 244–52) comparing Buckland's (1832) "Design" with that of Michael Behe,[1] I believe Roberts fails to properly portray Behe's position. He refers to Behe's "two-tier view of creation, part designed and part naturalistic." Behe's position is very similar to that of my own,[2] and though I have presented evidence, as has Behe, that certain processes were designed, I have tried to avoid stating that other processes were not designed. In fact, I have emphasized the traditional Christian statement: "that God is the Author, Sustainer and Finisher of all natural processes."

Roberts (p. 248) quotes a statement in Behe's book as follows: "If a biological structure can be explained in terms of those natural laws then we cannot conclude that it was designed" (p. 203). Roberts then indicates that this statement is equivalent to saying that "it was not designed." I submit that the second tier of Behe's position is that area where the evidence is simply not sufficient to say clearly whether a process or a structure was designed or whether it was not designed. Both Behe and I, as trained biochemists, acknowledge the role of chance (i.e., in mutations, etc.). We simply argue that chance is not sufficient to explain many of the complex processes or structures of living organisms.

Roberts makes specific reference to two structures that Behe supposedly said were a consequence of chance: cell membranes and hemoglobin. The words Behe used were: "it is difficult to infer intelligent design from cell membranes" (p. 206), and "Given the starting point of myoglobin, I would say that hemoglobin shows the same evidence for design as does the man in the moon: intriguing, but far from convincing" (p. 207). Behe is not saying that at some level, they might not have been designed, but that as a careful scientist, he does not see sufficient evidence to argue for design. I could take it a step further and note that for cell membranes and hemoglobin, the complexity of the amino acid sequences in the protein molecules of the membrane and in the alpha, beta, and gamma chains of hemoglobin, provides considerable evidence for design of the protein structures. Behe himself has noted the complexity of amino acid sequences in proteins in an earlier paper.[3]

In a previous paper,[4] I suggested three possible levels whereby a Creator might be involved in supplying designs to organisms. These may be summarized as follows: Level A, "every one of these processes and every connective pathway in the possibility space of viable creatures is a mindfully designed provision from a Creator possessing unfathomable intelligence."[5] Level B, "organisms possess the intrinsic capacity to organize themselves along developmental lines that have largely been predetermined by information that is either contained within or is assessed by the genome."[6] Level C, "in the history of the origin and development of living organisms, there has been a continuing provision of new genetic information by an intelligent cause."[7] Behe defines irreducible complexity as follows: "... a simple system of well matched interacting parts that contribute to the basic function wherein the removal of any one of the parts causes the system to effectively cease functioning" (p. 39). This definition is somewhat narrower and probably comes closer to my Level C, but it is certainly not meant to exclude Levels A and B as I have cited them from Van Till and Corey.

Consequently to suggest that design theorists must classify a process or a structure as either (a) designed or (b) not designed, would be a totally unreasonable requirement. Rather than a two-tiered view as described by Roberts, Behe's view is really three tiered: (1) Those structures or processes that show clear evidence of design; (2) those structures or processes where the evidence is insufficient to make a statement; and (3) those that may be explained by chance events. This three-tiered approach overcomes the primary criticism that Roberts has of Behe's view of intelligent design.

Notes and References

[1]M. Behe, *Darwin's Black Box: The Biochemical Challenge to Evolution* (New York: Free Press, 1996).

[2]G. C. Mills, "A Theory of Theistic Evolution as an Alternative to the Naturalistic Theory," *Perspectives on Science and Christian Faith* 47 (1995a): 112–22; also see ——, "Theistic Evolution: A Design Theory Utilizing Genetic Information," *Christian Scholar's Review*, XXIV (1995b): 444–58.

[3]M. Behe, "Experimental Support for Regarding Functional Classes of Proteins to be Highly Isolated from Each Other," in J. Buell and

V. Hearn, ed., *Darwinism: Science or Philosophy?* (Richardson, TX: Foundation for Thought and Ethics, 1994), 60–71.
[4]G. C. Mills, "Similarities and Differences in Mitochondrial Genomes: Theistic Interpretations," *Perspectives on Science and Christian Faith* 50 (1998): 286–91.
[5]H. J. Van Till and P. E. Johnson, "God and Evolution: An Exchange," *First Things* (June/July, 1993): 32–41, p. 38.
[6]M. A. Corey, *Back to Darwin: The Scientific Case for Deistic Evolution* (Lanham, MD: University Press of America, 1994), 309.
[7]G. C. Mills, "A Theory of Theistic Evolution," 114.

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Dissoulution?

There has to have been a multiple breakdown to produce part of Ben M. Carter's "The Salvation of Your Souls: But What Is a Soul?" (*PSCF* 52 [December 2000]: 242–54,). There are errors that a review or proofreading should have caught and corrected.

Psucho (pp. 243f) is not a noun. Indeed, I do not find a corresponding form for any ancient Greek noun, though it is a possible modern *katharevusa* dative of the adjective meaning "cool." It is a verb which means "to breathe or blow" (recognized on p. 243), "to make cool or cold," and hence "to refresh." In modern Greek, it means "to cool." In the New Testament, it occurs only once, tropistically, of waning love (Matt. 24:12). It occurs a few times, only three certain, in LXX.

Psuchon in 1 Peter 1:9 (p. 243) is the genitive plural of *psuche*. Only the latter is the citation form. The word may also be the genitive plural of *psuchos*, meaning "coolness," "chill," or "frost." This word, though not in the form Carter gives, occurs three times in the New Testament and three or four times in LXX. It has nothing to do with the soul except in being derived from the same root. What may mislead is that *psychon* looks like a second declension neuter. However, *psuche* is first declension and *psuchos* is third.

Psuche, like the Latin *anima*, basically meant "breath." Then, because breathing is connected to animal life, it came to mean the principle of life, then a living entity, and finally the continuing portion of a human being.

The situation with Aristotle is not quite as presented. Body is potentiality because it is on the material side. Soul is actuality because it is another term for the *eidos* or form. All that is combines form and matter except at the extremes: prime matter, which is totally irrational, and Pure Form, which is his deity. At the lowest level, prime matter is formed into the four elements, which in turn are formed into inanimate and animate entities. At the animate level, the *eidos* may be termed a soul.

In generation, according to Aristotle, the female provides the matter and the male provides the form. Among human beings, if the form is vigorous, the result will be a boy who will become a proper man. A lesser form will produce a girl or a slave. But, because the *eidos* or soul can only exist embodied, Aquinas, in adopting Aristotle as "the Philosopher," had a problem with an immaterial soul that survives the dissolution of the body. This is a major reason why Catholics usually hold that the soul of each infant is specially created rather than generated along with the body. The two views are known as creationism and traducianism, respectively. There is a third view, infusionism, which is more likely to be associated with metempsychosis.

Aquinas did not originate the notion that there is only one soul in a person (p. 245). He found that in Aristotle, where every entity has but one *eidos*, though the constituents may also have their forms. Some living things have only a nutritive soul, while others have a soul that has both nutritive and sensitive powers, etc.

Noting such problems in matters with which I am familiar, I can only hope that those knowledgeable in other areas will not find additional errors.

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Repeating Error: Another Perspective

After carefully reading John McIntyre's communication, "Repeating the Catholics' Galileo Error," (*PSCF* 52, no. 4 [December 2000]: 255–9) and discussing it with him at length, it is clear to me that McIntyre's position has some serious, perhaps fatal, flaws:

1. McIntyre says "Christians should wait for the scientific verdict before interpreting Scripture." [p. 256] I understand this to mean (and McIntyre confirmed my correct understanding in his final response to me) that whatever topic we might choose to address from Scripture, if the scientific community should choose to address the same topic from their materialistic perspective, the church is obliged to back off and defer to the scientists. I am unable to see how this differs from the rightly criticized "God-of-the-gaps" mentality, where the church backed off of every theological statement as science encroached on it. McIntyre was unable to help me see the difference, if he even tried to do so.

2. The atheists in the scientific community have a (materialistic) "scientific" explanation for every phenomenon of our existence. Since they are (by definition) offering a "scientific verdict," the church therefore is obliged to retreat from "*all*" pronouncements about anything at all—except perhaps a Mammy Yokum-ish "Good is better than evil, because it's nicer." This is the same as no church at all, and the atheists win. McIntyre did not reply to this point.

3. McIntyre offers essentially a David Hume definition of science, the "faithful report of the senses." Hume argues from the uniformity of the senses against the possibility of miracle, and I see no way to refute that from McIntyre's position. The "faithful report of the senses" tells us that the only way to get wine from water is to pour it on the ground in the vicinity of grapevines, wait some months, gather the fruit and crush it so that the yeast on the surface will ferment the juice, then wait some more for the flavors to chemically interact. Scripture has a different story, which McIntyre would have us interpret in the light of the "faithful report of the senses." In other words, it did not happen that way. The "faithful report of the senses" (*aka* science) tells us that a human body in which the heart and brainwave activity has been stopped for three days cannot be resurrected. If Christ be not raised from the dead, then we are yet in our sins, and our faith is futile. McIntyre did not reply to this point.

4. The Big Bang theory is not the "faithful report of the senses" but an *interpretation* of an interpretation of the dials and printouts of our instruments. Nobody has ever "sensed" the 3-degree radiation with their senses, and they certainly have never sensed the Big Bang. Except God. McIntyre was unable (or unwilling) to explain to me why we should believe the interpretations of the cosmologists over against the clear historical record offered by God. It is important to realize that in the Galileo example offered by McIntyre, the church attempted to interpret poetry as history; McIntyre now seems to wish to *re*-interpret history as poetry. Both are invalid interpretive techniques, whether applied to Scripture or to the musings of atheistic cosmologists. The Big Bang theory may be the best science we have today, but the historical grammatical interpretation is the best exegesis we have—and we use it to read the scientific papers.

5. The Galileo example cited by McIntyre is misleading as presented, as he admitted to me by email. Hummel clearly points out that the church actually sided with the scientific community in this case. For fifteen hundred years the "faithful report of the senses" was (and remains today) that the earth is stationary and the sun and stars move around it, and this was the position of the scientific community until Copernicus thought up an abstraction *based on Scripture*, in which he supposed that circles better reflected the glory of God in his creation than the complex epicycles of the Ptolemaic model. With Galileo the church followed exactly the procedure McIntyre recommends, and they were wrong. McIntyre did not reply to this point.

6. This is not to say that the Big Bang is wrong or that the Recent Creationists are right; there are other, more compelling arguments for making that decision. McIntyre chose rather a weak argument to defend his perspective in a very important controversy. I find it particularly disturbing that *PSCF* regularly publishes papers arguing this position, and says "we've seen enough of this discussion" when I ask why the other side is not given more print.

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Another View on the Review of *God After Darwin*

Having recently finished the book, I read Martin LaBar's review of John F. Haught's, *God After Darwin: A Theology of Evolution* (*PSCF* 52 [December 2000]: 278-9) with mixed feelings. I appreciate that Professor LaBar compliments Haught on his presentation, quotes some well-chosen passages that illustrate central themes in his theology, and credits him with his broad knowledge of scientific and philosophical ideas.

However, I feel compelled to say that the reviewer is off the mark when he states that "there is not a single Scripture reference in the book, and his theology does not seem to be founded on scriptural revelation." Thumbing through *God After Darwin*, I found citations of Gen. 9:12–17, Isa. 43:19, John 3:16, Rom. 8:22, 1 Cor. 1:25, Phil. 2:5–11, 2 Peter 3:10, and Rev. 21:5. There are also allusions and explicit but uncited references to, among others, Adam and Eve, Abraham, the prophets, Jesus' message of the kingdom of God and several of his parables, and the "Come, Lord Jesus" prayer.

More importantly, Haught's theology of evolution is suffused with major biblical themes. One is the *kenosis* theme of Phil. 2:5–11: the notion that Christ "emptied himself" of divinity in the incarnation has been richly suggestive to other theologians besides Haught of God's "letting the creation be" in ways new to thinking about the Genesis text. Another is the eschatology that pervades the New Testament, in which Haught grounds his notion of God's promise of future fulfillment in nature and creation evolving to realize that promise. Contrary to the reviewer's assertion on p. 279, the ecological dimension of Haught's theology connects the interrelationship of humanity and nature explicitly to the creation theologies of Genesis (he mentions stewardship), Psalms, the wisdom literature, the prophets, and the cosmic Christologies of John and Paul (p. 149), not merely to "the evolutionary perspective."

I hope these references are enough to show that Haught's theology of evolution is grounded in scriptural revelation as well as scientific knowledge. Haught illustrates again how scientific knowledge can enrich our understanding of revelation and help us discover dimensions in it that may not have been recognized in the past.

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