PERSPECTIVES on Science and Christian Faith

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

In this issue . . .

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

VOLUME 52, NUMBER 4

DECEMBER 2000

Perspectives on Science and Christian Faith

MANUSCRIPT GUIDELINES

The pages of *Perspectives on Science and Christian Faith (PSCF)* are open to any contribution dealing with the interaction between science and Christian faith in a manner consistent with scientific and theological integrity. Papers published in *PSCF* do not reflect any official position of the American Scientific Affiliation.

1. All manuscripts (except Book Reviews) should be addressed to: Roman J. Miller, Editor, 4956 Singers Glen Road, Harrisonburg, VA 22802. E-mail: millerrj@rica.net
2. Authors of *Papers* and *Communications* must submit **3 copies** for review purposes (an original and two copies) and **1 digital copy**.
3. Regular Papers should be accompanied by an *Abstract* of not more than 100 words.
4. All manuscripts should be typed double-space on good quality 8½" x 11" paper (computer copies should be printed letter-quality).
5. References and footnotes should be collected at the end. Each note must have a unique number. Accepted manuscripts should follow the *Chicago Style Manual* (14th ed., sections 15.1 to 15.426).
6. Graphics (electronic file preferred) that enhance the theme of the paper are desired. Figures and diagrams not in electronic format should be clear, black and white, line ink drawings or glossy photographs *suitable for direct reproduction*. Captions should be provided separately.

REGULAR PAPERS are major treatments of a particular subject relating science and the Christian position. Such papers should be at least 10 manuscript pages in length, **but not more than 6000 words**, excluding endnotes. Publication for such papers normally takes 9–12 months from the time of acceptance.

COMMUNICATIONS are brief treatments of a wide range of subjects of interest to *PSCF* readers. Communications **must not be longer than 2700 words**. Accepted Communications are normally published in 6–9 months from the time of acceptance.

NEWS & VIEWS are short commentaries on current scientific discoveries or events. Lengths range **from 200 to 2000 words**. Submissions are reviewed by the editorial board and are typically published in 3–6 months from the time of acceptance.

YOUNG SCIENTIST CORNER contains varied autobiography submissions as well as notices of special interest to science undergraduate and graduate students and young science professionals who are entering the workforce. Submissions by students (an e-mail attachment of the text is preferred) are encouraged and are typically published within 6 months.

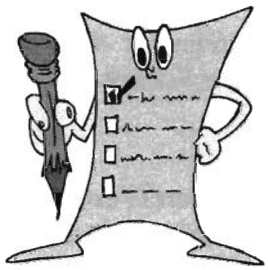
BOOK REVIEWS serve to alert the readership to books of interest and provide a valuable source for reference. Readers are encouraged to review books in their scientific fields which have implications for the Christian faith. Guidelines for book reviewers and books available for review are available from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

LETTERS to the Editor concerning contents of *PSCF* may be published unless marked not for publication. Any letter submitted for publication is subject to editorial review. Letters selected for publication will be published within 6 months.

ADVERTISING is accepted in *PSCF*, subject to editorial approval. Please address inquiries for rates or further information to the Managing Editor. The ASA cannot take responsibility for any orders placed with advertisers in *PSCF*.

PERSPECTIVES ON SCIENCE AND CHRISTIAN FAITH
(ISSN 0892-2675) is published quarterly for $30 per year by the American Scientific Affiliation, 55 Market Street, Ipswich, MA 01938-0668. Phone (978)356-5656. Fax (978)356-4375.
e-mail: asa@asa3.org
http://www.asa3.org
Periodicals postage paid at Ipswich, MA and at additional mailing offices. POSTMASTER: Send address changes to: *Perspectives on Science and Christian Faith*, The American Scientific Affiliation, P.O. Box 668, Ipswich, MA 01938-0668.

The View from Shepherd's Knoll...



A "Reviewing" Community

A major event in our church congregation is the biannual communion service. An extended Sunday morning worship service is dedicated to this occasion, which includes singing, Bible reading, meditations and sharing by members, a sermon, partaking of the symbolic bread and cup, as well as participating in a foot washing ceremony that highlights our common commitment to loving service.

In the Mennonite tradition, the seriousness of the occasion is heightened by a special pre-communion or review meeting, normally held one or two weeks prior to the scheduled communion service. Here each member is led in a process of self-examination through personal questions, such as "Am I at peace with God?" and "Are my relationships clear with my brothers and sisters in the congregation?" Among the questions that require individual response and commitment is the following ringer: "Are you willing to give and receive both correction and encouragement in the fellowship of the church?" The affirmative response to this question transforms us from a mere assembly of Christian persons into a Christian community. The willingness both to give and receive counsel acknowledges the ministry of the Holy Spirit through the words of my brother or sister as a valid corrective to my life. As we responsibly participate in a ministry of mutual admonition, the church is built and strengthened.

In a similar vein, we strive to produce a quality journal. The comments, critiques, and commendations of the reviewers to the manuscript author are indispensable. When the varied, but generally sympathetic, perspectives of the reviewers are anonymously shared with the author, the manuscript becomes honed with this interchange. Due to this review process, most published articles in *PSCF* have undergone at least one revision following their initial submission. As a result, they have been significantly improved.

In this issue, we are publishing the names of people who have reviewed one or more manuscripts from July 1, 1999,

In this issue ...

The Young Scientists' Corner, written by Douglas Hayworth, applies a lesson from riddles to the relationship between natural science and theology. Glenn Morton opens the News & Views section by describing the pending depletion of world oil supplies that may lead to a severe energy crunch! Next two educators reflect on aspects of evolution. John Woodburn suggests a labeling approach in education; Robert DeHaan maintains that "robotic evolution" as described in the popular press inaccurately portrays Darwinism.

In the Regular Paper section, authors Arthur Chadwick and Robert DeHaan, make a case for Intelligent Design by describing the complexity of the extinct trilobites. Ben Carter surveys varied understandings on the soul as an entity and then makes some tentative conclusions. Finally, John McIntyre warns against using a particular interpretation of Scripture to bolster a controversial scientific conclusion.

An essay review by Ian Hutchinson elucidates some flaws in Ray Kurzweil's book, *The Age of Spiritual Machines*. We conclude our issue with thirty-one book reviews and two letters to the editor.

Jocund reading,
RJM

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1. We accept the divine inspiration, trustworthiness and authority of the Bible in matters of faith and conduct.
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Opportunities for Service. The ASA sponsors and encourages individual and group efforts to serve both the Christian community and the scientific community. Major efforts are made to clear up misunderstandings of one group by the other, but speaking and writing are not the only forms of ASA ministry. We seek opportunities to witness as a body of people with a grasp of biblical truth wherever that witness is needed.

Affiliations and Commissions. Each member is asked to choose a primary and secondary affiliation or commission from the list below. Affiliations are autonomous but usually meet in conjunction with the ASA Annual Meeting. Commissions help plan annual meetings, report to the membership through the Newsletter, and have a chair with four to five other members as a steering committee. Each of the commissions is asked to relate its discipline toward science.

a. Affiliations

Affiliation of Christian Biologists
Affiliation of Christian Engineers and Scientists in Technology
Affiliation of Christian Geologists

b. Commissions

Bioethics
Communications
Creation
Global Resources and Environment
History and Philosophy of Science
Physical Sciences
Science Education
Social Sciences

The ASA is a member of The Evangelical Council for Financial Accountability.

WHAT EXACTLY IS THE AMERICAN SCIENTIFIC AFFILIATION?

The American Scientific Affiliation (ASA) is a fellowship of men and women in science and related disciplines, who share a common fidelity to the Word of God and a commitment to integrity in the practice of science. Founded in 1941, the ASA has grown significantly since then. The ASA's stated purposes are: (1) "to investigate any area relating Christian faith and science" and (2) "to make known the results of such investigations for comment and criticism by the Christian community and by the scientific community."

Science has brought about enormous changes in our world. Christians have often reacted as though science threatened the very foundations of Christian faith. ASA's unique mission is to integrate, communicate, and facilitate properly researched science and biblical theology in service to the Church and the scientific community. ASA members have confidence that such integration is not only possible but necessary to an adequate understanding of God and his creation. Our total allegiance is to our Creator. We acknowledge our debt to him for the whole natural order and for the development of science as a way of knowing that order in detail. We also acknowledge our debt to him for the Scriptures, which give us "the wisdom that leads to salvation through faith in Jesus Christ." We believe that honest and open study of God's dual revelation, in nature and in the Bible, must eventually lead to understanding of its inherent harmony.

The ASA is also committed to the equally important task of providing advice and direction to the Church and society in how best to use the results of science and technology while preserving the integrity of God's creation. It is the only American evangelical organization where scientists, social scientists, philosophers, and theologians can interact together and help shape Christian views of science. The vision of the ASA is to have science and theology interacting and affecting one another in a positive light.

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American Scientific Affiliation

Founded in 1941 out of a concern for the relationship between science and Christian faith, the American Scientific Affiliation is an association of men and women who have made a personal commitment of themselves and their lives to Jesus Christ as Lord and Savior, and who have made a personal commitment of themselves and their lives to a scientific description of the world. The purpose of the Affiliation is to explore any and every area relating Christian faith and science. *Perspectives on Science and Christian Faith* is one of the means by which the results of such exploration are made known for the benefit and criticism of the Christian community and of the scientific community.

Canadian Scientific & Christian Affiliation

A closely affiliated organization, the Canadian Scientific and Christian Affiliation, was formed in 1973 with a distinctively Canadian orientation. The CSCA and the ASA share publications (*Perspectives on Science and Christian Faith* and the *ASA/CSCA Newsletter*). The CSCA subscribes to the same statement of faith as the ASA, and has the same general structure; however, it has its own governing body with a separate annual meeting in Canada.

Local Sections

Local sections of the ASA and the CSCA have been organized to hold meetings and provide an interchange of ideas at the regional level. Membership application forms, publications, and other information may be obtained by writing to: American Scientific Affiliation, P.O. Box 668, Ipswich, MA 01938-0668 or by contacting the ASA web site at: http://www.asa3.org or Canadian Scientific & Christian Affiliation, P.O. Box 40086, 75 King St. S., Waterloo, ON, Canada N2J 4V1 or by contacting the CSCA web site at: http://www.csca.ca

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INDICES to back issues of *Perspectives on Science and Christian Faith* are published as follows:

Vol. 1–15	(1949–1963)	*Journal ASA*	15	126–132	(1963)
Vol. 16–19	(1964–1967)	*Journal ASA*	19	126–128	(1967)
Vol. 20–22	(1968–1970)	*Journal ASA*	22	157–160	(1970)
Vol. 23–25	(1971–1973)	*Journal ASA*	25	173–176	(1973)
Vol. 26–28	(1974–1976)	*Journal ASA*	28	189–192	(1976)
Vol. 29–32	(1977–1980)	*Journal ASA*	32	250–255	(1980)
Vol. 33–35	(1981–1983)	*Journal ASA*	35	252–255	(1983)
Vol. 36–38	(1984–1986)	*Journal ASA*	38	284–288	(1986)
Vol. 39–41	(1987–1989)	*PSCF*	42	65–72	(1990)
Vol. 42–44	(1990–1992)	*PSCF*	44	282–288	(1992)
Vol. 45–47	(1993–1995)	*PSCF*	47	290–296	(1995)
Vol. 48–50	(1996–1998)	*PSCF*	50	305–312	(1998)

A keyword-based on-line **subject index** is available on the ASA web site at: http://www.asa3.org

Articles appearing in *Perspectives on Science and Christian Faith* are abstracted and indexed in the CHRISTIAN PERIODICAL INDEX; RELIGION INDEX ONE: PERIODICALS; RELIGIOUS & THEOLOGICAL ABSTRACTS, and GUIDE TO SOCIAL SCIENCE AND RELIGION IN PERIODICAL LITERATURE. Book Reviews are indexed in INDEX TO BOOK REVIEWS IN RELIGION. Present and past issues of *Perspectives* are available in microfilm form at a nominal cost. For information write: University Microfilm Inc., 300 North Zeeb Rd., Ann Arbor, MI 48106.

"Upholding the Universe by His Word of Power" — Hebrews 1:3

Volume 52, Number 4 — **December 2000**

Reviewers

We wish to publicly acknowledge and thank the following men and women for their work in reviewing manuscripts that were submitted for publication in *Perspectives on Science and Christian Faith* from July 1, 1999 to August 30, 2000:

Jerry D. Albert
Jonathan P. Arm
Harold Aukema
Brent Baas
Roland Bagby
Stephen Bell
William L. Bell
Jud Bergan
Richard Bowman
Raymond H. Brand
Kenton Brubaker
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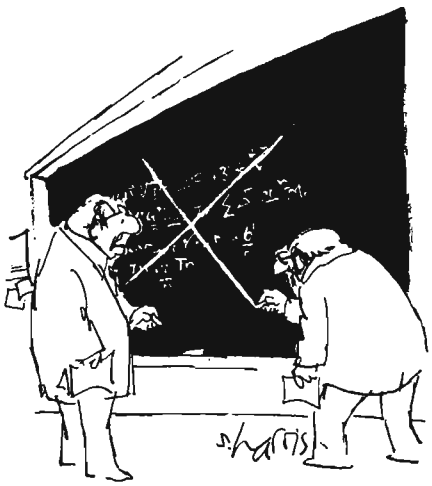

"That's it? That's peer review?"

through August 31, 2000. As published authors, these men and women have experienced the value of the peer review process in the publication of their own manuscripts. For many of them, reviewing manuscripts is a reciprocating labor of love, a professional courtesy, and a contribution that improves the dialogue between science and Christian faith. We salute them! ★

Roman J. Miller, Editor
millerrj@rica.net

Ideas for Creative Research in Neurobiology

$5000 Awards for Creative Research Ideas to Explore Deeper Realities through Neurobiology

Up to ten awards of $5,000 each will be given by the John Templeton Foundation for essays outlining the best ideas for neurobiological research which explores deeper realities such as love, purpose, creativity, moral sense, worship, mystical experience, and the search for meaning.

Sir John Marks Templeton suggests that the accelerating rate of discovery in fields such as medicine, cosmology, genetics, and computer science could be matched or exceeded if significant rigorous scientific research could be directed toward investigation of such deeper, but largely unexamined, realities. This award program is designed to elicit ideas for rigorous neurobiological research into basic realities from a broad spectrum of creative individuals in science or with some background in science.

The choice of neurobiology as the focus for this first exploration of new ideas is based upon the current rapid expansion and technical sophistication of research on the human brain. Among the elusive secrets under study are consciousness, memory, and the mind-brain relationship. Deeper human qualities that define us, yet remain so elusive and mysterious, such as love and purpose, imagination and creativity, which provide ultimate meaning for our lives, deserve the same rigorous creative study that has been so fruitful for science in the past.

Initially, applicants will submit a brief description of the research idea. After review, authors of up to 50 of the most promising applications will be invited to submit an essay (maximum of 4000 words) describing the new scientific research idea and the way it will expand our understanding of the deeper reality chosen for study. Submission of the invited essay establishes the applicants' eligibility for an award. This award program is not looking for detailed research proposals, but rather for well substantiated creative **ideas** with scientific merit. *It is the Foundation's expectation that one or more of these winning essays could serve as the basis for a significant future research program.*

To register and receive guidelines for the award program, write to:
Dr. Robert Herrmann
Creative Research Ideas
Gordon College
255 Grapevine Road
Wenham, MA 01984 USA
Email: herrmann@gordon.edu
Fax: (978) 524-3752

Initial brief proposal deadline:
March 1, 2001
Winners announced:
December 2001

www.templeton.org

Young Scientists' Corner

The "Lesson of Riddles"

by Douglas Hayworth, ASA Member, 2307 23rd Street #5, Rockford, IL 61108
hayworth@uic.edu

Place graphic here - last used Sept. 2000, p. 156.

My children are learning to tell jokes and riddles. Two-year-old Samantha enjoys repeating jokes, but she does not understand them. Five-year-old Nate comprehends some jokes, but his own riddles do not work. Seven-year-old Alison has got it down. "Why do cows wear bells around their necks?" she asks. Before I can respond, she blurts out, "Because their horns don't work!" Alison understands that riddles are based on puns and double-meanings. A riddle's punch-line depends on a switch to a different sense of meaning, the funniest of which are obviously absurd.

I remember my first attempt at making up a riddle: "Why do goats have horns?" Answer: "Because God made them that way!" Of course, this is not particularly funny. Instead of switching meanings of the word "horn" (e.g., "Because kids always drive crazy on the troll bridge!"), my punch-line played off different meanings of the word "why."

Obviously, there are several ways of interpreting and answering this question: "Why do goats have horns?" Is it because (a) nutrients, cells, and hormones interact in appropriate measure during goat ontogeny? (b) goats inherit genes that specify horn development? (c) horns assist goats (or assisted goat ancestors) in surviving and obtaining mates? (d) horned goats are part of God's intended expression of his creativity? or (e) God made them that way?

Here, the riddle gets serious. Instead of shifting to absurd meanings (with their attending humor), these "punch-lines" remain sensible. More significantly, they can seem conflicting, without a navigable connection between them by which to "translate" one into the other. Of course, the conflict is not in the underlying reality, but in the different modes of description used to communicate alternative levels of meaning.

It appears that profound riddles are the unavoidable consequence of all human endeavors to observe, interpret, and describe reality and truth. When I told my riddle at age five, I could not appreciate how important this "Lesson of Riddles" would become in my life. Today, as both a Christian and an evolutionary biologist, I am glad for the opportunities I have had to wrestle very consciously with the "Lesson of Riddles," to mature in faith by exercising an appreciation of the alternative forms of meaning inherent in all human understanding. Indeed, I find the concept to be an essential part of what it means to have a faith at all.

How I Learned the "Lesson of Riddles"

Certainly, my upbringing influenced how I came to appreciate the "Lesson of Riddles." My Midwestern American family heritage is bound more by a strong thread of genuine Christian faith than by any ethnic or vocational tie. I cannot remember a time when faith in Christ and involvement in church were not the defining themes of my family's activities; nor can I remember a time when I did not believe in Jesus as my Savior and Lord. My upbringing might have remained culturally myopic and theologically rigid, except that my family moved to Iran in 1972, where my parents began work as self-supporting missionaries. Those seven years in Iran broadened my cultural perspective, my Christian identity (via friendships with missionary families from other Christian traditions), and my sense of history (via visits to ancient archeological sites).

Seven years in Iran broadened my cultural perspective, my Christian identity, and my sense of history.

Then there were the summers spent stateside at the National Music Camp in Interlochen, Michigan. While my parents worked on staff and my brother and sister were campers, I spent all my time fishing, catching snakes and turtles, collecting butterflies, exploring creek tributaries, and searching for Indian arrowheads and Petosky fossils. Undoubtedly, these were the experiences that sparked my interest in biology.

When I was twelve, my family left Iran following the 1979 revolution. I had a rough year adjusting to American schools and the narrow world view of my peers. When my father eventually obtained a job as music pastor (and later missions pastor) at Elmbrook Church in Waukesha, Wisconsin, it meant a new start for me. I quickly became absorbed in the church youth group. I remained interested in missions, spending one summer in the Philippines and another in Kenya. I also attended Urbana missions conferences in 1984 and 1987.

I was always keenly aware of the difference between reality and current human expressions of that reality.

Although I was voted "most conservative" of my high school graduating class of 1985, I considered myself intellectually liberal. I held strongly to my Christian faith and my commitment to missions (with its attending theology of salvation only through Christ), but I enjoyed listening to diverse musical styles, reading world literature, discussing philosophy, considering alternatives to the political right, and laughing at parodies of American Christian pop culture. In other words, I was always keenly aware of the difference between reality and current human expressions of that reality.

When I started at the University of Wisconsin, my interest in biology rekindled. I soon became especially interested in the biology of plants,

Doug earned his B.S. in botany from the University of Wisconsin, his M.S. in biology from the University of Texas in Arlington, and recently his Ph.D. in population and evolutionary biology from Washington University in St. Louis. His dissertation research involved a study of hierarchical patterns of concerted evolution in ribosomal DNA intergenic spacers among species of the plant genus Arabidopsis. *His current interests include helping to homeschool his children, getting some kind of permanent job, and then one day buying a home and planting a garden.*

a group of organisms I had hardly taken notice of before. While still a sophomore, I took an upper-level ecology class and swallowed up every detail. As a junior, I especially enjoyed plant taxonomy and plant biogeography. At this point, I did not need an evolution course to convince me that all I had observed and had learned about biodiversity, biogeography, ecology, genetics, and geology was interconnected by a wondrously real, functional, and formative natural history. I was invigorated by the challenges of inferring patterns of biological diversification (speciation), and I was humbled to contemplate that God had recorded in his creation visible traces of his work by which I might appreciate more fully the overwhelming extent of it.

It was in a macroevolution class at Washington University that I formally learned about the "epistemological principle of complementarity" (what I have introduced here as the "Lesson of Riddles").

Scientific understanding of natural history is clearly a valid description of reality. The revelation of God in Scripture and the Incarnation is also clearly a valid understanding of history and truth. I could not directly translate between these two descriptions, but my experience had taught me that overcoming this epistemological hurdle should not be, in itself, a necessary condition for my confidence in either meaning. I went on to earn my Masters in biology at the University of Texas in Arlington and my Ph.D. in population and evolutionary biology at Washington University in St. Louis. It was in a macroevolution class at Washington University that I formally learned about the "epistemological principle of complementarity"[1] (what I have introduced here as the "Lesson of Riddles"). The principle states that, because human knowledge is never complete, alternative modes of description (i.e., answers to the same question) may often be formally incompatible even while both are valid (i.e., accurate) perceptions of the same object (i.e., reality).

The Riddle at Play

The principle states that, because human knowledge is never complete, alternative modes of description may often be formally incompatible even while both are valid perceptions of the same object.

I first learned the "Lesson of Riddles" in a science class because complementarity emerges within the practice of natural science itself. For example, in biology the concepts of genotype and phenotype comprise alternative modes of description with respect to inheritance. We have known for nearly a century that genotype and phenotype are thoroughly connected in reality; yet our knowledge at present remains insufficient to draw a complete straight-lined (i.e., deterministic) relationship between them (except in the most simplistic cases). I have come to appreciate the fact that fruitful investigation and discovery in natural sciences has continued despite (indeed, because of) such "incompatibilities" among modes of description.

The "Lesson of Riddles" also applies in Christian theology, that science by which we observe and interpret Scripture (God's revelation of truth) and describe our understanding in the form of doctrines. For example, in some very important sense, all Christians affirm that God is sovereign, that humans have free will (i.e., responsibility for their actions), and that God is not the author of sin. Nevertheless, we are unable to fully comprehend and completely explain how these basic doctrines can coexist. Although different systems of doctrine provide helpful ways to think about the whole, no one of them does complete justice to the depth of these difficulties. Thus, while theologians strive to work out these complexities as a noble pursuit, the individual follower of Christ (myself included) proceeds in confident faith despite the tensions that remain.

Of course, the more specific concern of Christians in science is how the "Lesson of Riddles" applies to the relationship between natural science and theology. Actually, I believe this concern belongs to every Christian in every life experience. This is because we are both physical and spiritual in being. Every human experience has both physical and spiritual implications, and these implications comprise alternative modes of describing the experience. For example, when we are sick, we pray for God's healing and simultaneously seek medical attention. If healing comes, we thank God for answering our prayers even while we acknowledge the use of medicine in materially effecting the cure. If healing does not come, we understand that current medical treatments are not one hundred percent effective, but we also affirm God's sovereignty over our condition. Even in those cases where healing comes without an attending physical explanation, we are wise not to condition our thanks to God on there being no physical basis in fact. In every experience, we acknowledge the validity of both physical explanations (based on natural science) and spiritual explanations (based on Christian theology), though the two accompanying languages are very different.

In every experience, we acknowledge the validity of both physical explanations (based on natural science) and spiritual explanations (based on Christian theology), though the two accompanying languages are very different.

Working the Riddles (For Good and Bad)

In his essay entitled "Transposition," C. S. Lewis dealt with the "Lesson of Riddles," considering why it is that all spiritual experiences find their expression in ordinary physical sensations.[2] In so many words, Lewis acknowledges that there is little about the manifestation of spiritual experiences that cannot be explained by natural processes. Consequently, the philosophical naturalist will observe little in a supposedly spiritual event to compel him to abandon his conclusion that the physical realm is "all there is." Lewis's essay is addressed to Christians, however, and as such it expresses a top-down or presuppositional approach to understanding Christian experience rather than a bottom-up or evidentialist apologetic aimed at convincing skeptics. ("Transposition" refers to the top-down expression of spiritual truth into the physical medium, which is thereby sanctified and "lifted" into greater meaning).

In several important respects, Lewis's "doctrine of Transposition" rings true with me personally. It promotes a godly attitude of bringing everything (even our most mundane and "natural" acts) under the Lordship of Christ. It also represents a healthy respect for the "Lesson of Riddles." Indeed, Lewis *wrestled* with the "problem" presented by alternative spiritual and physical modes of description; he did not attempt to invalidate one mode with language from the other. I conclude that we should not—and in most circumstances, in fact, do not—require that all conflicts among our alternative modes of description be resolved fully and clearly as a prerequisite to our acceptance of a particular form of understanding reality. Knowing the physical basis of a disease and its cure does not, in itself, invalidate the very immediate work of a sovereign God in all aspects of those same events; or visa versa. And just as this principle applies in regard to the natural realm in terms of its current function (physics, chemistry, physiology, ecology, inheritance), it also applies to the natural realm in terms of its past function and formative history (cosmology, chemical and biological evolution, etc.). I am convinced by the manifold scientific evidence that the earth has enjoyed a long evolutionary history in which continents have separated and collided, mountains and seas have appeared and

We should not ... require that all conflicts among our [physical and spiritual] modes of description be resolved fully and clearly as a prerequisite to our acceptance of a particular form of understanding reality.

disappeared, glaciers have advanced and receded, species of living organisms have multiplied from common ancestors, and a rich diversity of life forms has evolved to fill the whole of it.

The "Lesson of Riddles" advises me against carelessly co-opting the language of one descriptive mode into another.

I am left to wrestle with certain difficulties relating to the biblical account of creation, and I do wrestle with them rather than ignore them. However, I cannot dismiss the compelling scientific evidence for evolution solely to avoid conflict with a traditional interpretation of the creation account. And, in the end, I have found that the theological difficulties are no more difficult from my scientific position than from a young-earth or non-evolutionary one.

Finally, the "Lesson of Riddles" advises me against carelessly co-opting the language of one descriptive mode into another. Indeed, to do so becomes an absurdity, placing one squarely into the realm of comedy once again. I remember discussing human evolution and descent-with-modification with a pastor friend. He disagreed with my understanding of the evidence on the basis that, because humans are the pinnacle of creation, humans are not descended but *ascended!*

As Lewis points out in his essay, there is no one-to-one correspondence between alternative modes of description: no word-for-word translation and no straight-line connection. That evolution involves random mutations and chance events does not disturb my theology of God as sovereign Creator and Sustainer because I do not attempt to make a word-for-word translation of the languages used in these two modes of description. Likewise, I do not attempt to relate the fact that natural selection depends on "survival of the fittest" with God's concern for the weak and fatherless by a simplistic one-to-one correspondence. Even the description of evolution as occurring "without plan or purpose" has its appropriate (valid) sense of meaning, namely that evolution occurs without a plan or purpose *of its own*; species do not, indeed cannot, anticipate where to go evolutionarily.

[Jesus chastised] his hearers for not using their cognitive abilities (as they do correctly in the way of natural processes) also to contemplate God's unique revelation of truth in Scripture and human history.

Not too long ago, I suffered through a sermon based on Matt. 16:1–4.

> *The Pharisees and Sadducees came to Jesus and tested him by asking him to show them a sign from heaven. He replied, "When evening comes, you say 'It will be fair weather, for the sky is red,' and in the morning, 'Today it will be stormy, for the sky is red and overcast.' You know how to interpret the appearance of the sky, but you cannot interpret the signs of the times."*

In expounding this passage, the preacher missed its central point by failing to appreciate the "Lesson of Riddles." He spent the better half of his sermon first disparaging the godlessness of evolutionary theory (as unable to interpret the sign of the times) and then praising recent efforts of intelligent design theorists (as the right way to interpret the signs). But Jesus was not pitting two scientific theories against one another; nor was he suggesting that scientific description of the weather was invalid. Rather, he was chastising his hearers for not using their cognitive abilities (as they do correctly in the way of natural processes) also to contemplate God's unique revelation of truth in Scripture and human history. In effect, he was saying, "You know how to think about natural processes and do good science, but there is more than one mode of describing what you see and hear; you need to understand from a spiritual perspective just as you already do from a physical one."

Indeed, reality is *more than* physical and chemical, but it is *not less than* physical and chemical, at least not as long as there is a creation. To be human means *more than* to function chemically, physiologically, and ecologically and to be the product of biological evolution (a formative history), but it is *not less than* these things. The natural realm (the domain of natural science) is not "all there is," but it exists. It has orderly laws by which it may be examined from top to bottom and from beginning to end. Will scientists (Christians or non-Christians) discover complexities within the natural order that cannot be explained legitimately by physical modes of description? Are there components of the time-bound creation where physical reality ends and only spiritual reality remains? Perhaps, but everything that I have ever experienced suggests that I should not count on this to be so.

At least until perfection comes and my knowledge is complete,[3] I believe I will continue to encounter some form of complementarity in all ways of knowing.[4] Riddles remain as mind-benders to spur me on in scientific research and as spirit-molders to press me into stronger faith. At times it seems as if God is intent on frustrating me, but I believe his purpose is to keep me trusting in him at every turn.

And now for a closing riddle: "What do you do when you get an idea stuck in your head?"[5] ★

At least until perfection comes and my knowledge is complete, I believe I will continue to encounter some form of complementarity in all ways of knowing.

Notes

[1] H. H. Pattee, "The Complementarity Principle in Biological and Social Structures," *Journal of Social and Biological Structures* 1 (1978): 191–200.

[2] C. S. Lewis, "Transposition," in W. Hooper, ed.,*The Weight of Glory, and Other Addresses* (New York: Macmillan Publishing Company, 1980), 54–73.

[3] 1 Corinthians 13:8–12.

[4] Herein, I have related my personal story, how I learned about the principle of complementarity and came to apply it in my understanding of the relationship of science to Christian faith. However, it should be obvious that I was not the first to do so. After joining the ASA in 1995, I was delighted to find that others had already discussed complementarity as a useful pattern for relating natural science and Christian theology. I highly recommend Richard Bube's book, *Putting It All Together*, (Lanham, MD: University Press of America, Inc, 1995) and also various articles (pro and con) of complementarity in the pages of *PSCF*.

[5] Use mental floss.

Call for Papers

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

Renewal: Papers dealing with the physical ecological environment, including renewable resources and stewardship issues, are desired. Appropriate articles may focus on renewal in other modalities such as living organisms, cellular systems, and psychological or theological realms. Extended deadline for submitted manuscripts: February 1, 2001.

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

Future themes for invited papers include **science education**, **order & chaos**, and **health & healing**. Deadlines will be announced although papers are currently solicited.

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

News & Views

The Coming Energy Crisis

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For as long as the oil industry has existed, there have been those who claimed that the world will soon run out of oil. Such claims have usually been attacked as being too pessimistic. And they were. One would seem to be a fool to say the same thing today. However, some fundamental laws of nature that cannot be avoided will show their teeth during this century. Sometime between 2004 and 2020 the world oil production will peak around thirty billion barrels of oil per year. After that, a slow but inexorable production decline will occur, creating a major societal impact enhanced by an increasing world population and the rising standards of living in the third world.

This prediction is based on the work of M. King Hubbert, who in 1956, after analyzing USA oil production, projected that USA production would peak in 1970 at around ten million barrels (bbl) per day.[1] Everyone thought Hubbert was a terrible pessimist. History has confirmed what Hubbert predicted. The USA production rate peaked in 1971. Since that time, the USA oil production has declined at a rate always within 5% of Hubbert's original prediction.

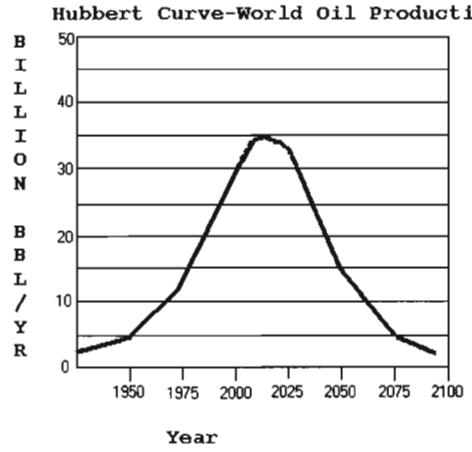
Hubbert had captured a law that governs the production of all natural resources from oil, coal, and metals.[2] Many energy analysts, using Hubbert's methodology, are predicting that the world will soon see a declining availability of oil, with oil depleted in thirty-five years and natural gas in fifty years.[3] These estimates include projections of future discoveries of petroleum resources, most of which lie outside the U.S. The past and predicted world production curve is shown in the graph below.

Can this decline be avoided? From my experience, the answer is no. In the early 1980s, the oil industry engaged in a massive search for oil. The graph of the USA production shows that all that effort did was flatten the decline for those years. We were unable to turn the production around.

For twenty years, the world has been using more oil than we have been finding.[4] Presently this deficit is 15 billion barrels per year. Prudhoe Bay (the oil field in north Alaska) will only produce 12.5 billion barrels. To maintain oil production, we need to find more than one Prudhoe Bay each year! We are not doing that.

The world uses 390 quadrillion British thermal units (quads) of energy per year. Oil provides 162 quads; coal, 112 quads; natural gas, 92 quads; renewable energy sources, 20 quads; and nuclear, 4 quads.[5] In the next fifty years, we need to find a replacement for 65% of our energy supply. But energy use will grow. Energy use in Asia is expected to double by 2020.[6] If this turns out to be true, Asia will require the equivalent of all today's oil supply, 160 quads.

Easy answers cannot be found. We cannot use oil shale, because it costs as much energy to make the oil from shale as is contained in the oil recovered. Using coal requires tripling of the bituminous coal output with a consequential environmental cost. Tripling coal usage will also result in the depletion of coal resources by the year 2200.[7] Biomass conversion would not work. If we harnessed every wood fire, all the agricultural wastes, and all the grain alcohol in the world, they would provide only 15% of our needs today. Hydropower today provides 5.5% of our energy but could only provide 25%. Solar energy is unlikely to be a viable replacement. Solar power cannot be generated at night and even during the day there is only a 12-15% efficiency of



conversion.[8] Some have suggested a hydrogen economy where we split oxygen from hydrogen in water via photocells and then ship the hydrogen like natural gas. This is not a primary energy source. It requires energy to do this, which is what we would not have in the future.

Nuclear fission is an extremely unpopular source of energy. People are afraid of it and there is a risk that nuclear weapons would be produced.

Hydrogen fusion, the process that powers the sun, is unlikely. The technology is still in its infancy and most feel that it would be decades before we solved the problems, if ever.[9] But in the long run, it is the only viable solution to the energy problems over the next two centuries. The energy in one percent of the earth's deuterium (the form of hydrogen used for fusion) represents 500,000 times more energy than all the fossil fuels burned to date.

Some might delight in the demise of the oil age, thinking that we could use clean electric power. Electric power must be generated from other forms of energy. Today electricity is generated from coal (39%), nuclear (16%), natural gas (15%), oil (10%), hydro and other sources (20%).[10] The loss of oil and natural gas over the next fifty years will result in a 25% reduction of electrical power.

Failure to replace this energy is not an option. Besides heating and fuel for vehicles, petroleum is used to manufacture a wide range of products, such as synthetics used in clothing, plastics, styrofoam, detergent, lip gloss, paint thinner, furniture polish, insecticides, fertilizer, and hundreds of other things. Petroleum has come to occupy a very important place in modern civilization. Many of these products will be lost to us as the fuel stocks will no longer be available or affordable as the price of oil rises. Conservation in the face of higher prices will spread these effects out, but the fact is that conservation will not produce more oil. Conservation will extend the life of the oil era, but not indefinitely.

By the middle of this century the auto will be a thing of the past. Mass transit will become a way of life, which will require major restructuring of how cities are laid out. People will need to live close together and close to work. Currently our economy depends upon vehicles to move products to market. Without fuel, trucks will not move and gross national products will decline. Raw materials will not get to the factories and finished products will not get to market. How can an economy survive that?

Modern agricultural methods are possible only because we have tractors that can plow, fertilize, and harvest the crops. They run on petroleum. Without fuel, tractors cannot plow or provide the power needed to run harvesting equipment. Without natural gas it will be harder to make fertilizer. Since pesticides are made from petroleum, insects will reduce the crop yields even further. The world simply cannot support the present population on nineteenth century farming methods.

Politicians will feel pressure to ensure their country's oil supplies. This will create squabbles over who gets the oil, resulting in wars. Oil exporting nations may come under pressure from their citizens to cease exporting and simply use the oil for their own need. Of course, such a policy will cause grave concern in petroleum dependent countries.

All of these issues present severe concerns. Some pessimistic persons believe that a massive die off and a new stone age is upon us.[11] While the concerns about future energy requirements are certainly valid and we have no clear path forward today, like previous energy crises in human history, we can hope that an unexpected solution will appear that will solve the problem. Regardless of what happens, Christians are called to be witnesses in both good and bad times. ★

Notes

[1]http://www.hubbertpeak.com/campbell/images/com19.gif

[2]http://www.geo.umn.edu/courses/3005/energyuse.htm The Hubbert curve for coal shows that at current production rates it will be totally depleted by 2400. A tripling of the rate of mining will accelerate that total depletion to the year 2200. But long prior to 2200, the amount of coal will be so small as to no longer suffice as the energy supply for the world.

[3]http://www.hubbertpeak.com/campbell/commons.htm David Price, "Population and Environment," *A Journal of Interdisciplinary Studies* vol. 16, no. 4 (March 1995): 301–19. See also http://energy.usgs.gov for the USGS assessment which in general has been optimistic.

[4]http://www.hubbertpeak.com/campbell/images/com10.gif

[5]See http://www.eia.doe.gov/oiaf/ieo/ for the current energy consumption of 400 Quads per year. See http://www.eia.doe.gov/oiaf/ieo/images/figure_15.jpg and http://www.eia.doe.gov/oiaf/ieo/images/figure-8.jpg for the percentages of various forms of energy.

[6]http://www.eia.doe.gov/oiaf/ieo/images/figure_13.jpg

[7]http://www.uic.com.au/nip38.htm

[8]http://www.geo.umn.edu/courses/3005/energyuse.htm

[9]Some think that the physics is so complex that we might never solve the fusion problem. Joel Cannon, Personal communication 15 Jul 2000.

[10]http://www.uic.com.au/nip11.htm

[11]http://www.oilcrisis.com/duncan/olduvai.htm and http://www.dieoff.com/

The Label Problem

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As teachers, we experience satisfaction in helping young people to enjoy and to benefit from the wonders and realities of our natural world. We nurture curiosity and help our students to acquire a repertory of concepts, principles, and laws. We develop interrelationships that transform apparent disorder into order. We find satisfaction in adopting the methodology that successfully matches our wits with the ways and means of nature.

At the same time, our peace of mind is always threatened by the student who asks: "How and when did all of this begin? What are the origins of matter, energy, and life? What powers the animate and inanimate machinery of the universe?" And most challenging of all, "To what end?"

Faced with this challenge, teachers often say that such questions fall outside the domain of science. In effect, science teachers have the option to consider only those questions that apply after the appearance of the universe. Questions that involve circumstances prior to this moment are fodder for other disciplines.

But this response only evades a crucial problem. Points of view regarding the origin and destiny of the universe tend to provide both subtle and overt support for collateral agenda that reach far beyond the usual domain of science. Classroom presentations are subject to disabling criticism, not so much because of the accuracy or legitimacy of their content but because they are in conflict with core beliefs or values. Conflict between opposing points of view provides attractive grist for the media and exposes young people to mind-bending controversy before, during, and beyond their classroom experiences. At risk is the rejection of any point of view that extends beyond the domain of science.

A step toward reducing this risk is to clarify opposing points of view in ways that meet several criteria:

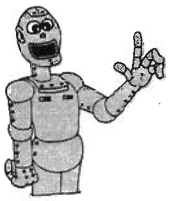
1. Explain the positive features unique to each perspective in ways that are understandable to students.
2. Reduce to fundamentals each point of view so that one view features a creative power that controls the total universe while the second sees the primeval entities of matter, energy, and life as interacting randomly with chance determining the affairs of the universe.

Labeling these points of view seems to stand in the way of reconciliation. To use such labels as "religious" and "non-religious" risks burdening both points of view unduly. Religion evokes interests that go beyond accounting for the origin of the universe and the interactions among its entities. The term, "non-religious," tells us no more than what this point of view does not include. Even such labels as "first" and "second" can be misleading. Either point of view could have preceded the other. Similarly, the acceptance of each is equally dependent upon hope supported by faith. Labels that focus on the creative process are doubly troublesome. Both points of view agree that the universe with all of its entities had a beginning. The problem is to label this beginning in a way that does not introduce controversy at the very advent of effort to understand our origin and destiny.

Consider labels that focus on the fundamental distinguishing character of the two points of view, namely. "Design" and "Chance." Because design implies a designer, it is easy to equate design with God. On the negative side, chance evokes ideas of gaming and connotations far less consequential than that which is being labeled.

Will these proposed labels favor keeping student curiosity and open-mindedness alive? Will teachers be better able to nurture admiration and respect for the natural world and to encourage treating its entities as gifts to be sustained rather than needlessly depleted? Will clarification of these labels help to restore respect for and greater adoption of the methodology and discipline that characterize the pursuit of science? And will theologians of all faiths and denominations be better able to convey the unlimited inspiration, guidance, and comfort that religion provides?

What will be our heritage if young people realize that they are choosing between two opposing points of view, "Design" and "Chance"? Will they realize that this choice will be a major influence in how they think of themselves and how they are seen by others? Will their choice create more fulfilling lives in a world where greed and aggression would be on the wane? ★



Robotics: Darwinism, Intelligent Design, and Genesis

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The Scientific Report. A system that evolves locomotive machines inside a computer and then automatically manufactures them, using rapid-prototyping technology, so that they can move around in the real world, was reported in the journal *Nature* by Jordan Pollack and Hod Lipson, two researchers from Brandeis University.[1] They demonstrated the process of building the robotic machines with almost no human interaction—only motors needed to be snapped on by hand. The commentator stated: "This is a long awaited and necessary step towards the ultimate dream of self-evolving machines."

The Media Report with a Darwinian Spin: *USA Today* printed a story on the scientific report.[2] A computer programmed to follow the rules of evolution has produced offspring for the first time, and has designed and manufactured simple robots with minimal help from people. Pollack and colleague Lipson merged automatic manufacturing techniques with evolutionary computing to create a major milestone in the field of artificial life. The computer that evolved the designs was told only what parts it would be working with, the physics of the environment in which its offspring would be moving, and the goal of locomotion.

Over several days, the computer thought up different designs and methods of movement, creating traits that worked and failed. The little white robots were made of bars, actuators, ball joints, motors, and circuits. People intervened only to insert the motors into the plastic parts spit out by the prototyping machine. Like dinosaurs, woolly mammoths and dodo birds, the failures were cast into the dustbin of history. The most promising designs survived and passed their success to future generations. Hundreds of generations later, three robots were manufactured by a prototyping machine. "It evolved various kinds of locomotive mechanisms—all surprising, given there was no human coming up with how to do it," Pollack said.

An Intelligent Design Interpretation. I looked at this story from a much different perspective, as others may have who read these accounts. First, the entire experiment was intelligently designed. It would not have happened if Pollack and Lipson had not conceived and executed it.

Second, a "goal of locomotion" was specified—a robot that will crawl across a tabletop. A prime characteristic of Darwinian evolution, however, is that it has no long-range goals. It has only short-range goals—adaptation and survival in the immediate environment. On the other hand, a foremost characteristic of Intelligent Design is purpose. Thus design, not natural selection, was the basic causal agent involved in the production of these robots.

Third, the environment was specified—a tabletop. Its physics were described to the computer. Nothing was random about this environment. Moreover, there was no feedback from the environment to the computer; thus, a vital condition of Darwinian evolution was absent.

Fourth, the necessary structural components were selected and supplied by the experimenters. The computer was told what they would be. Where did the parts come from—especially the motor, without which locomotion would have been impossible? Clearly, it was previously designed, that is, constructed with a purpose in mind of becoming a part of a robot, indeed, its most essential part.

Fifth, natural selection kicked in only after the project had been designed, its purpose defined and communicated to the computer, the environment specified, and materials supplied.

Sixth, the experimenters had to intervene to supply and insert motors where needed—intelligent intervention.

Finally, after all of the above, the authors claim that something happened that looks like Darwinian natural selection in action. It does not, however, exhibit Darwinian evolution in action. It is a demonstration of artificial selection, or perhaps just a breeding project, with experimenter intervention at (at least) one critical point.

On the other hand, given the Intelligent Design perspective, I submit that the whole project is a pretty accurate model of the way nature works. Intelligent Design must come first. Purposes must be built into nature. Materials need to be supplied. Only then can Darwinian natural selection function in a constructive manner. Once a long range purpose has been designated, natural selection can operate in the way Darwinians say it does, by selecting the most adaptive phenotypes to survive in a given environment all the while moving toward the

long-range objectives supplied by Intelligent Design.

The Genesis Account. In this project there is an uncanny parallel to the Genesis account of the creation of human beings.[3] We read that God said:

> *"Let us make humankind in our image according to our likeness"* – the basic design, conception of the plan.
>
> *"And let them have dominion over the fish of the sea, and over the birds of the air, and over the cattle, and over all the wild animals of the earth, and over every creeping thing that creeps upon the earth"* – the purpose or intent of the design.
>
> *"So God created humankind in his own image, in the image of God created he them, male and female created he them"* – execution of the design.
>
> *And God said to them, "Be fruitful and multiply and fill the earth and subdue it; and have dominion over the fish of the sea and over the birds of the air and over every living thing that moves upon the earth"* – providing the divine template, and repetition of the purpose or intent of the creation human beings.
>
> *"See, I have given you every plant yielding seed that is upon the face of all the earth, and every tree with seed in its fruit, you shall have them for food"* – providing the parts needed to complete the design and defining the environment – "the face of all the earth."

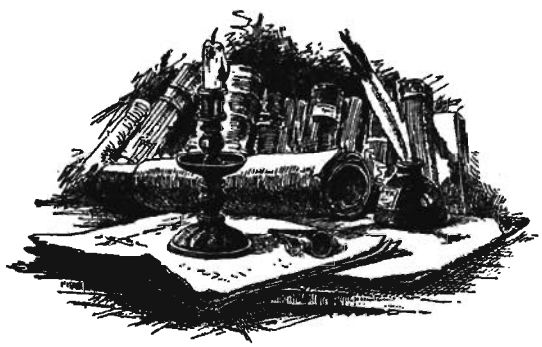
Having designed the basic parameters, God created and placed the first humans in the world where the laws of nature, particularly the processes of development, were allowed to complete and round out the designed project. The outcome was human beings, not just robots. ★

Notes

[1]Rodney Brooks, "From Robot Dreams to Reality," *Nature* 406 (August 31, 2000): 945–47; H. Lipson and J. B. Pollack, "Automatic Design and Manufacture of Robotic Lifeforms" *Nature* 406 (August 31, 2000): 974–76.

[2]Matthew Fordhal, "Computer Designs and Makes Robots with Little Human Aid," © The Associated Press, *USA Today* (August 31, 2000): 4A.

[3]The New Revised Standard Version of the Bible.



Books Available for Review

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

Fred Adams and Greg Laughlin, *The Five Ages of the Universe: Inside the Physics of Eternity*, Simon and Schuster, 250 pp., 1999

Mariano Artigas, *The Mind of the Universe: Understanding Science and Religion*, Templeton Foundation Press, 356 pp., 1999

Jan Brunvand, *The Truth Never Stands in the Way of a Good Story!* University of Illinois Press, 217 pp., 2000

Nigel Cameron, et al., eds., *Bio-Engagement: Making a Christian Difference Through Bioethics Today*, Eerdmans, 263 pp., 2000

Richard Carlson, ed., *Science and Christianity: Four Views*, IVP, 276 pp., 2000

John Casti, *Paradigms Regained: A Further Exploration of the Mysteries of Modern Science*, Harper Collins, 287 pp., 2000

Frances Clark, *Godfaring: On Reason, Faith, and Sacred Being*, CUA Press, 229 pp., 2000

Herbert Cutner, *Jesus: God or Myth? An Examination of the Evidence*, The Book Tree, 298 pp., 2000

Anne Dalton, *A Theology for the Earth: The Contributions of Thomas Berry and Bernard Lonergan*, University of Ottawa Press, 223 pp., 2000

Joseph Davydov, *God Exists: New Light on Science and Creation*, Schreiber Publishing, 300 pp., 2000

Steven Dick, ed., *Many Worlds: The New Universe, Extraterrestrial Life and the Theological Implications*, Templeton Foundation Press, 217 pp., 2000

Anthony Diekema, *Academic Freedom and Christian Scholarship*, Eerdmans, 214 pp., 2000

Gabriel Dover, *Dear Mr Darwin: Letters on the Evolution of Life and Human Nature*, Univ. Cal. Press, 268 pp., 2000

Colin Duriez, *The C. S. Lewis Encyclopedia*, Crossway Books, 240 pp., 2000

Neil Freer, *Breaking the Godspell: The Politics of Evolution*, The Book Tree, 151 pp., 2000

Hilary French, *Vanishing Borders: Protecting the Planet in the Age of Globalization*, W. W. Norton, 257 pp., 2000

Philip Frymire, *Impeaching Mere Creationism*, iUniverse.com, 101 pp., 2000

Marc Gopin, *Between Eden and Armageddon: The Future of World Religions, Violence, and Peacemaking*, Oxford Univ. Press, 312 pp., 2000

Gerald Holton, *Einstein, History, and Other Passions: The Rebellion against Science at the End of the Twentieth Century*, Harvard University Press, 240 pp., 2000

J. R. Hyland, *God's Covenant With Animals: A Biblical Basis for the Humane Treatment of All Creatures*, Lantern Books, 107 pp., 2000

Stanley Jaki, *The Savior of Science*, Eerdmans, 255 pp., 2000

Eric Johnson and Stanton Jones, eds., *Psychology and Christianity*, IVP, 270 pp., 2000

Rob Kaplan, ed., *Science Says: A Collection of Quotations on the History, Meaning, and Practice of Science*, Freeman, 254 pp., 2001

More books listed on p. 254.

The Trilobite: Enigma of Complexity A Case for Intelligent Design

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This paper will demonstrate that we can know in detail the molecular biology of one of the earliest forms of metazoa, the Trilobite. We will reconstruct its molecular biology in order to show the existence of all of the major innovations found in the spectrum of life on the earth today. In the absence of evidence for the evolution of complex biochemical and integrated organ systems in the Trilobite, and for any increase in its information content, reliance on Darwinian evolution remains a matter of secular faith. We propose another theory of origins that involves an Intelligent Designer and Special Creation.

Trilobites are extinct members of the large animal group (phylum Arthropoda) to which modern insects belong. They are well-represented in a long and detailed fossil record beginning in earliest Cambrian, 550 million radiometric years[1] ago, and ending in the Permian, 250 million radiometric years ago. Universally they are found in the boundary between rocks relatively barren of metazoan life, and rocks containing abundant evidence of such life.

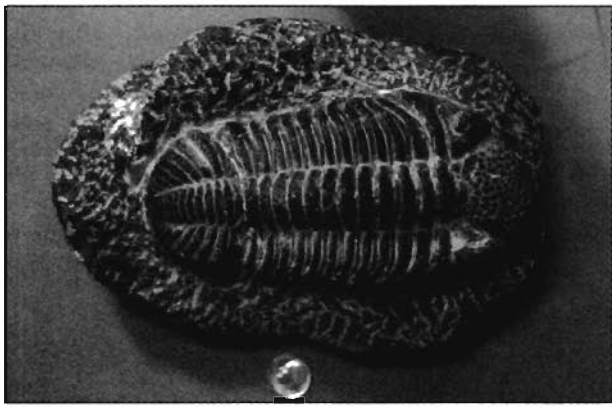

Fig. 1. A trilobite, *Phocops africanus* from the Middle Devonian strata of the Atlas Mountains in Morocco.

**ASA Members*

Trilobites are complex, elaborately segmented forms with jointed appendages and swimmerets, antennae, compound eyes, and cephalized, or head-to-tail, nervous systems. Because they are extinct, very little is known of their life habits except for deductions by association with other forms that do have living representatives, and from careful examination of the geologic deposits in which they are found. However, evolutionary theory provides a conceptual framework for reconstructing the physiology and molecular biology of this earliest widely distributed metazoan (complex, multicellular organism).

The tools of contemporary molecular systematics along with advances in understanding of molecular and cellular processes challenge the standard theory of undirected, naturalistic selection in Darwin's original proposal. Molecular features of a variety of organisms can now be compared, and genetic relationships, called phylogenetic linkages, can be constructed based upon those comparisons. With such powerful tools, it is not necessary to guess about operative processes in organisms no longer available for study. Thus, much of the molecular architecture of ancient organisms can be reconstructed with data readily available from contemporary

living animals. The conclusions of such work are rather surprising.

Before continuing to explore the nature of the trilobite, a statement of premises employed in this reconstruction include:

- A fundamental assumption of evolutionary theory is that molecular biological traits shared by disparate organisms today require common ancestry as an explanatory principle. It allows exploration of the molecular biology of the trilobite based on knowledge of the molecular biology of contemporary animals.
- The molecular biology of trilobites is in every sense as complex as that of any modern form.
- Evidence of the complexity of the trilobite reveals the inadequacy of the theory of Darwinian evolution and is interpreted instead by reference to another theory of origins involving an Intelligent Designer.

Revealing the Past

The mechanisms operating in the trilobite's cells, tissues, and developmental processes when it first appeared on earth can be determined in precise detail.[2] The assumption that complex molecular biological traits shared by disparate organisms require a shared ancestry is the basis of modern evolutionary taxonomy. Thus, molecular features shared by trilobites and mammals would require, at some time in the distant past, a common ancestor possessing those common features.[3] Any other conclusion would assume highly unlikely events to have been repeated with exacting precision, falsifying the fundamental assumption of molecular systematics and taxing credulity beyond limits. Consequently, a complex feature shared by modern arthropods and humans, or arthropods and plants, was present in a common ancestor. A representation of such a proposed common ancestry for arthropods and humans is shown in Fig. 2.

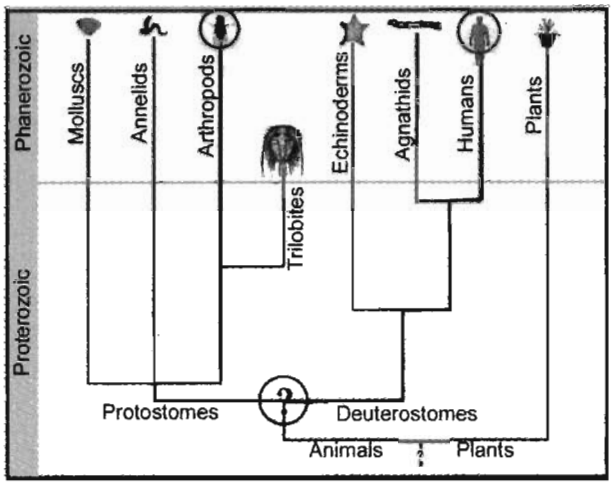

Fig. 2. The common ancestor of humans and modern arthropods.

Since trilobites were derived arthropods, they too must have exhibited features shared by modern complex animals, and we attribute complex features to this early metazoan with confidence. Several examples are drawn from a large number of equally good examples of complex molecular biological systems. It is necessary to include some technical material in order to understand the level of complexity present in cells, and the significance of this proposal.

DNA and the Chromosome

Eukaryotic (nucleated) cells are the building blocks of all multicellular complex organisms, including humans. These cells are intricately constructed and highly integrated in function. The vast array of information in the cell is coded on long (up to 15 cm or more) molecular strands of DNA carried by the cell's chromosomes. Every somatic cell in the human body has a complement of 46 chromosomes; the total DNA of a single human cell would extend nearly two meters if stretched end-to-end. However,

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all of this material is housed in the cell nucleus, which has a diameter of about ten micrometers. This is a reduction by a factor of 200,000 in linear extension, a feat comparable to packing fifty miles of kite string into a shoe box.

The DNA must be organized very precisely to fit into the nucleus so that the cell has easy access to the genes, can carry out replication of entire strands, and can accurately divide replicas to daughter cells during cell division. This process is achieved by associating the DNA with a class of proteins called histones. Four different histones form a very stable octet containing two copies of each histone molecule. Since histones are positively charged to enable them to interact with negatively charged DNA, assembly of the octamer requires the aid of several special "scaffolding" proteins. This assembled histone core structure is so fundamental to cells that it is preserved across the entire spectrum of living eukaryotic cells almost without modification. For example, only one amino acid change distinguishes the histone H3 of a human from that of a sea urchin. Human H4 differs from H4 of a bean plant by only two amino acids, out of the hundred or so making up these proteins.

One and one-half turns of the DNA molecule (about 146 base pairs) are wrapped around each histone core to form a condensed structure called a nucleosome. These in turn are associated into higher order structures called solenoids, each a helical form comprised of six nucleosomes and a fifth histone protein, greatly reducing the overall extension of the chain. The solenoids are further condensed in a complex packing arrangement anchored to the backbone chromosome structure. The backbone is composed mainly of a class of proteins with remarkable properties that are attached to the DNA chain at specific sites. The protein can cut one strand of the double helix DNA structure at the point of attachment, hang on to the cut ends, pass the uncut strand through the cut ends, then rejoin the two ends, an operation that removes undesirable stresses from or adds desirable stresses to the chain. All these condensations reduce a 10 cm strand of DNA to an intricate structure 50,000-fold smaller in linear dimension. Because of its universal occurrence in all living things almost without variation, we can reasonably infer that this complex apparatus was also present in trilobite cells.

Cell Division

Without cell division there could be no growth in multicellular plants and animals. Before a cell can divide in a fashion that maintains its integrity and function, it must replicate its contents. The central core of biological memory coded in DNA must be duplicated so that an equivalent copy exists in each strand, producing another two meters of DNA in the case of human chromosomes. The two copies must then be separated from one another in such a way that one copy comes to reside in each daughter cell. To prevent dilution of cell contents, the cell must also make copies of all other molecules present and distribute these. This occurs in all eukaryotic cells, with essentially the same mechanisms. We will consider a few highlights of this incredibly complex process.

A human cell has 46 chromosomes to be duplicated. The ninety-two separate molecular assemblies must then move through the cytoplasm on directed journeys to the proper daughter cells. This process is mediated by *microtubules,* structural elements of the cell made up of a spiral array of protein molecules around a hollow interior space, much like a drinking straw. Chromosomes contain a special patch of protein where microtubules may attach, almost like a Velcro patch on fabric. When enough microtubules from opposite ends of the cell have attached to the two duplicated members of each chromosome pair, the chromosomes line up in the center, split apart, and the microtubules begin pulling their attached chromosomes through the cytoplasm to opposite ends of the dividing cell. The movement mechanism seems to involve contraction, expansion, and depolymerization of tubule

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structures as they pull, much in the fashion of tiny machines.[4] This complex, elaborately controlled process is common to all eukaryotic cells and, therefore, presumably was already present in all essential details in the trilobite—one of the earliest metazoic fossils.

The Neuron and Synapse

The neuron, or nerve cell, transmits a nerve impulse to other neurons across the gap that lies between them, called a *synapse*, or synaptic gap. The resting neuron has a negative electrical potential on the inside of its membrane of about sixty millivolts. This potential is established by a special sodium/potassium pump that uses cellular energy to pump positively charged sodium ions out of the cell. A nerve impulse is initiated and propagated by the movement of sodium ions back into the cell through special protein sodium channels in the membrane. Propagation is mediated by the successive opening of these channels, called *voltage-gated sodium channels*, along the length of the neuron's axon.

These channel proteins, located in neuron membranes, are intricately constructed. Each protein extends across the membrane twenty-four times, forming a barrel-shaped channel that has a voltage-sensitive gate. As the channel protein senses the depolarization of the nerve, the gate opens and sodium ions flow into the cytoplasm, propagating the voltage change and triggering the same response in adjacent channels. Once the membrane is fully depolarized, that is, the nerve impulse has passed, a "ball and chain" extension of the protein in the cytoplasm closes the channel, preventing further depolarization until the resting membrane potential has been reestablished by the sodium ion pump.

When an impulse reaches the terminus of a neuron, it must transfer the signal across the synaptic gap. In many cells, the transmission is effected by the release of a neurotransmitter substance, often acetylcholine, a small biomolecule. The acetylcholine accumulates in special membrane-bound synaptic vesicles within the cell. As a vesicle fills with neurotransmitter, it is transported through the cytoplasm toward the synapse by a unique protein called *synapsin*. This protein "walks" along microtubule highways of the cytoskeleton toward the membrane of the synaptic surface, carrying the synaptic vesicle along with it.

The vesicle membrane contains several proteins not found elsewhere in the cell. Two of these carry the technical names of *synaptobrevin* and *synaptotagmin*. Synaptobrevin binds a complex of proteins, which in turn binds to *syntaxin*, a protein in the cell membrane. Syntaxin thus anchors the acetylcholine-containing vesicle to the synaptic membrane. Synaptotagmin has two sites that can bind calcium ions. In the absence of calcium, synaptotagmin binds to the protein complex, preventing the vesicle from releasing its contents.

When an impulse reaches the synaptic region, calcium channels (similar to the voltage-gated sodium channels previously mentioned) are opened, allowing calcium to enter the cytoplasm. Synaptotagmin binds the calcium, allowing fusion protein to bind to the complex. In this state, the vesicle membrane can now fuse with the cell membrane, releasing acetylcholine into the synapse. The nerve impulse is thus transmitted, or propagated, to the neighboring neuron. All of these reactions of the traveling nerve impulse occur in milliseconds.

Because this process represents a very complex mechanism shared by insects and humans, the reasonable assumption is that nerves and synapses in trilobites worked this way also.

Cells contain many types of cytoplasmic vesicles. Each vesicle has, in addition to its normal component of membrane proteins, a special protein called Rab that directs a vesicle to its correct destination, much like a shipping label. These shipping labels are added when the vesicle is formed. They are "read" at the destination. If the vesicle has reached its proper site, it is retained. If not, it is redirected elsewhere. The synaptic vesicle must also have the correct label attached to be effective.

Other cytoplasmic proteins, called clathrin, identify an empty vesicle and surround it with a protein cage that preserves the membrane and the associated proteins from being lost. The empty vesicle remains enclosed in the clathrin cage until it has traveled away from the synaptic membrane into the cytoplasm for refilling.

This process, described in the barest details, is common to all animals with nervous systems from the simplest invertebrates to humans. Because this process represents a very complex mechanism shared by insects and humans, the reasonable

assumption is that nerves and synapses in trilobites worked this way also. Thus, one of the earliest complex, mulicellular animals possessed the nervous system elements that are found in modern insects and humans.

Developmental Biology of Insects (and Trilobites)

Thanks to recent advances in understanding the molecular biology of development, a great deal can be inferred about the complex processes by which a single ovum in a mother trilobite becomes a functioning offspring. Trilobites belong to the same phylum as modern insects, so the corresponding formation of a typical metamorphosing insect, the fruit fly *Drosophila*, may be considered. Since these insects are very small, it is impractical for them to hatch a fully functional, winged offspring from a single, fertilized egg. The strategy of many insects is to lay an egg, which "hatches" into a stage called a caterpillar or larva. A larva is just a larger, developing "egg" with legs and a mouth for accumulating food material and eventually producing the adult form. Deep within the recesses of each caterpillar are the embryonic seeds of an entire adult organism. These special tissues, called *imaginal disks*, remain dormant until *pupation*, at which time the body of the caterpillar dissolves and the imaginal disks develop into the various parts of the adult. This is itself also a very complex process, but the sequence of events leading up to the formation of the imaginal disks gives remarkable insights into the complexity that can reasonably be concluded to be already present in trilobites.

While an insect egg is still in the ovary, unique distributions of special proteins are already being established within its cytoplasm. These proteins originate either from the egg nucleus or from maternal accessory cells surrounding the egg in the ovary. After fertilization, additional series of genes are activated, producing still other regulatory proteins in specific regions of the fertilized egg. The spatially asymmetric distribution of developmental proteins forms an early embryo in which each cell has a unique combination of regulators. The balance of these developmental gene regulators determines which genes are activated and which are suppressed in each cell. This asymmetry in turn determines head-to-tail, and other differentiation along the resulting body axis.

Genetic studies in *Drosophila* revealed that when developmental genes were mutated, they produced not just a single change such as eye color, but either massive and lethal effects or large changes in body form. For example, a single mutation in one such gene makes legs grow where antenna normally occur; another causes the formation of an extra body segment complete with extra wings. Extensive regulatory networks link activity for each of these developmental genes to hundreds of other more specific genes. Investigators have found that genes controlling fruit fly development are very similar in structure and action to those regulating vertebrate development, and that the genes often control analogous parts of the embryos of flies and humans. Thus, these developmental gene sequences, present in flies and humans, must also have been present in trilobites.

The sequence of events leading up to the formation of the imaginal disks gives remarkable insights into the complexity that can reasonably be concluded to be already present in trilobites.

Later studies have revealed the location of some of these genes on the *Drosophila* chromosome. When the main series of regulator genes (HOM-C genes) determining head-to-tail polarity and axial development in the *Drosophila* embryo was identified and mapped, investigators unexpectedly found that these lie on the chromosome in the same head-to-tail order as the portions of the anatomy whose development they control (colinearity). There is no obvious functional reason for this correlation of spatial arrangement to occur, and it would seem improbable if the organism's distinct parts had developed randomly at widely different times.

Even more recent studies have shown the existence of homologous types of regulatory genes responsible for ordering head-to-tail organization of the bodies of vertebrates, including humans. These genes, called Hox genes, are very similar to the corresponding genes in *Drosophila* (for some homeotic genes, the similarity between human and *Drosophila* is 98%), and they lie on the human chromosome in the same order as those found in the fruit fly. The inference of a common origin is very probable. Again, it is likely that this complex organization, along with the complexities already described for eukaryotic cell behavior, nerve synapse function, and all the other myriad, complex developmental

and functional processes, were already in place in metazoan trilobites of the Cambrian, some of the earliest known multicellular forms.

The Trilobite Eye

The eye has been an object of wonder throughout recorded history because of its critical functions and complexity of organization. Recently discovered properties of some early trilobite eyes, which are similar to those found in modern insects, represent an "all-time feat of function optimization."[5] The lens in each individual ommatidium, or facet, of the compound eye was composed of a single crystal of calcite (calcium carbonate) with the optical c-axis of the crystal coincident with the optical axis of the lens. This design presented an unusual problem for the trilobite, since a simple thick spherical lens of calcite could not have resolved light into a coherent image. These Lower to Middle Paleozoic trilobites, however, had a unique optical system unknown in any other creature that solves this problem.[6] The optical system is a biconvex lens, composed of two lenses with differing refractive indices joined together. The interface of these two lenses is called a Huygens surface,[7] as shown in Fig. 3.

The biconvex lens required an exact shape for the trilobite eye to correctly focus light on receptors.[8] In Fig. 3, the left side shows how the incident light is focused into a coherent image by the biconvex lens; the right side shows how the image is diffused without the lens. Levi-Setti states:

> The realization that trilobites developed and used such devices half a billion years ago makes the shock even greater. And a final discovery – that the refracting interface between the two lens elements in a trilobite's eye was designed in accordance with optical constructions worked out by Descartes and Huygens in the mid-seventeenth century – borders on sheer science fiction.[9]

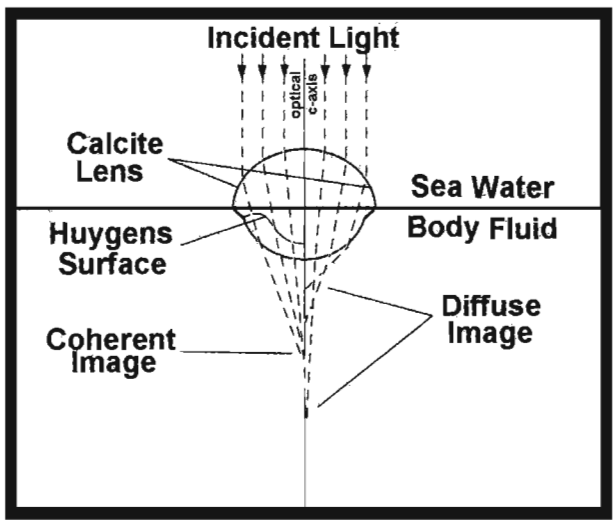

Fig. 3. The left side of the figure shows a schematic sketch of the Huygens Surface (the wavy line) in the lens of the Ordovician trilobite eye. The lens is free of spherical aberration and forms a coherent image. The right side displays a cross sectional view of the lens without the Huygens Surface which results in a diffuse image.

The significance of the biconvex lens of later trilobite ommatidia merits further elaboration, since a better example of intelligent design is hard to find. Levi-Setti continued: "When we humans construct optical elements, we sometimes cement together two lenses that have different refractive indices, as a means of correcting particular lens defects."[10] Obviously, no one doubts that such optical elements in cameras, field glasses, and telescopes are intelligently designed, and Levi-Setti concurred in the case of the trilobite eye: "The design of the trilobite's eye could well qualify for a patent disclosure."[11] When such a biconvex lens is found in nature, logic demands that intelligent design is a required element in the explanation of its formation.

Levi-Setti continued: "What we would like to hear, to appease our Darwinian upbringing,[12] is that new visual structures were evolved in response to new environmental pressures as a means of survival."[13] As a possibility he suggests that it "allowed the trilobite to see at some depth in sea, at dusk, or in turbid water."[14] He added other imagined advantages, that they provided a prompter recognition and response to impending danger and that "mating may have proven more effective with sharper images."[15]

The earliest trilobites lacked the sophisticated lens described above, but had eyes that were apparently more like those of modern insects. No intermediate forms are known from the fossil record. When the Huygens lens is first found in trilobites, it was fully functional.

The regulatory mechanism of the early trilobite eye development must indeed be complex, since an estimated 2,500–5,000 genes appear to be involved in the developmental process of the insect eye.[16] The ommatidium, or individual facet, of a compound eye such as that in *Drosophila* consists of a cluster of eight cells, seven of which develop into light receptors. One of these retinal cells, called R7, is responsible for detecting ultraviolet light (UV). Intensively studied for some years, the pathway

from an undifferentiated cell to a sophisticated UV detector cell follows an intricate cascade of interactions.

The R7 cell membrane contains special proteins called receptor tyrosine kinase, or RTK. RTK projects active portions on either side of the membrane, both inside and outside the cell. The external RTK can join with another molecule of RTK to form a dimer in the presence of a specific activating agent. The internal portion of each RTK molecule then enzymatically attaches three phosphate groups to its partner. Thus phosphorylated, RTK binds a cellular protein, GRB2, and becomes activated to bind another protein, Sos. The Sos-GRB2-RTK complex can then interact with a critical membrane-bound protein called Ras. Ras is freed from the membrane into the cytoplasm, where it activates an enzyme called Raf. Activated Raf is able to bind another enzyme, MEK. MEK in turn activates a terminal cytoplasmic enzyme, MAP kinase, which apparently activates DNA-binding proteins and other key cellular proteins to change the direction of cellular differentiation. The cell can now become a normal R7 cell. Fundamentally similar processes are found in the cells of all multicellular eukaryotic organisms, presumably including the trilobite, and also (with slight differences) in the single-celled eukaryotes, yeast and protozoa.

The same system of genes controlling eye development functioned in the first trilobites.

Recently, manipulations in flies of a master eye developmental gene called Eyeless, caused the growth of eyes to be induced on wings, legs, and tips of the antennae. A similar master gene has been found in vertebrates, which have eyes that are completely different from insect eyes yet the developmental gene is nearly identical with that in *Drosophila*. When the appropriate gene from a mouse chromosome (presumably, the human gene would work as well) is inserted into a fly, it produces the specialized fly eyes wherever it is activated on the fly's body. The two genes are similar enough that the mammal gene can cause the formation of an insect eye. That line of reasoning then leads to the conclusion that the same system of genes controlling eye development functioned in the first trilobites.

More and more developmental pathways are found to be shared across a broad spectrum of organisms. Most of these would likely have been present in the trilobite. For example, genes responsible for the organization of the human front-to-back axis were discovered using the genes from *Drosophila* as molecular probes. Genes responsible for human brain organization in embryogenesis were discovered, again using *Drosophila* genes.

The eye, the hindbrain, the spinal cord, the pathing of axons, the differentiation of skeletal and heart muscle, the photoperiodic response, the sculpting of tissues involving select cell death (apoptosis), embryonic patterning, cell signaling, and a host of other "evolutionarily conserved" processes could also be cited as examples. The developmental gene called Hedgehog, directs the formation of limbs in fruit flies, while the equivalent vertebrate gene "Sonic Hedgehog" directs the formation of limbs in all known vertebrates, including human, mouse, chick, and fish. The elaborate control mechanisms precede any known organism with limbs, and all of these processes were probably operative in the trilobite.

The Problem of Complexity for One of the First Metazoa

Careful consideration has been directed to a few brief examples illustrating the complexity of living eukaryotic cells, nervous systems, developmental processes and organs already present in one of the first metazoa, the trilobite. These were drawn from among hundreds of other examples that could equally well have been used to make certain points. The trilobite, one of the earliest complex animals in the fossil record, first appeared in the Lower Cambrian.[17] Trilobites are arthropods, in the same alliance as modern insects. The cells of trilobites divided in a manner similar to every modern eukaryote. The molecular mechanisms were all in place, all functioning as they do today in insects. The trilobites had nervous systems as complex as those of modern insects. The synapses in the nervous systems of trilobites functioned just as the synapses of all modern organisms do. The complex system of development of cephalized forms was already present and functioning. The eyes of trilobites manifest all of the complexity and developmental integrity of modern forms. Their eyes were developed by processes not only similar to those of other arthropods, but like those of vertebrates, including humans. A similar case could be presented for swimmerets and gills, legs, antennae, and intricately sculpted forms. Trilobites and all

other forms appear on the scene as fully formed, fully competent organisms.

Since the complexities that have just been described were all present and fully functional in one of the first multicellular animals for which there is a record, the questions may be asked: Where did these complexities come from? Where and when did evolution take place? There is no indisputable evidence of any earlier form from which they could have been derived. Conway Morris, in discussing steps that might have led up to the true arthropods (the phylum to which trilobites belong), concluded: "All this is very speculative indeed, and really raises more questions than it answers."[18] Furthermore, there is no evidence for the existence of a mechanism in biological systems for adding information to complex systems.[19] To argue that they came from Precambrian forms which were not preserved because they had no hard parts, is to argue from the absence of evidence. Fossils with preserved soft parts have in fact been found in the Cambrian and Upper Precambrian sediments in many localities.[20] There is no confirmed Precambrian evolutionary sequence leading up to the trilobite that can be accounted for by Darwinian mechanisms, hence the conclusion that there was no Precambrian Darwinian evolution of trilobites.

Conclusion

The complex biochemical systems and the integrated organ systems of the trilobite just described did not happen by accident. Darwinian mechanisms have not been demonstrated to be active, causal factors, nor have they been universally considered a reasonable scientific explanation of the phenomena described in this paper. When it has been tried, the result is no more effectual than the attempt proposed by Levi-Setti to account for the formation of the trilobite's double lens. Studies of these systems of the trilobite are an indictment of the inadequacies of Darwinian evolutionary theory. This may be why some evolutionary authors, when they write books about the earliest life forms, carefully skirt the sudden appearance of endlessly complex forms. Their attitude seems to be: "If it's there, evolution must be able to do it."

Yet we have seen from a careful consideration of the evidence that the origin of the complex biochemical systems and integrated organ systems of trilobites, and by extension, biological organisms in general, cannot be accounted for by Darwinian evolution (an extension of a naturalistic philosophy, in which there is no role for a Creative Intelligence). When Darwinian evolution is used as an explanation for the existence of complex living systems, it becomes a philosophical or even a quasi-religious view held by those who wish the world to have no Designer.

While design and its purposes can be reasonably inferred from biological data presented in this paper and while design logically implies the operation of an intelligent designer, the designing agent and mechanism employed by the designer cannot be identified by scientific means. We have few if any conceptual tools at this time with which to pin down the elusive concept of *intelligence* in biology so that it can be studied and characterized. The mode, mechanism, locus, domain, or *modus operandi* of intelligence in biology is not known. The interface between intelligence and the material world remains a mystery at this time.

At least two possible approaches to studying intelligent design can be explored. First, one may posit that there is a purposive or functional logic embedded in living organisms that is as real and objective as the laws of physics. The nature and origin of this logic and its role in effecting change in the biological world would be the focus of study. This approach places design squarely in the natural order.

The second approach may be to grant the above, but to claim further that the designer acted in nature throughout the history of life in the universe to bring about certain purposes. This approach would acknowledge that recognizing an Intelligent Designer and the mode of operation lies outside the competence of science and must be approached through interdisciplinary methods and concepts of theology and philosophy. Indeed, when one pushes beyond the design inference and its purposes, one leaves the domain of science and enters that of philosophy/theology. The purposes of the Intelligent Designer would be the focus of study, and their effect on the history of life in the universe would be considered. Clearly, this is an area ripe for further study by scientists, philosophers, and theologians within the Judeo-Christian tradition.

While the authors also believe that intelligent design originates in the mind of a Supreme Intelligent Designer, the Christian God, and is actualized as part of God's purpose for the universe, this belief is not essential to the study of Intelligent Design as a scientific theory. Design is a reasonable inference, as witness the trilobite, and as such is amenable to scientific study by believer and unbeliever alike. ★

Acknowledgment

The authors wish to thank Joy Chadwick for her indispensable assistance in preparing the manuscript for publication.

Notes

[1] Radiometric means the measurement of geologic time based on the disintegration of radioactive elements.

[2] The rationale for arguing that studies of molecular features of present day animals can tell us about the molecular features of ancient organisms is supported by Harold J. Morowitz, a biophysicist, who wrote about the very earliest protocells. He says: "In practice, the outputs of metabolism have a universal as well as a specific character ... Within the universal core of the metabolic chart, we can assume we are recovering knowledge of 3.7 billion-year-old or older biochemistry ... we are studying the biochemistry of the universal ancestor" (*Beginnings of Cellular Life: Metabolism Recapitulates Biogenesis* [New Haven: Yale University Press, 1992], 51).

[3] J. S. Levinton, G. Wray, and L. Shapiro, "Molecular Evidence for a Deep Precambrian Divergence of Animal Phyla. I. Introduction and Regression Approach," Geological Society of America annual meeting, Denver, CO, *Abstracts with Programs*, 28:7 (1996): A-52.; G. Wray, J. S. Levinton, and L. Shapiro, "Molecular Evidence for a Deep Precambrian Divergence of Animal Phyla. II. Relative Rate Tests and Implications," Ibid.; and G. A. Wray, J. S. Levinton, and L. H. Shapiro, "Molecular Evidence for Deep Pre-Cambrian Divergences Among Metazoan Phyla," *Science* 274 (1996): 568–73.

[4] David J. Sharp, Gregory C. Rogers, and Jonathan M. Scholey, "Microtubule Motors in Mitosis," *Nature* 407 (September 7, 2000): 41–47.

[5] The nuclear physicist Riccardo Levi-Setti (Director of the Fermilab at the University of Chicago) and trilobite authority has made an in-depth study of trilobite eyes, reported in his book, *Trilobites*, 2d ed. (Chicago: The University of Chicago Press, 1993).

[6] Levi-Setti, *Trilobites*, 29–74.

[7] The optical principles utilized by this trilobite were elaborated by Huygens (and Descartes) in the seventeenth century, but the trilobite lens worked perfectly well using these optical principles long before the Dutch mathematician figured out how.

[8] Levi-Setti, *Trilobites*, 55.

[9] Ibid., 54.

[10] Ibid., 44.

[11] Ibid., 57.

[12] Levi-Setti's honesty is admirable. By his own admission, it is his personal development that directed him to seek an evolutionary explanation. Rather than seeking a new explanation he tried to "shoehorn" the data into an evolutionary framework.

[13] Ibid., 59.

[14] Ibid.

[15] Ibid., 66.

[16] G. Rubin, "Secrets in the Fly Eye," *Discover* 17:7 (July 1996): 110.

[17] The basal Cambrian is sometimes loosely defined as the point in the geologic column where the first trilobites appear.

[18] S. Conway Morris, *The Crucible of Creation* (New York: Oxford University Press, 1998), 184.

[19] L. Spetner, *Not By Chance* (New York: Judaica Press, 1997).

[20] S. Bengston and Y. Zhao, "Fossilized Metazoan Embryos from the Earliest Cambrian," *Science* 277 (September 12, 1997): 1645–48; S. Xiao, Y. Zhang, and A. H. Knoll, "Three-dimensional preservation of algae and animal embryos in Neoproterozoic phosphorite," *Nature* 391 (February 5, 1998): 553–57; C.-W. Li and J.-Y. Chen, "Cambrian Sponges with Cellular Structures," *Science* 279 (February 6, 1998): 879–82.

Upcoming ASA Conferences

July 20–23, 2001: Kansas State University
Manhattan, KS
"Caring for God's Creation"

August 2–5, 2002: Pepperdine University
Malibu, CA
Theme: Christian Pioneers in Science

July 25–28, 2003: Colorado Christian University
Lakewood, CO
Theme: Cosmology

2004: Trinity Western University
Langley, BC, Canada

Additional References

E. Boncinelli, A. Simeone, A. La Volpe, H. Faiella, D. Acampora, and L. Scotto, "Human cDNA Clones Containing Homeobox Sequences," Cold Spring Harbor Symposium, *Quantitative Biology* 50 (1985): 301–6.

J. P. Grotzinger, S. A. Bowring, B. Z. Saylor, and A. J. Kaufman, "Biostratigraphic and Geochronologic Constraints on Early Animal Evolution," *Science* 270 (1995): 598–604.

The Salvation of Your Souls: But What Is a Soul?

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Writing to God's elect, Peter concludes that the outcome of the redemption won for the elect by Christ is the salvation of their souls (1 Peter 1:9). Saving souls is of central importance in God's plan of redemption, but just what is a soul? In this essay, we will look at a variety of representative ways that question has been answered, both in Western and in Non-Western traditions. We will begin with a linguistic analysis of the Hebraic and Greek terms. Then we will discuss how attempts by Western philosophers and theologians to systematize the various nuances embraced in those terms modified the meaning of the concept. Next we will examine the significance other traditions invested in the idea. Finally, we will look at contemporary secular accounts of the soul before we draw our conclusions.

Receiving the end of your faith,
even *the salvation of* your *souls* —1 Peter 1:9 (KJV).

As the outcome of your faith you obtain
the salvation of your souls —1 Peter 1:9 (RSV).

obtaining as the outcome out come of
your faith the salvation of your souls —1 Peter 1:9 (ASV).

for you are receiving the goal of your faith,
the salvation of your souls —1 Peter 1:9 (NIV).

Semantic Analysis

Drawing its meaning from both Indo-European and Afro-Asiatic languages, the word "soul" has a long and heterogeneous history. Derived from the Old English *sawl*, soul shares a common origin with the word "sea," the supposed habitation of souls in Celtic mythology.[1] Its roots, however, are thousands of years deeper and its ultimate etymology is uncertain. As Indo-European languages, English and Greek are assumed to have a common origin in a hypothetical proto-Indo-European people. Archeologists have yet to uncover such a culture though the Kurgan peoples are sometimes proposed as candidates. The Kurgan peoples from the steppe zone north of the Black Sea and beyond the Volga invaded the Balkans and adjacent regions during the middle of the fifth millennium B.C.[2] However, etymological constructions based on such hypothetical scenarios are highly imaginative.

Data from preliterate, extinct societies is thin to non-existent. Even among the highly literate Greeks, little written material has survived, making it difficult to trace in any detail the development of the idea of soul. From what can be determined, it would seem that the Greeks, even into the classic period,

*ASA Member

were interested—like so many ancient peoples—not primarily in the soul's ultimate destiny but in issues involving this present life. Enough literature has survived to suggest that in the Archaic age (800–500 B.C.), the Greeks conceived of the soul as a multiple entity consisting of a free-soul or *psuche* that represented the individual personality and one or more body-souls (*thumos, menos*) that motivated specific activities. Then, toward the end of the Archaic age, *psuche* and *thumos* began to merge to express the idea of what we would recognize as a centered consciousness.[3]

The Greek word for soul in the 1 Peter passage is *psuchon*. Derived from *psucho*, which means to breathe voluntarily and gently, *psuchon* denotes a sentient principle believed to energize animal life.[4] It is distinct from *pneuma* which, in humans, refers to the rational principle and is translated as spirit. Angels, demons, and God are also *pneuma*. *Psuche* is distinct as well from *zoe*, which refers to mere vitality, and can be applied to both animals and plants. Though Hebrew is part of the Afro-Asiatic family of languages, these Greek words have their Hebrew correspondents. The Hebrew word *nephesh*, which means either a breathing creature or animal vitality, corresponds to *psuche*.[5] Hence in the Septuagint, *psuche* is used to translate *nephesh*. *Ruwach*, an onomatopoeic word which can refer to mind, spirit, or wind, corresponds to *pneuma* and is often used to designate powers or actions outside the body, while *chay*, meaning life, corresponds to *zoe*.[6]

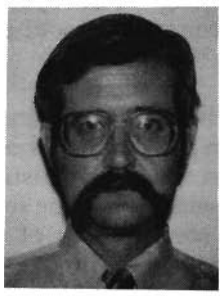
In Gen. 2:7, when God shapes and breathes life into man, man becomes a living soul (KJV) or living being (RSV, ASV, NIV). That is a *nephesh chay*. It is of the same phrase applied to the beasts of the field in Gen. 1:24.[7] Humanity's unique spiritual component is found not in God's breathing the breath of life into the nostrils of *adam* (Gen. 2:7) but in God's decision to make *adam* "in our own image" (Gen. 1:26).[8] The Hebrews were not given to analytical ontological speculation and tended to view human beings holistically. They thought that a person does not have *nephesh* or *ruwach*, but is *nephesh* or *ruwach*. It is generally agreed, among evangelicals at least, that Paul's anthropology reflects a Hebraic holism rather than Hellenistic dichotomies.

Western Systematization

The three Greek words, however, can also suggest three degrees of soul, a concept Aristotle, who was given to analytical ontological speculation, developed in *De Anima (On the Soul)*.[9] He argued that three degrees of soul can be described using the three words: *zoe, psucho,* and *pneuma*. Beginning with the proposition that the soul is in some sense the principle of animal life,[10] Aristotle notes that most people agree that the soul is characterized by three marks: movement, sensation, and incorporeality,[11] but that it is itself unmoved.[12] It is the source of movement and sensation and is characterized by them.[13]

Though insisting that soul and body must be inseparable,[14] Aristotle distinguishes soul from body,[15] defining soul as "substance in the sense which corresponds to the definitive formula of a thing's essence" and "'the essential whatness' of a body."[16] Soul, according to Aristotle, is that by which "we live, perceive, and think."[17] It is actuality, while the body is potentiality.[18] Indeed, soul "is the actuality of a certain kind of body ... soul is an actuality or formulable essence of something that possesses a potentiality of being besouled."[19] It is "the cause of source of the living body"[20] and "analogous to the hand; for as the hand is a tool of tools, so the mind is the form of forms and sense the form of sensible things."[21]

Aristotle then argues that the soul has four forms expressed in powers: the power of touch,[22] the power of appetite, the power of locomotion, and the power of thinking.[23] He then distinguishes between the souls of plants, animals, and humans, arguing that all share the nutritive soul, which is the most primitive and widely distributed power of soul.[24] While animals also have the power of sensation, locomotion, and imagination, humans have an additional power, the power to think or calculate.[25]



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Aristotle was the first to demarcate three degrees of *psucho*, and his analysis has been tremendously influential in subsequent discussions about the soul, including Christian discussions. Augustine, e.g., in *City of God* when critiquing Marcus Varro's belief that the Earth is a deity, mentions that Varro distinguishes three degrees of the World Soul: the degree that instills life, the degree that provokes sentience, and the highest degree, which is the mind. This last, according to Varro, is God. In human beings, Varro calls it the *genius*.[26]

Aristotle was the first to demarcate three degrees of* psucho, *and his analysis has been tremendously influential in subsequent discussions about the soul, including Christian discussions.

Augustine objects to Varro's unnecessary multiplication of deities, asserting that the numerous titles Varro uses number demons, not deities.[27] Instead Augustine, basing his thesis on scriptural references to soul and spirit, argues in *A Treatise on the Soul and Its Origin* (419) that human beings have only "two somethings, soul and spirit," that these two terms can be used interchangeably, and that they refer to the same substance.[28] The soul, he says, is made by God, but its mutability testifies to its being distinct from God.[29] To claim it is a part of God is blasphemous.[30] While the soul derives its life from God, the body derives its life from the soul.[31] Augustine says later: "The entire nature of man is certainly spirit, soul and body; therefore who would alienate the body from man's nature is unwise."[32]

His argument is intended to defend against doctrines that would denigrate the physical world and is not intended to establish any sharp distinction between spirit and soul. Indeed, Augustine argues that the close identification between soul and body suggests that the soul has gender.[33] Augustine is far more interested in differentiating between created souls and God, and in defending the goodness of the body as part of God's good creation, than he is in distinguishing between aspects of the soul. And he seems predisposed, perhaps because of the influence of Hebraic anthropology, to view persons in holistic rather than pluralistic terms. Nevertheless, the three aspects, *zoe* (bodily vitality), *psucho* (soul), and *pneuma* (spirit), are still discernible, and it is mind (*pneuma*) that differentiates us from the beasts.[34]

Such distinctions were preserved well into the Middle Ages in Christian, Muslim, and, particularly via Moses Maimonides, in Jewish thought. For example, the Scholastics who dominated European metaphysics from the eleventh to the fourteenth centuries differentiated among three types of soul or three aspects of a soul: (1) the *vegetative* soul, which imparted the property of life (analogous to the *zoe*); (2) the *sensitive* soul, which was associated with animal awareness and shared by humans and other animals (analogous to the *psucho*); and (3) the *rational* soul (analogous to the *pneuma*), which was the seat of critical reflection and the earmark of human beings. They argued that only the rational soul was immortal, a doctrine they borrowed from Aristotle's belief that the mind alone had the power to exist independently. While Scholasticism was founded on a basic cultural unity that came to dominate Europe and can be traced to the Carolingian empire, it evidenced considerable variety, making sweeping generalizations about the movement problematic. Thus, I shall use Thomas Aquinas as my example, not only because he is the best known and most influential of the Scholastics (and probably the most relevant today), but also because his debt to Augustine, in this case, is explicit and considerable.

Augustine's view on the comparative simplicity of the soul impressed Aquinas, who began his own discussion of the soul by citing Augustine's defense of that simplicity.[35] The soul, Aquinas tells us, is the first principle of life, and life reveals itself in two activities: knowledge and movement. Since all bodies are not alive, we know that no body can be the first principle of life.[36] He defines the human soul as the principle of intellectual operation that is both incorporeal and subsistent. The body provides the soul with sense impressions that the soul interprets.[37] Appealing again to Augustine, Aquinas argues that a human being cannot be reduced to soul or body alone but is both soul and body.[38] Thus Aquinas argues that humans are not essentially souls inhabiting bodies. Nor, he says, does soul refer to a general form that belongs to the species. Human beings are instead a complex of soul and body expressed as individuals.[39]

The intellectual principle that is the distinctly human soul, though it relies on a corruptible body, is itself incorruptible. Human souls are distinct from the souls of brutes in this sense: while the souls of animals are generated by some power of the body, the human soul is produced directly by God.[40] This intellectual principle is both the form of

the human body and the agency by which we understand the form of the human body.[41] Each intellect is individual—indeed it is impossible that it should be otherwise—and it has primacy among all other things that pertain to a person.[42] Furthermore, Aquinas argues that it is impossible for several essentially different souls to be in a body, hence the nutritive soul (*zoe*), the sensitive soul (*psucho*), and the intellectual soul (*pneuma*) are numerically one and the same soul.[43] In fact, he argues, the intellectual soul contains the nutritive and sensitive souls.[44]

The monistic view ... that the soul is the form of the body is, in the opinion of many, a fair summation of the Christian position.

The monistic view (defended by Augustine and later Aquinas) that the soul is the form of the body is, in the opinion of many, a fair summation of the Christian position. Certainly through Augustine, it had a profound influence on the Reformers. Calvin, e.g., though he explicitly rejected Aristotle's assertion that the soul is inseparable from the body[45] was willing, like Augustine, to use soul and spirit interchangeably.[46] Soul is, he said, the essence of a person, separable from the body, immortal but created[47] out of nothing.[48] It is the proper seat of God's image in human beings.[49] Soul, Calvin maintained, is an incorporeal substance that, though set in the body in which it dwells as though in a house, is not limited to the body.[50] The soul has a variety of powers,[51] but its two most basic powers are its power to understand and its power to will.[52] This definition by Calvin seems to be the one generally accepted today. Compare it to three dictionary definitions selected at random.

> **Soul:** an entity conceived as the essence, substance, animating principle, or actuating cause of life, or of the individual life manifested in thinking, willing, and knowing. In many religions it is regarded as immortal and separable from the body at death ... 8. A disembodied spirit [partial definition] *Webster's Collegiate Dictionary*, 5th ed. (1944).

> **Soul:** 1. The principle of life, feeling, and action in man, regarded as distinct from the physical body; the spiritual part of man as distinct from the physical part. 2. The spiritual part of man regarded in its moral aspect, or as capable of surviving death and subject to happiness or misery in a life to come. 3. A disembodied spirit of a deceased person" [partial definition] *The Random House College Dictionary Revised Edition* (1984).

> **Soul:** 1. The animating and vital principle in human beings, credited with the faculties of thought, action, and emotion and often conceived as an immaterial entity. 2. The spiritual nature of human beings, regarded as immortal, separable from the body at death, and susceptible to happiness or misery in a future state. 3. The disembodied spirit of a dead human being, a shade" [partial definition] *The American Heritage College Dictionary*, 3rd ed. (1993).

Clearly there are differences in the definition given by Calvin and those given by the dictionaries. The concept of soul as substance that one finds in Calvin and in the 1944 dictionary has been superseded by the concept of soul as an immaterial principle in the forty, primary definition years later, while the idea of the soul as something essential to human beings has been lost. The 1984 and 1993 dictionaries, following ancient tradition, use soul and spirit as synonyms but in the 1944 dictionary that point, while there, is not emphasized. This lack of emphasis is especially striking since the definition given for spirit in the 1944 dictionary is quite similar to the one given for soul. Calvin and all three dictionaries, however, associate soul with volition and awareness, conceive it as distinct from and separable from the body, and assume an individuality to soul that suggests identifiable personality. Finally, in all cases, soul is understood to have significant religious overtones.

Aristotle, applying reason to the assumptions of his day and structuring that data within the philosophical system he developed, attempted to describe and classify what was meant by soul. His conclusions were both precise and complex. Since then there has been some significant reductionism at work. Although Augustine and Aquinas owe much to Aristotle, they are far more comfortable with the term's ambiguities than was Aristotle. They are noticeably less precise and much less willing to attach the kind of importance to shades of meaning that Aristotle saw as significant. Both men use soul and spirit as synonyms, though they concede a technical distinction between the two words. Calvin, despite having read *De Anima*, owes even less to Aristotle than do Augustine and Aquinas. And today we are likely to find Aristotle's approach even less compelling than Calvin did.

It is striking that both Augustine and Calvin in their discussions of soul are less interested in defining the word than they are in applying certain theological principles to it. In this they differ from Aquinas, who does discuss the nature of the soul at

some length. Augustine's concerns, as we noted, have more to do with defending the Christian doctrine of creation than they do with clarifying what he means by soul itself. Calvin in his *Institutes* has much to say about the soul but most of his discussion is couched in the terms of forensic salvation. He is more concerned with the soul's care and redemption than he is with its nature.

Before we begin the next part of our discussion, let us pause and formulate our conclusions to this point. Our symbols for soul are derived from natural phenomena like wind, shadows, and sea.[53] Such tropes were an attempt to focus on soul understood as a metaphysical, vital principle that existed within living things. In animals it betrayed its presence by activities (particularly breathing), and in humans—and sometimes in animals—it was believed to continue on after death. Soul had significant religious implications.

As a continuing vital principle, soul is closely associated with consciousness, especially a concept of consciousness as something that endures after death. Initially concepts of the afterlife seemed less significant. In time, however, pagans like Plato and Aristotle, then Jews, and finally Christians began to associate the soul's survival after death with the idea of a penultimate or a final judgment. Hence, like most metaphysical terms, soul is what Paul Helm has called theory-laden.[54] The metaphors, by which we understand soul, work insofar as they express what is explicit or implied in whatever world view gave rise to them. For example, if one believes that the universe is fundamentally pluralistic, one's symbols for soul will reflect that pluralism. If one believes that the universe is fundamentally monistic, one's symbols for soul will reflect that monism. Furthermore, the term itself is not static but evolves as world views change, and even borrows its meaning from different world views, sometimes mixing distinct traditions. While such eclecticism enriches some terms, it compromises the clarity of others. In the case of "soul," clarity seems to suffer.

Thus some Christian theologians do not like the word "soul." Charles W. Carter, e.g., believes that "person" or "individual" is a more satisfactory designation in English than is soul, since person or individual is a more specific indicator of a self-conscious rational human. He prefers *ego* (or more precisely *ego-psyche*) to *psyche* itself.[55]

Many scholars who study non-Christian faiths also find the term soul problematic. Because it is so conditioned by a culture's larger metaphysical world view, and because many cultures do not systematize in the same critical way Western cultures do, it is quite possible that our very "Aristotelian" attempts to criticize and classify other concepts of soul result in our misunderstanding them. However else contemporary ethnographers evaluated nineteenth century efforts by E. B. Tylor (*Primitive Culture*, 1871) or early twentieth century efforts by James Frazer (*The Golden Bough*, 1911–1915) to organize concepts about the soul, none would affirm the evolutionary paradigm these pioneers used to structure their work. Nevertheless, the twelve volumes of *The Golden Bough* remain a treasure trove of specific information about what so-called primitive societies thought.

Non-Western Concepts of the Soul

In *The Golden Bough*, Frazer[56] acknowledges this theory laden aspect of the soul and notes:

> As the savage commonly explains the process of inanimate nature by supposing that they are produced by living beings working in or behind the phenomena, so he explains the phenomena of life itself. If an animal lives and moves, it can only be, he thinks, because there is a little animal inside which moves it: if a man lives and moves, it can only be because he has a little man or animal inside who moves him. The animal inside the animal, the man inside the man, is the soul.[57]

But a soul does not necessarily exist only within oneself. In some cultures one's shadow or reflection is regarded as one's soul.[58] Nor is the belief in the unity of one's soul necessary or universal. Frazer writes:

> The divisibility of life, or, to put it otherwise, the plurality of souls, is an idea suggested by many familiar facts, and has commended itself to philosophers like Plato, as well as to savages. It is only when the notion of a soul, from being a quasi-scientific hypothesis, becomes a theological dogma that its unity and indivisibility are insisted upon as essential. The savage, unshackled by dogma, is free to explain the facts of life by the assumption of as many souls as he thinks necessary.[59]

Frazer goes on to describe how in different cultures various phenomena are explained by inferring the existence of several souls in each person.

In fact, much of Frazer's argument is based on his observation that across history and around the world, conceptions of the soul, its composition, and its powers are myriad. For example, it is believed in many cultures that not only do humans and animals have comparable souls, but that a soul can depart the body under certain circumstances and enter

other bodies. As a result, ceremonies are sometimes contrived to facilitate the transfer of souls between humans and totem animals so that a member of the Wolf clan, let us say, may believe that after undergoing an initiation ritual, the wolf's soul dwells in him and his soul dwells in the wolf.[60] This desire to share or exchange souls with an animal is evidence of the profound religious significance animals have for many peoples.

Henri Frankfort notes that animals are conscious entities very different from human beings. As such they express an enduring distinctive reality that remains unchanged despite the birth and death of individual members within a given order. Such predestined living patterns appeared to ancient Egyptians to be a manifestation of the divine. Thus Egyptian gods were portrayed as animals.[61]

Conceits, which assume a high level of rationality among animals, require a view of the soul markedly different from the one described in Scripture or posited by most Hellenistic philosophers.

Eliade, investigating shamanism, has also commented on the religious significance animals have among many peoples. Animals, he says, possibly have much richer spiritual lives than humans have. Shamanism believes that animals have language and know the secrets of life and nature. Thus, the shaman, in an effort to access such knowledge, seeks friendship with animals and imitates their behavior or cries.[62] Clearly such conceits, which assume a high level of rationality among animals, require a view of the soul markedly different from the one described in Scripture or posited by most Hellenistic philosophers.

In the modern West, we tend to imagine a union between body and soul so absolute that it can only be severed by death, but, as the above examples illustrate, not all cultural complexes make such an assumption. Frazer relates how some people interpret dreams as instances when a soul leaves the body and actually engages in the actions of the dream.[63] But a soul may not only decamp during sleep, it may also get away during waking hours, perhaps escaping from one's mouth while one is eating or drinking.[64] Sickness or insanity may be interpreted as evidence of such a disaster.[65]

The living dead are of central significance in many cultures and are often the focus of a very complex metaphysic. Frankfort, writing about ancient Egypt, tells us that the ancient Egyptians imagined life as a vital force or *Ka*, which persisted after death and which always required sustenance. Therefore, food for the Egyptians had a spiritual dimension, and *Ka* could refer to both the vital principle of life and, when used in its plural form, to that which sustained life.[66] The *Ba*, on the other hand, though it is sometimes translated as soul, is more accurately rendered as "animation" or "manifestation." It refers not to a part of the living person but to the whole person when he or she appears after death.[67]

While few cultures become embodiments of the living dead in the way ancient Egyptian culture did, many ascribe a high level of importance to "ancestors." Traditional African societies believe that their ancestors after death continue to be interested in the affairs of the tribe and can be consulted, generally via spiritual possession. Indeed, such consultations are probably the single, most important reason for invoking a possessed state. Chinese culture even today honors their ancestors with gifts of food and money, and one finds similar beliefs in many other parts of Asia. We will look at a specific example to illustrate one form assumed by such beliefs.

In 1968 Robert Gardner and Karl G. Heider published an account of how the Dani in the Grand Valley of Baliem in the Central Highlands of western New Guinea experienced ghosts as an immediate, continual, and essential—though sometimes bothersome—reality. The Dani believe that all creatures except insects and reptiles possess *etai-eken* ("seeds of singing"). These "seeds of singing," roughly analogous to our concept of soul or personality, are the most significant elements in human beings. They first appear near a child's spinal column about six months after birth. They remain there until the child begins to speak, at which point they move toward the solar plexus where they will take up permanent residence.[68] At death the *etai-eken* are released by shooting an arrow through a small bundle of grass held above the body before it is cremated.[69] In this way, an *etai-eken* becomes a ghost. The Dani believe their world is controlled in part by ghosts who afflict them with sickness, bad weather, and spiritual malaise. Thus their religion is concerned primarily with controlling these ghosts.[70] Protecting themselves by magic ritual, the Dani seek to confine ghosts to places called *mokat ai*, usually located about one-half mile from the village. It is important for the Dani to do this since ghosts, refined by death, are imagined as more demanding, more meddle-

some, more inquisitive, more vindictive, and hungrier than they were prior to death.[71]

One of the most striking things about such accounts is the intimacy they reveal between the living and the dead. In these traditions, the ancestors are experienced frequently and directly, so much so that they can become a problem. Clearly those who have these sorts of beliefs consider them to be empirically based. They know from hard experience that the living dead are real. Of course, one might argue that they know nothing of the sort, that their "hard experiences" are highly interpreted judgments based upon a metaphysic which in turn validates itself via these judgments. But the objection misses the point, in part because it could be mounted against almost any empirical datum. We know that world views are interpretive and are held by those who, for whatever reason, find them credible. Even beasts seem to have the power of imagination.

Contemporary Secular Accounts

From a broader perspective, however, the point about the interpreted nature of empiricism is of significance. Contemporary science, particularly disciplines like neurobiology and evolutionary psychology, is in the process of jettisoning the entire ancient interpretive apparatus in favor of a radically new model of soul, and is making some powerful empirical arguments to justify its creative demolition.

It could once be claimed that materialists denied the existence of a soul. This is no longer strictly true. For a host of reasons, scientific materialists have been forced to postulate a soul, but they have reinterpreted soul in some very important ways in order to solve some very specific problems. We will look at two such problems: (1) the apparent lack of a center or Cartesian theater in the brain; and (2) the need to posit a universal human nature. The first problem relates to neurobiology; the second to evolutionary psychology.

Since the 1970s, studies in neurobiology, particularly of the brain's visual system, have completely undermined the notion that there is a Cartesian theater in the brain that interprets received sensory content. Writing in the September 1992 issue of *Scientific American*, Semir Zeki, professor of neurobiology at University College, London, describes four systems which, operating together, produce our experience of unified vision. One system is for motion, one for color, and two for form. One of these systems for envisioning form is interlinked with the system for seeing color, the other is independent.[72] Zeki also notes that there is no single master area where all of these processes interconnect. Instead there is a vast complex of anatomic links that brings the functioning systems together, either directly or via other systems.[73] This suggests, according to Francis Crick and Christof Koch, that consciousness is a process[74] that is distributed over the neocortex.[75] If this model of consciousness is correct, its implications to our understanding of the human soul are revolutionary. Philosophers like John R. Searle, David J. Chalmers, and Daniel C. Dennett have found this scientific model very intriguing. For the sake of brevity, we will consider Dennett as representative of the group. However, the ideas of these men differ in such marked ways that they disagree, often emphatically and even unpleasantly, with each other.[76]

Dennett claims that Darwinism reduces us to the level of robots.

Dennett's *Consciousness Explained* is the culmination of a lifetime spent reflecting on the puzzle of what it means to be aware. His startling conclusion is that qualitative, private, subjective experiences or "*qualia*" do not exist. Rather our inner mental state is the result of a mistake in judgment as outer stimulation triggers an inner reaction.[77] In an analysis obviously influenced by behaviorism, Dennett argues that our ability to discriminate among stimuli is based on various information states that exist simultaneously and, in their mutual interaction, create what we perceive as consciousness. One experience Dennett uses to illustrate what he means is our experience of a unified reality. Experiments have shown that consciousness is not unified. It is a patchy affair whose unity appears as the brain fills in the blanks created by the incomplete nature of the stimuli we receive. It is a whole stitched together from many parts, and its very wholeness is part of its illusion.[78] This wholeness is what we experience as a soul, but that soul is not what Gilbert Ryle would dismissively call "the ghost in the machine." Soul according to Dennett is the accidental, emergent creation of the complex interaction of myriad subprocesses, a swarming insectile thing that he compares to the organization of a termite colony. In a letter to me, Dennett approvingly quoted an Italian journalist's description of his position: "Yes, we have a soul. But it's made of lots of tiny robots."[79] Dennett claims we are descendants of robots,[80] and as such are little more than robots ourselves.[81]

To fully appreciate Dennett's claim that Darwinism reduces us to the level of robots, we should

remember that evolution itself has no particular implications for the existence of soul. For example, Alfred Russel Wallace, who is recognized along with Darwin as the co-originator of current evolutionary thought, was a convinced spiritualist. Darwinian evolution with its materialist implications presents the real challenge. If that challenge is apparent when Darwinian thinking is applied to the realm of neurobiology as Dennett has done, it is equally apparent when applied to the field of psychology. Here scholars like Steven Pinker are breaking new ground and drawing some disturbing conclusions.

Pinker refers to the soul as the "traditional explanation of intelligence" and, parodying Ryle, calls it "the spook in the machine."[82] Theories of the soul, Pinker writes, confront theorizers with two problems: (1) How does this spook, "an ethereal nothing," interact with "solid matter?" and (2) What are those who defend the concept of a soul to make of "the overwhelming evidence that the mind is the activity of the brain"?[83] He associates soul with part of that "technique for success" called religion. Religion, he informs us, "is a desperate measure that people resort to when the stakes are high and they have exhausted the usual techniques for the causation of success."[84] Religious beliefs, noted for their lack of imagination,[85] are not worth knowing for they merely pile enigmas upon enigmas.[86] In this regard, a spirit or soul is simply a cognitive module subject to most natural laws but exempted from others.[87] Such entities are nothing more than "piecemeal revisions of ordinary things."[88] In fact, Pinker opts for a Kantian solution to both religion and philosophy: Because the mind is a product of natural selection, it is best at solving practical problems rather than more transcendental ones.[89] The mental equipment necessary to resolve such questions simply failed to evolve.[90]

Although Pinker does not give us an example of such "piecemeal revisions," Jan Bremmer, quoting the Swedish anthropologist A. Hultkrantz, offers one. Noting the early connection between breath and soul, Hultkrantz observes that both are simultaneously material and immaterial, connected to the body but freed from it. He goes on to suggest that the idea expressed in this trope can be imposed over the memory-image of a dead person, thus producing a supernatural reality.[91]

Pinker's ridicule of traditional ideas of the soul is rooted in his contempt for religion, but his philosophical stance is firmly grounded in his rejection of essentialism. He points out that "the driving intuition behind natural kinds is a hidden essence,"[92] that Darwinism is anti-essentialist, and that "in the sciences, essentialism is tantamount to creationism."[93] Yet essentialism, as he points out, seems to be an inborn human attribute.[94] We are, he says, born with "an intuitive physics relevant to our middle-sized world," a physics that accepts matter as enduring and motion as regular.[95] This is because the human mind evolved not as an instrument for metaphysical contemplation, but as a tool for solving practical survival problems in an environment where there was greater benefit in the ability to generalize risk than to be precise about it. However, it also evolved in tandem with the lifestyle that our human ancestors pursued. Though all creatures are related, they are related indirectly in a great bush rather than a great chain, and each species maintains its distinct habits. This means that efforts to rank the intellect of animals is problematic because such efforts assume a general standard when there is no such standard.[96] Just because we evolved from apes, he says, does not mean we have the minds of apes.[97] Paul MacLean's theory of a Triune brain, that is, a three-layered brain reflecting our evolution from reptile to primitive mammal to modern mammal, is incorrect. The human cerebral cortex works in tandem with the limbic system rather than riding piggy-back on it.[98]

In [Pinker's] opinion, a recognizable human mind expresses a combination of intellect and emotion, but it is a creation of genes rather than a creation of God.

Although Pinker has been influenced by Dennett and peppers his work with references to the philosopher, he is not a behaviorist. Indeed, he specifically states that behaviorists are wrong.[99] Pinker argues that we do not need "spirits or occult forces to explain intelligence," but neither do we need to "claim that human beings are bundles of conditioned associations."[100] Instead he uses a computational model of the mind to unravel the mysteries of consciousness by wedding it to the theory of the natural selection of replicators,[101] and it is that model of reality which eliminates the need to appeal to a soul. Pinker believes that information is the real juice of the psyche and that emotions are adaptations engineered by genes to work in harmony with the intellect.[102] Thus the major human emotions—his examples are anger and fear (this last he argues

is a combination of several emotions)[103]—have evolved from precursors like fighting and fleeing.[104] However, he argues that consciousness, which he defines as "being alive and awake and aware,"[105] is essential to moral reasoning.[106] All of which means that Pinker does accept the reality of human universals. The ability to recognize pictures as depictions,[107] the ability to make and recognize facial expressions,[108] and the desire to avoid incest,[109] are among his examples of such universals. Basing his arguments on the clear results of studies conducted on "thousands of people in many countries," Pinker concludes that human behavior is firmly rooted in genetics and that about fifty percent of the variations in that behavior have genetic causes.[110] In his opinion, a recognizable human mind expresses a combination of intellect and emotion, but it is a creation of genes rather than a creation of God. It is this mind that he has identified with earlier concepts of the soul. Thus, Pinker implicitly leaves room for a soul but redefines it in some very radical ways.

Conclusions

To this point we have investigated different ideas as to what constitutes a soul. What can we conclude from this investigation?

First, it seems significant that universally, and for as far back as we can trace, soul and consciousness have been closely associated, so much so that consciousness might be described as the central manifestation or function of soul. Also, from the beginning, consciousness has been ascribed to animals as well as humans, to the degree that animals (or some animals) were believed to possess souls that were, if not divine or semi-divine, then on a par with human souls. The degrading of animal souls is a late development, and one that seems suspiciously tied to the kind of rationalism that would eventually lead philosophers like Dennett to the bizarre conclusion that human consciousness is an illusion generated by our robot ancestors as they evolved ever more complex mental machinery. Such a conclusion, counter-intuitive and method-bound as it is, might be grounds for doubting the method that produced it. It seems fair to suggest that a rationalistic approach to understanding the soul, particularly when that approach is based on a mechanistic agenda emphasizing secondary causality, might be wrongheaded. If we are willing to assume with Kant and Pinker that there are questions with which we are ill-suited to grapple, then it is hard to see why a judgment that questions an approach to a problem by pointing out that the conclusions generated by that approach are absurd should not be taken seriously. Rather than analyzing soul too closely, perhaps we should be content to allow some ambiguity in our conception of it, and to admit that attempts to explain soul as a materialistic interplay of cause and effect are doomed to failure.

In this regard, we have seen that the definition of soul is fluid, so fluid that it can borrow its meaning from a wide variety of sources and still be used with some degree of intelligibility. We have argued that the nature of soul as conceived in any given society reflects that society's basic assumptions about the nature of the world. One of the ways we described such assumptions was to call them theory-bound. This observation is unsurprising and may be made of many metaphysical entities.

The nature of soul as conceived in any given society reflects that society's basic assumptions about the nature of the world.

We have seen that soul can be conceived as unitary or plural, and we have suggested that soul as plural may have historical precedent to soul as unitary. Though I would not want to go so far as Jaynes or even Bremmer and argue that centered consciousness is a late social creation, it does seem arguable from such evidence as we have that soul eventually became a synonym for our experience of centered consciousness. However, given what we know from the Hebraic tradition and the thin evidence from other traditions, I suspect that theories which explain why this happened (if it did) express little more than our own social presuppositions. It is certainly significant that despite their various conceptions of the soul, all peoples we know of seem to have a firm awareness of their own centers of being. Just because people do not have a single word for a thing does not mean they have no conception of that thing.

We also noted that old ideas about the soul's plurality survived for many centuries—although in a different form in our own tradition—despite that tradition's basic agreement that the soul was one thing and that individuals were a complex of two things: a soul and a body. In fact, the idea of the soul as unitary seems to have become dominant through a process of reductionism. The questions that gave credence to the idea that a soul was plural eventually ceased to be asked, and the unitary nature of soul implicit in the Christian faith, an idea that Christians had inherited from the Jews, was

assumed by default. It is interesting to remember that the Hebrews, who viewed humans as holistic beings, were not given to analytical ontological speculation. Perhaps our own analytical approach to metaphysical questions is as wrongheaded as philosophers like Kant or psychologists like Pinker have suggested.

Concerning the question of reductionism as applied to the soul, it is interesting to note that materialists are monists of a sort. They believe that all is reducible to some kind of stuff. Therefore, it is unsurprising that materialists like Dennett and Pinker are highly critical of dualism and reject the traditional concepts of soul expressed by dualism. However, a dualism latent in materialism drives them toward affirming some kind of soul. In Dennett's case, soul is generated by the body, a position reminiscent of Aquinas' position concerning the souls of animals: they, too, were generated by the body. Ironically Dennett finds himself affirming a position firmly secured in a long dualistic tradition. Pinker fares little better. On the one hand, he wants to reject essentialism, yet, on the other hand, for moral reasons must affirm some universal human distinctives that separate us in quite radical ways from the apes. After ridiculing the enigmas inherent in theology, Pinker ends by constructing a justification for the enigmas that crop up in his own system, a justification with philosophical roots going back at least to Peter Abelard. Their solutions to the dilemmas confronting them suggest that perhaps dualism is not quite as defunct a tradition as Dennett and Pinker pretend.

Finally, it is fair to ask just what Christian missionaries should teach about the soul when they introduce the Gospel into cultures with distinct numinal traditions. In this regard, I find the Bible's silence on ontological questions striking. For example, in the Old Testament, the unity of God is stressed against the background of deities who had consorts. As Isaiah says: "I am the Lord; and beside me *there is* no saviour." (43:11) "I *am* the first and I *am* the last; and beside me *there is* no God (44:6) "... Is there a God beside me? yea, *there is* no God; I know not *any*." (44:8) "I am the Lord, and *there is* none else, *there is* no God beside me ..." (45:5) "... I *am* God, and *there is* none else; I *am* God, and *there is* none like me." (46:9) Such assertions tell us more about God's relationship to other gods (e.g., there is no divine consort, no "Mrs. God") than they tell us about God's being.

How do we know about God's being? Jesus reveals it to us in the New Testament. Even then the precise nature of God's being is never explicitly defined. We are left to puzzle it out. That process resulted in the doctrine of the Trinity expressed provisionally in the terminology of Hellenistic philosophy. I suggest that we can infer from this example that God is not in the business of blessing our ontological models, and that the Gospel in all its fullness will find comprehending ears in all of the world's traditions. It is not our concept of the soul that saves us, it is our faith in the incarnate and risen Lord. This is not to say that we cannot teach some things about the soul: that it is not divine, that it is created, that it needs to be saved, and so forth. But it is to say that we should be less than dogmatic about many of its particulars. God's silence invites us to ponder and participate in his revelation. It is precisely in that silence where Christianity's incarnational aspects are most apparent. ★

Notes

[1] Celtic myth refers to Otherworld to which one can voyage, or which can be entered through caves or lakes. A place of ambiguous significance, it was also called the Plain of Two Mists, the Land of the Young, the Land of the Living, and the Promised Land, and was believed to lie either in the West beyond the ocean or beneath it.

[2] Calvert Watkins, "Indo-European and the Indo-Europeans," *The American Heritage College Dictionary*, 3d ed. (Boston: Houghton Mifflin Company, 1993), 1579.

[3] Jan Bremmer, "Soul: Greek and Hellenistic Concepts," vol. 13 in *The Encyclopedia of Religion*, ed. Mircea Eliade, Editor in Chief (New York: Macmillan Publishing Company, 1987), 434–8. This merging has occasioned some speculation that a conscious self actually emerged at the time. Such conjecture can be found in Jan Bremmer's own *The Early Greek Concept of the Soul* (Princeton, 1983) or Julian Jaynes' *The Origin of Consciousness in the Breakdown of the Bicameral Mind* (Houghton Mifflin, 1976). It has even, sad to say, found its way into the pages of the *Journal of the Evangelical Theological Society* (see Terry C. Muck, "After Selfhood: Constructing the Religious Self in a Post-self Age," vol. 41, no. 1 [March 1998]: 107–22).

[4] One might suppose that *psuchon* would be translated as life, that the outcome of our faith is the salvation of our lives, but no one translates *psuchon* as life. All the translations I checked from the New English Bible to the Good News Bible use the word "souls" to translate the passage. Jan Bremmer points out that just because *psyche* once had a connection with breath, it does not follow that such a connection is maintained indefinitely ("The Soul," in *The Early Greek Concept of the Soul* [Princeton, NJ: Princeton University Press, 1983], 5).

[5] *Nephesh* can also be applied to God. In Lev. 26:11 and Isa. 42:1, God, speaking of himself, refers to his own *nephesh*. In the former passage, he says, "... my soul (*nephesh*) shall not abhor you." In the latter, he says, "... my elect *in whom* my soul (*nephesh*) delighteth ..." In such instances, soul may be a metaphor for self, or it may be used ontologically. Whichever is the case, the examples serve to illustrate the term's ambiguity in Scripture. It was not uncommon among many ancient cultures to address metaphysical questions by employing a variety of ap-

proaches rather than appealing to a single coherent theory. Our insistence on using a single coherent theory to answer our metaphysical questions expresses a cultural bias that developed later.

[6] Arabic, also an Afro-Asiatic language, maintains the same distinctions. In pre-Islamic Arabic poetry, *nafs* designates blood while *ruh* encompasses the concepts of breath and wind, but in the *Qur'an, nafs* refers to the human soul while *ruh* refers to God's spirit. However, Muslims traditionally use *ruh* to refer both to God's spirit and the human spirit. It is worth noting that Islamic philosophers, like Christian ones, borrowed much of their metaphysics of the soul from the Greeks, particularly Aristotle and the neo-Platonists (see Michael E. Marmura, "Soul: Islamic Concepts," *The Encyclopedia of Religion*, 460–5).

[7] We should note that these Genesis passages eliminate theories of a pre-existing soul, like those expressed by Plato in *Phaedo* or Book X of his *Republic*. They also eliminate pantheist philosophies, since such philosophies deny the ultimate individually of the soul. *Adam* becomes a living being after God breathes the breath of life into a form of dust. This indicates that each individual *adam* has a composite nature, an implication Aquinas develops to defend the unique particularity of each person.

[8] I take *adam* to mean both male and female (Gen. 1:27; 5:1–2). Given that sexual distinctions are the norm among plants and animals, I do not take that distinction to refer to God's image.

[9] The title of this text is Latin. As knowledge of Greek became a rare accomplishment among Western scholars from the sixth century to the middle of the twelfth century, Aristotle was known primarily through Boethuis' Latin translations of his work. From the thirteenth and into the seventeenth centuries, a large number of Latin commentaries on Aristotle were composed. Richard McKeon notes that if all these Latin texts were collected, their number would exceed the total of everything else that survives (General Introduction, Section 6 "The Influence of Aristotle," *Introduction to Aristotle*, [New York: Random House, 1947], xxvii). Thus, many of Aristotle's works are known by their Latin titles. It is worth noting that Thomas Aquinas, who wrote commentaries on most of the Aristotelian corpus including *De Anima*, did so in Latin. *Anima* signifies in Latin what *psucho* signifies in Greek. What Aristotle is describing is the *psucho*.

[10] Aristotle, *De Anima*, Book I, chap. 1; Book II, chap. 2.

[11] Ibid., Book I, chap. 2.

[12] Ibid., chaps. 3–5.

[13] Ibid., Book II, chap. 2.

[14] Ibid. He does note early in his discussion that mind or the power to think seems to be different in kind from other parts of soul and is capable of existence about from other psychic powers.

[15] Ibid., chap. 1.

[16] Ibid.

[17] Ibid.

[18] Ibid.

[19] Ibid., chap. 2.

[20] Ibid., chap. 4.

[21] Ibid., Book III, chap. 8. This is reminiscent of Plato's proposition that a human being is a soul making use of a body. The rational principle of the soul is, according to Plato, the divine element in human beings (*Republic*, Book V, chap. 18) and is immortal, an ethical necessity since the soul must reap the consequences of its acts whether good or bad (Book X, chap. 40).

[22] This power, he asserts, is the primary form of sense (Book II, chaps. 2 and 3; Book III, chap. 12).

[23] Ibid., Book II, chap. 3.

[24] Ibid.

[25] Ibid.; Book III, chap. 10.

[26] Augustine, *City of God*, Book VII, chap. 23.

[27] Ibid., chap. 24.

[28] Augustine, *On the Soul and Its Origins*, Book II, chap. 2. In Book IV chap. 36, he argues that while the designation *spirit* may be more accurately applied to an aspect of the soul, it is not incorrect to use it as a synonym for soul. The question, he says, is one of names rather than things. He also says that ignorance about such subtle distinctions puts the believer in no great danger (Book II, chap. 2).

[29] Ibid., Book I, chap. 4. Augustine points out forcefully in Book II, chap. 9, that God's immutability is one of the key dogmas that the doctrine, creation from nothing, was developed to protect.

[30] Ibid., Book I, chap. 24.

[31] *City of God*, Book XIII, chap. 2.

[32] Ibid., *On the Soul and Its Origin*, Book IV, chap. 3.

[33] Ibid., chaps. 32 and 33.

[34] Ibid., Book IV, chap. 35.

[35] Thomas Aquinas, *Summa Theologica*, Book I, Question LXXV, First Article. Aquinas appeals to Augustine's argument as he developed it in *The Trinity*. In fact, throughout his discussion Aquinas appeals repeatedly to Augustine.

[36] Ibid.

[37] Ibid., Second Article.

[38] Ibid., Fourth Article. Aquinas' reference is *The City of God* Book XIX, chap. 3, where Augustine commends Varro. However, Augustine is concerned that such a position might lend itself to the proposition that the Supreme Good lies in ourselves. Therefore, he argues in chap. 4 that it is only when the soul is subordinate to God rather than in control of itself that the body is subordinate to the soul.

[39] Ibid., Question LXXV, Fourth Article.

[40] Ibid., Sixth Article. This distinction between animal and human souls is particularly significant given the arguments of evolutionists.

[41] Ibid., Question LXXVI, First Article. Aquinas' identification between a form and the agency by which we understand that form reflects Aristotle's debt to Plato. Plato, as a means to overcome dualism's epistemological dilemma, identified form and the agency by which we understand form. Hence knowledge in Plato's system relies ultimately on intuition. However, Aquinas disagrees with Plato over how the soul comes to know bodies through the intellect. He argues that Plato's opinion that the form of the thing known must of necessity be in the knower in the same way that it is in the known is a mistake. Aquinas denies the necessity of Plato's condition, noting that we perceive variation in the degrees of a quality. This suggests that there is a distinction between the thing itself and the way it is known in the senses (Question LXXXIV, First Article), and, as we saw, Aquinas argued that knowledge comes to the soul via sense impressions mediated by the body. He also defends Augustine against the claim that Augustine's doctrine of knowledge was the same as Plato's by pointing out that Augustine intentionally modified Plato at this point, since he claimed that forms, rather than existing in themselves apart from matter, exist as exemplars in the divine mind (Question LXXXIV, Fifth

Article), and can also exist in the human soul by their own essence. It is through such exemplars that we understand the information our bodily senses relay to us (Question LXXXIV, First Article). Thus Aquinas argues that, since it is from material things that we acquire our knowledge of immaterial things, our ability to acquire such knowledge is based on our ability to abstract universals from particulars (Question LXXXV, First Article). We understand by composition and division (Question LXXXV, Fifth Article), which is why we can error (Question LXXXV, Sixth Article).

[42] Ibid., Second Article.

[43] Ibid., Third Article. It would be fascinating to know how Aquinas would have interpreted demon possession, but I am not aware that he wrote on the subject.

[44] Ibid., Fourth Article.

[45] John Calvin, *Institutes of the Christian Religion*, Book I, chap. 1, section 5. Aristotle based his argument on his belief that the soul is the actuality of the body's potentiality.

[46] Ibid., chap. 15, sections 2, 3, and 6.

[47] Ibid., section 2.

[48] Ibid., section 5.

[49] Ibid., section 3. Calvin dismisses the quarrels of those who distinguish between image and likeness. There is, he says, no difference between the two, and he traces the confusion to the practice of repetition as a literary device among Hebrews.

[50] Ibid., section 6.

[51] Ibid. Calvin lists those he understands as probable but says he is not inclined to argue strongly with those who make a different list.

[52] Ibid., section 7.

[53] Birds, too, are often associated with souls, as are insects and small animals like mice. Indeed, many traditions believe the dead manifest as theriomorphs.

[54] Haul Helm, "Soul" in *Dictionary of the Christian Church*, ed. J. D. Douglas (Grand Rapids, MI: Zondervan Publishing House, 1974), 916.

[55] Charles W. Carter, "Anthropology: Man, the Crown of Divine Creation," in *A Contemporary Wesleyan Theology* vol. 1 (Grand Rapids, MI: Asbury Press, 1983), 210. In this he differs from Bremmer whose analysis depends on a distinction between *psyche* (which he identifies as free soul) and the ego souls under which he groups *thymos* (emotions), *noos* (a thought or a purpose), and *menos* (impulse).

[56] My purpose here is not to defend Frazer. Like most pioneers, he laid the foundations his successors would use to dispute him. But his catalogue of cultural beliefs and practices around the world remains impressive, and will serve to illustrate their variety.

[57] James Frazer, "The Soul as Mannikin," *The Golden Bough* vol. 1, abridged ed., (New York: The Macmillian Company, 1951), 207. This idea of the soul as mannequin is found all over the world, a distribution that suggests it is ancient. Among the ancient Semites, *nephesh* was imagined as a diminutive replica of the body (Geddes MacGregor, "Soul: Christian Concept," *The Encyclopedia of Religion*, 455).

[58] Ibid., 220.

[59] Ibid., 800.

[60] Ibid., 802.

[61] Henri Frankfort, "The Egyptian Gods," in *Ancient Egyptian Religion* (New York: Harper & Row, 1961), 12–14.

[62] Mircea Eliade, "Nostalgia for Paradise in the Primitive Traditions," trans. Philip Mairet, in *Myths, Dreams, and Mysteries* (New York: Harper & Row, 1975), 63.

[63] Frazer, *The Golden Bough*, 210.

[64] Ibid., 230.

[65] Ibid., 212.

[66] Frankfort, *Ancient Egyptian Religion*, 91. Stevan L. Davies in "Soul: Ancient Near Eastern Concepts" (*The Encyclopedia of Religion*, vol. 13) describes it as the power to do (p. 432).

[67] Ibid., *The Encyclopedia of Religion*, 96–7. The *Ba*, Davies notes, bound together the mummy and the *Ka* (p. 433). Because some Afrocentric scholars have alleged that precursors of the Christian doctrine of resurrection can be found in the Egyptian *Book of the Dead*, we should point out that Egyptian ideas about the soul's existence in the afterlife are significantly different from the resurrection Christians expect. The *Book of the Dead* is comprised primarily of magic spells intended to protect the soul in the afterlife. The Christian doctrine of resurrection is simply not found there. Instead the soul is said to be revived while the corpse remains entombed.

[68] Robert Gardner and Karl G. Heider, *Gardens of War* (New York: Random House, 1968), 87–8. Gardner and Heider mention later that some Dani believe that only humans have *etai-eken* (p. 91).

[69] Ibid., 95.

[70] Ibid., 93.

[71] Ibid., 88–9.

[72] Semir Zeki, "The Visual Image in Mind and Brain," *Scientific American* vol. 267, no. 3 (September 1992): 73.

[73] Ibid. 75.

[74] Ibid., "The Problem of Consciousness" by Francis Crick and Christof Koch, p. 153.

[75] Ibid., 158.

[76] For an example of such disagreement, I call the reader's attention to an exchange published in *The New York Review of Books* as John R. Searle reproduces it in *The Mystery of Consciousness* (NYRV, Inc., 1997), Appendix to "Conscious Denied: Daniel Dennett's Account," pp. 115–31.

[77] Daniel Dennett, "*Qualia* Disqualified," *Consciousness Explained* (Boston: Little and Brown, 1991).

[78] Ibid., 355–66.

[79] In *Consciousness Explained*, Dennett describes souls as "mathematical abstractions rather than nuggets of mysterious stuff. They're exquisitely useful fictions" (p. 367).

[80] Dennett, *Darwin's Dangerous Idea* (New York: Simon & Schuster, 1995), 206. Here Dennett writes: "Well, if Darwin is right, your great-great ... grandmother *was* a robot! A macro, in fact. That is the unavoidable conclusion of the previous chapters. Not only are you descended from macros, you are composed of them."

[81] John Searle in his section on Dennett in *The Mystery of Consciousness* makes this very plain. He writes: "This looks as if [Dennett] is claiming that sufficiently complex zombies would not be zombies ... but ... his claim is that in fact we are *zombies* ... The claim is not that the sufficiently complex zombie would suddenly come to conscious life ... Rather Dennett argues that there is no such thing as conscious life ..., there is only complex zombiehood" (pp. 106–7).

[82] Steven Pinker, *How the Mind Works* (New York: W. W. Norton & Company, 1997), 64. Pinker is so eager to express his contempt for traditional religious conceits that he misuses the word "spook," equating it with the intellectual soul. Jan Bremmer points out that a spook is better

thought of not as a real personality but as an aspect of the person (his emotions, impulses, desires, etc.) that survives death. He also states that spooks are commonly associated with thoroughly dualistic traditions (*The Early Greek Concept of the Soul*, p. 76. Quoting Hultkrantz, Bremmer notes that the "spook-ghost [is] a distorted by-product, a remote echo of the departed individual ..." [p. 83]). The real personality that survives death is more closely associated with what Bremmer calls the free soul, and it is this soul which is associated with intelligence (p. 51). Pinker's gaff reveals both his contempt for and his ignorance of soul traditions.

[83] Ibid. Notice that to raise such an objection Pinker dematerializes soul altogether while retaining matter's solidity. In an era where advances in physics have resulted in the dematerialization of matter, this move seems strange. But besides noting its strangeness, I will not discuss it in this paper.

[84] Ibid., 556.

[85] Ibid., 557. That seems like an odd reason to criticize the truth claims of an idea. Surely a more traditional reason for rejecting a conclusion would be the objection that it is too imaginative!

[86] Ibid., 560.

[87] Ibid., 556.

[88] Ibid., 557.

[89] Ibid., 525.

[90] Ibid., 562–3.

[91] Jan Bremmer, *The Early Greek Concept of the Soul*, 23. He uses the word *producing* rather than *expressing*.

[92] Pinker, *How the Mind Works*, 324.

[93] Ibid., 325.

[94] Ibid., 326–7.

[95] Ibid., 321.

[96] Ibid., 182.

[97] Ibid., 23, 40. In Chapter 3, he lists some of those differences (pp. 186–7) and insists "that there is no such thing as an 'ape legacy' that humans are doomed to live by" (p. 465). But lest we go overboard with the implications of all this, Pinker reminds us that "real science" recognizes that "people are apes" (p. 309).

[98] Ibid., 370–1. MacLean's theory has received a great deal of attention in popular publications (see, e.g., Carl Sagan's Pulitzer Prize winning *The Dragons of Eden* [New York: Ballantine Books, 1977]).

[99] Ibid., 329.

[100] Ibid., 92.

[101] Ibid., ix.

[102] Ibid., 370. He understands intelligence as a capacity naturally selected by evolution to exploit a "cognitive niche." (p. 200). I have discussed problems with this approach in "Communication as General Revelation," a paper delivered at the forty-ninth annual meeting of the Evangelical Theological Society, and reproduced in the *Global Journal of Classical Theology* and the *Journal of Christian Apologetics*.

[103] Ibid., 386–7.

[104] Ibid., 416.

[105] Ibid., 134.

[106] Ibid., 148. In Chapter 8, Pinker specifically equates consciousness, sentience, and subjective experience, just in case there is any doubt about his meaning (p. 558). Furthermore, Pinker has strong moral concerns that underlie what he says. When addressing the question whether humans are still evolving, he lists several reasons to believe they are not. Among those reasons is human vice which he sees as proof that human evolution is a thing of the past (p. 207). And he denies that what comes naturally is always good (p. 492).

[107] Ibid., 214.

[108] Ibid., 365–6.

[109] Ibid., 456.

[110] Ibid., 448.

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David Loye, *Darwin's Lost Theory of Love: A Healing Vision for the New Century*, iUniverse.com, 308 pp., 2000

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Repeating the Catholics' Galileo Error

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Big Bang cosmology presents a challenge to the interpretation of Scripture. This new science describes a universe with an age of at least ten billion years in contrast to the six days of creation in Genesis. A similar challenge was presented in 1633 when the Catholic Church condemned Galileo for supporting the new science of a fixed sun and a moving earth because it disagreed with Scripture. The error of the church was to introduce Scripture into a scientific controversy. Today, however, some evangelicals are opposing the Big Bang because it apparently disagrees with Scripture.

The story of the condemnation of Galileo by the Catholic Church in 1633 is part of the folklore of modern opponents of the Christian Church. The story is used to imply that Christians, even today, are anti-intellectual and superstitious and have yet to come to terms with the scientific age.

Unfortunately, there is truth in this observation. For, in a fundamental sense, some evangelicals today are repeating the steps of the Catholic Church when it was faced with the new science of Galileo. The issue for the Catholic Church was the reinterpretation of Scripture in light of the new scientific discoveries of Copernicus and Galileo. The error of the Catholic Church was to use the authority of Scripture to oppose the new science; today, some evangelicals are repeating the same error by using a literal interpretation of Genesis to oppose Big Bang cosmology.

To make clear the parallels between the present situation and that of Galileo in 1633, we first consider the problem for evangelicals of reconciling the scientific Big Bang with the scriptural six days of creation. We then recall the "traditional" procedure for interpreting Scripture used by the Christian Church from the time of Augustine (400), through Aquinas (1250) and John Calvin (1550), to the present day. We next review the story of Galileo and the Catholic Church and learn how the church misused the "traditional" procedure in condemning Galileo. Finally, we will find that evangelicals today are interpreting Scripture in the same flawed manner as the Catholic Church when confronting the problem of the Big Bang and the six days of Genesis.

*ASA Fellow

The Six Days of Genesis and the Ten Billion Years of Science

In the first edition of his influential book, *The First Three Minutes*, Steven Weinberg wrote:

> The present book is concerned with the early universe, and in particular with the new understanding of the early universe that has grown out of the discovery of the cosmic microwave radiation background in 1965.[1]

In the Afterword to the second edition, Weinberg continued:

> Nothing has happened since the book was written in 1976 to change the broad outline of the story. It is still believed that the universe is expanding in the sense that the galaxies are rushing apart from each other.[2]

And from this picture of an expanding universe, Weinberg concluded:

> Our calculations allow us to extrapolate the expansion of the universe backward in time, and reveal that the expansion must have begun between 10,000 and 20,000 million years ago.[3]

This picture of a universe older than ten billion years is generally accepted by the scientists active in the field of cosmology, as dozens of books written since Weinberg's will testify. Also, it should be noted, the age of the universe found by cosmologists has nothing to do with biological evolution and all of the controversy surrounding it. Standard physics is used to obtain the ten-billion-year age for the universe. The age is calculated from the cosmic background radiation and from the "red shifts" of light collected each night by telescopes. Unlike the early stages of evolution, the Big Bang can literally be "seen" today in the sky.

In contrast to the ten billion years of science, the simplest reading of the first chapter of Genesis has the creation of the heavens and the earth occurring during a period of six days. Here, there is a vast difference between a literal reading of Genesis and science. Fortunately for Christians today, the Christian Church encountered this same situation when the church moved out of Israel, the land of Scripture, and into the skeptical Greek world of science and philosophy. At that time, the church developed a procedure for dealing with disagreements between Scripture and secular knowledge. We now review this "traditional" procedure that has been used from the time of Augustine to the present day.

The "Traditional" Procedure for Interpreting Scripture

In 1657, Blaise Pascal summarized the "traditional" procedure in his Eighteenth Provincial Letter in the following terms:

> According to St. Augustine and St. Thomas, when we meet with a passage even in the Scripture, the literal meaning of which, at first sight, appears contrary to what the senses or reason are certainly persuaded of, we must not attempt to reject their testimony in this case, and yield them up to the authority of that apparent sense of the Scripture, but we must interpret the Scripture, and seek out therein another sense agreeable to that sensible truth ... And as Scripture may be interpreted in different ways, whereas the testimony of the senses is uniform, *we must in these matters adopt as the true interpretation of Scripture that view which corresponds with the faithful report of the senses* (Italics added).
>
> St. Thomas explains his meaning by the example of a passage in Genesis, where it is written that "God created two great lights, the sun and the moon, and also the stars," in which the Scriptures appear to say that the moon is greater than all the stars; but as it is evident, from unquestionable demonstration that this is false, it is not our duty, says that saint, obstinately to defend the literal sense of that passage; another meaning must be sought, consistent with the truth of the fact, such as the following, "That the phrase *great light*, as applied to the moon, denotes the greatness of that luminary merely as it appears in our eyes, and not the magnitude of its body considered in itself."
>
> An opposite mode of treatment, so far from procuring respect to the Scripture, would only expose it to the contempt of infidels; because, as St. Augustine says, "when they found that we believed, on the authority of Scripture, in things which they assuredly knew to be false, they would laugh at our credulity with regard to its more recondite truths, such as the resurrection of the dead and eternal life." "And by this means," adds St. Thomas, "we would render our religion contemptible in their eyes, and shut up its entrance into their minds."[4]

It is interesting that Calvin also uses the example of the magnitude of the moon in his *Commentary on Genesis* (1554). Thus, the reformers, as well as the mediaeval church, accepted the same procedure for dealing with the problems for interpreting Scripture arising from the discoveries of science.

The controlling statement in the "traditional" interpretation has been placed in italic type. When "the faithful report of the senses" (the content of scientific investigation) disagrees with the literal meaning of Scripture, *Scripture must be reinterpreted to agree with "the faithful report of the senses."* As Pascal says above: "An opposite mode of treatment, so far from procuring respect to the Scripture, would only expose it to the contempt of infidels."

John McIntyre obtained a B.S. in electrical engineering from the University of Washington in 1943. After two years of developing radar for the Westinghouse Corporation, he went to Princeton University for graduate studies in physics under the supervision of Robert Hofstadter. Upon receiving a Ph.D. in 1950, he accompanied Hofstadter to Stanford University where they carried out the electron scattering experiments for which Hofstadter won the Nobel Prize in 1962. He was on the faculty at Yale University for six years before going to Texas A&M University in 1963 to direct the nuclear physics research program at the new Cyclotron Institute. At about this time, McIntyre served five years on the Executive Council of the American Scientific Affiliation. Changing his research interests from nuclear physics to nuclear medicine, he developed several novel positron tomographs. In 1979, he and his wife, Madeleine, became charter members of a new congregation of the Presbyterian Church in America in Bryan, TX. In 1995, McIntyre was made Professor Emeritus at Texas A&M University.

The church has adhered to this procedure throughout its history. Thus, as St. Thomas says above, if the Scripture speaks of the moon being a light greater than the stars, the Scripture should be interpreted to agree with the scientific evidence. Today the scriptural four corners of the earth are not interpreted to contradict the known spherical shape of the earth nor does the scriptural passage, "the earth shall not be moved," lead Christians to believe that the earth does not move around the sun.

When "the faithful report of the senses" (the content of scientific investigation) disagrees with the literal meaning of Scripture, Scripture must be reinterpreted to agree with "the faithful report of the senses."

It should also be noted that Augustine anticipates an objection to his rule that "we must in these matters adopt as the true interpretation of Scripture that view which corresponds with the faithful report of the senses." The objection is that if the interpretation of Scripture must always agree with the faithful report of the senses, then Christians cannot believe in such recondite (hidden) truths as the resurrection of the dead, which certainly is not in agreement with the faithful report of the senses. Augustine, however, is distinguishing recondite truths from the public truths of science. He is saying that unbelievers will not believe in the hidden truth of the resurrection unless Christians interpret the Scriptures to agree with what the unbeliever already knows from the public truths of science.

We now turn to the history of the conflict between Galileo and the Catholic Church about whether the earth is moving. One would think that the church would have followed the "traditional" procedure described above for settling such a scientific question. However, the issue was not so simple.

The Catholic Church and Galileo

In 1633, Galileo was condemned by the Catholic Church on the following grounds:

> Believing and holding the doctrines—false and contrary to the Holy and Divine Scriptures—that the sun is the center of the world, and that it does not move from east to west, and the earth does move and is not the center of the world.[5]

The scriptural statements used by the church were:

> The Lord speaks and summons the earth *from the rising of the sun to the place where it sets* (Ps. 50:1).
>
> *The world is firmly established; it cannot be moved* (Ps. 93:1).

Galileo's scientific source for his belief in a moving earth was the Copernican theory of the solar system where the sun is fixed at the center and the earth revolves around its axis. One wonders, then, why Galileo did not use the "traditional" procedure described above to defend himself from the charge of "holding doctrines—false and contrary to the Holy and Divine Scriptures." He could have quoted Augustine: "We must in these matters adopt as the true interpretation of Scripture that view which corresponds with the faithful report of the senses."

However, Copernicus' 1543 description of the solar system was just a theory; it was not "a faithful report of the senses." And Galileo was unable to demonstrate that the earth was indeed rotating on its axis and not the universe revolving around the earth.[6] The mathematics was simpler with the Copernican system, of course, but the church, in agreement with the literal interpretation of Scripture, could still claim that, for an observer on the earth, the earth did not move. In fact, it was not until 1838 that Bessel showed that the earth moved in its orbit with respect to a star,[7] and not until 1851 that Foucault used his pendulum to demonstrate the rotation of the earth.[8]

For almost all scientists, however, the correct description of the solar system was settled in 1687, long before these dates. It was then that Newton published his mathematically convincing description of Copernicus' solar system based on a gravitational force attracting all of the planets to the sun. After 1687, then, almost all scientists accepted a solar system with the sun stationary at the center, just as before 1543, almost all scientists accepted a solar system with the earth stationary at the center. Unfortunately, in 1633 during the period of scientific uncertainty, the Catholic Church condemned Galileo for claiming that the *sun* was stationary. The grounds for the condemnation was that the Holy Scripture said that the *earth* was stationary. Thus, the church used the authority of Scripture to answer a scientific question.

To compound the error, the scientific answer obtained by using Scripture was incorrect. And, the prediction of Augustine was confirmed:

> When they found that we believed, on the authority of Scripture, in things which they assuredly knew to be false, they would laugh at our credulity with regard to its more recondite truths, such as the resurrection of the dead and eternal life.

Consequently, since this mistake of placing the prestige of Scripture above "the faithful report of the senses," opponents of Christianity have rightly been able to criticize Christians for opposing science.

The mistake of the church was to interpret the passages in Scripture about the movement of the earth before the scientists had agreed on the motion of the earth.

Actually, the Catholic Church did not oppose science directly. The church introduced the authority of Scripture at a time when the scientists were in disagreement about the movement of the earth in the solar system. The mistake of the church was to interpret the passages in Scripture about the movement of the earth before the scientists had agreed on the motion of the earth. *The lesson of the condemnation of Galileo is that Christians should not incorporate a controversial scientific conclusion into their interpretation of Scripture.* The scientists will eventually clarify the scientific situation. They have the tools to obtain the "faithful report of the senses." Christians should wait for the scientific verdict before interpreting Scripture.

Evangelicals and the Big Bang

Evangelical Christians face a problem with the ten-billion-year age of the universe and the Big Bang. Rather than face the problem of incorporating the ten billion years of the Big Bang into the interpretation of the six days of Genesis, some evangelicals have proposed a "creation science" with the six days of Genesis incorporated into the science.[9] This "creation science," then, has become a competitor with the "consensus science" of the Big Bang.

By proposing "creation science," these evangelicals cast the age controversy into a form appropriate for the "traditional" procedure for scriptural interpretation. The age controversy is no longer a question of Scripture (six days) against science (ten billion years). Rather the controversy has shifted to a disagreement between two "reports of the senses": on the one hand, "creation science" (six days); on the other hand, "consensus science" (ten billion years). Today, then, the problem of interpreting Scripture (the six days of Genesis) has been reduced to selecting the correct "faithful report of the senses."

It is at this point that some evangelicals are following the steps of the Catholic Church in its confrontation with Galileo. These evangelicals are insisting that Genesis be interpreted according to "creation science," one of the two competing "faithful reports of the senses." Hugh Ross reports many instances where scientists who believe in the Big Bang are not accepted as Christians by evangelical churches.[10]

In my own denomination, The Presbyterian Church in America (PCA), the 1998 General Assembly resolved "that the General Assembly erect an *Advisory* committee to study the exegetical, hermeneutical, and theological interpretations of Genesis 1-3 *and the original intent of the Westminster standards' phrase 'in the space of six days.'*"[11] The Committee has now reported, and in June 1999 the 27th General Assembly of the PCA passed a Resolution on Creation (see Appendix). For its interpretation of Genesis, the Resolution has chosen to follow "creation science" which incorporates a literal six-day interpretation of Genesis and disagrees with the scientific consensus on the faithful report of the senses. However, the Resolution does not specifically reject Big Bang cosmology.

The [age] controversy has shifted to a disagreement between two "reports of the senses": on the one hand, "creation science" (six days); on the other hand, "consensus science" (ten billion years).

Just as the Catholic Church did with Galileo, these evangelicals are placing the prestige of Scripture on one side of a scientific controversy. The resolution of a controversy about the "report of the senses" will only be found by using the senses. And, the scientists have the tools to sharpen the senses in the interrogation of nature. Christians must be

patient until the scientists come to agreement about "the faithful report of the senses" before interpreting a controversial passage in Scripture.

Conclusion

According to the procedure used by Christians throughout the history of the church, the interpretation of the six days of Genesis must incorporate "the faithful report of the senses." At the present time, two different "reports of the senses" are accepted by evangelical Christians: "consensus science" and "creation science." Until there is an agreement on the "faithful report of the senses," evangelicals should defer their scriptural interpretation of the six days of Genesis. Otherwise, they will be repeating the error of the Catholic Church when it selected as scriptural one of two competing "reports of the senses" to condemn Galileo. ★

Notes

[1] Steven Weinberg, *The First Three Minutes*, 2d ed. (New York: Bantam, 1984), ix.
[2] Ibid., 167.
[3] Ibid., 37.
[4] Blaise Pascal, *Pensees, the Provincial Letters* (New York: Random House, 1941), Eighteenth Letter.
[5] Arthur Berry, *A Short History of Astronomy* (New York: Dover, 1961), 170.
[6] See, for example, C. E. Hummel, *The Galileo Connection* (Downers Grove: InterVarsity, 1986).
[7] Berry, *A Short History of Astronomy*, 360.
[8] *The New Columbia Encyclopedia* (New York: Columbia, 1975), 2097.
[9] See, for example, Henry M. Morris and Gary E. Parker, *What is Creation Science* (El Cajon: Master Books, 1987).
[10] Hugh Ross, *Creation and Time* (Colorado Springs: NavPress, 1994), chapter 4.
[11] Minutes of the 26th General Assembly of the Presbyterian Church in America.

Appendix

Resolution on Creation

The 27th General Assembly of The Presbyterian Church in America made the following declaration:

1. That Genesis 1 and 2 is an historic, self-consistent, and true account of God's creation of the universe and of mankind in six days;
2. That Genesis 1 and 2 do not represent a mythical account of creation without reality in space and time;
3. That Genesis 1 and 2 represent one unified account of creation and not two accounts that are inconsistent with each other.
4. We concur with our fathers, that God made all things directly by His command. That no part of the universe nor any creature in it came into being by chance or by any power other than that of the Sovereign God.
5. That the eight fiat acts of Genesis 1 were discrete, supernatural acts, and describe the creation of all "kinds."
6. That those things created by these acts were brought into existence instantaneously and perfectly.
7. That God made Adam immediately from the dust of the ground and not from a lower animal form and that God's in-breathing constituted man a living soul, in the image of God.
8. That God made Eve directly from Adam.
9. That the entire human race, with the exception of our Lord Jesus Christ, descended from Adam and Eve by ordinary generation.
10. That each of the kinds resulted from separate creative acts, and that any genetic development is only within these kinds, thus denying macroevolution.

Essay Review

Faith in the Machine

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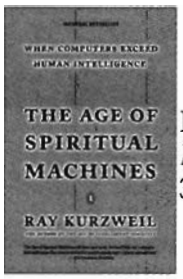

Ray Kurzweil, *The Age of Spiritual Machines: When Computers Exceed Human Intelligence* (New York: Viking Penguin, 1999). 352 pages. ISBN: 0670882178.

Most secular futurologists set out with a few plausible, but unverified, principles of development and try to imagine their consequences as far into the future as permitted by the reader's patience. Much futurology, during the past fifty years, has been developed as science fiction. With fiction, it is understood that readers will suspend disbelief, allowing authors to develop their ideas relatively unhindered by immediate factual criticism. More recently, the popular imagination has been captured by overt futurology, like Ray Kurzweil's *The Age of Spiritual Machines.* Kurzweil presents his predictions of the developments in Artificial Intelligence for the next century as factual. Judging by recent coverage in the magazine, *Technology Review,* they are taken that way. However, despite its many stimulating qualities, this book requires as much suspension of disbelief as many a work of fiction; or rather—and this is perhaps the main point—it draws upon, and promotes, faith in the ultimate triumph of Artificial Intelligence.

The principle of development Kurzweil adopts is that the power of computers will continue to grow exponentially at the current rate (usually summarized by "Moore's Law") for the next century. Now, extrapolations based on assumptions of continued exponential growth have largely been discredited in many other fields. So why should computer technology be different? Kurzweil's main argument is presented as a proposed "law" of nature.

> **The Law of Time and Chaos:** In a process, the time interval between salient events ... expands or contracts along with the amount of chaos.

One problem here is that Kurzweil's vague and shifting use of the word "chaos" leaves the reader unable reliably to concretize this law. But he helps us with two "corollaries:" (1) a "Law of Increasing Chaos," which purports to explain processes that slow down—his primary example being the universe; and (2) "The Law of Accelerating Returns," that is, "as order exponentially increases, time exponentially speeds up." Kurzweil regards this second law as explaining what he sees as an acceleration in evolution, of which computer technology is the latest form. He says: "The Law of Accelerating Returns applies equally to the evolutionary process of computation, which inherently will grow exponentially and without limit." How the undoubted fundamental limits of miniaturization are to be circumvented is left as an open question, but beyond a brief allusion to use of three-dimensional chips and longer discussions of nanotechnology and quantum computing, Kurzweil feels no need to demonstrate that there is a way to sustain the exponential growth. For him, it is a proven consequence of his Law of Accelerating Returns. Eventually the required innovations "will come from the machines themselves."

Moore's law, that the speed (and capacity) of digital computers doubles approximately every 1.5 years, has had an impressive run since it was first proposed in 1965. These thirty-five years have been

*ASA Member

the age of integrated circuits. Kurzweil argues that the exponential growth has been occurring much longer, since about 1900. His supporting data includes mechanical, electromechanical, and vacuum-tube digital computers. Within those individual technologies, the data actually shows little growth as a function of time in computing speed per dollar, but the improvements from technology to technology can be fitted by a curve of slowly increasing exponential slope.

The data becomes far less convincing, though, if one includes analog computing devices. Examples might include special-purpose computers such as the steam "governor" or a host of astronomical instruments and models, for example, the astrolabe as well as general purpose electronic analog computers or the lowly slide-rule. Analog computers were quite widely used in the mid-twentieth century to solve complicated, ordinary differential equations. They solved problems at speeds that would require a digital computer capable of roughly 100 kflops (per $1000), approximately 10^5 times higher than Kurzweil's fit to digital capabilities at that time. Kurzweil is inconsistent when he ignores such points and restricts his data to purely digital computation, because his hopes for future computational gains are based in part on non-digital algorithms. For example, he discusses specifically neural nets that can be approximated by digital computers, but which are inherently analog computers, though highly nonlinear. So only by arbitrary selection of the data does he obtain his result.

Perhaps Kurzweil recognizes that many of his readers are likely to be unpersuaded by his pseudo-scientific "laws." So he offers us his expert credentials as a further justification of his authority. He recounts a brief history of his outstanding entrepreneurial career—starting several, successful small businesses based on emerging computer technology. The book's fly leaf also lists some of his prizes: Outstanding Computer Science Book of 1990; Dickinson Prize, 1994; and MIT Inventor of the Year, 1988. Very impressive. The partial list he provides of fulfilled predictions from his 1990 award-winning book is somewhat less impressive, however, both because he does not provide the full scorecard (how many were wrong as well as right) and because some of the successes require substantial interpretation or actually have yet to be fulfilled.

Perhaps one ought rather to assess the reliability of Kurzweil's future predictions on the basis of the accuracy of his historical and scientific reporting and the logic and consistency of his arguments. Such an assessment would probably be less favorable. Examples of historical and scientific misrepresentations include:

- "The British government organized ... under the intellectual leadership of Alan Turing, with the mission of cracking the German military code ... the cracking of Enigma was enough to enable the Royal Air Force to win the Battle of Britain" (pp. 67–8). [The early Enigma cipher used by the Luftwaffe was cracked by Polish cryptanalysts in 1933, and an Enigma machine constructed by them was provided to Britain at the start of the war. So the role of the Bletchley Park team in the Battle of Britain was mostly deciphering and translating messages sent using this already cracked code. In itself, this was a critical contribution to the war effort. The U-boats used a more secure version of Enigma. It *was* cracked by the Bletchley team but not until 1943 after an Enigma cipher machine was recovered intact from a U-boat—by the *Royal Navy*, not the U.S., as portrayed recently by Hollywood!]
- "The physical world only bothers to manifest itself in an unambiguous state when one of us conscious entities decides to interact with it" (p. 114). [Recent research on Quantum Decoherence largely disproves this extreme interpretation of quantum physics.]

Examples of logical non-sequiturs or self-contradictions include:

- "The human brain presumably follows the laws of physics, so it must be a machine" (p. 5). [By this argument anything in the universe is a machine.]
- "The establishment of basic body plans of modern animals in the 'Cambrian Explosion' ... allowed evolution to concentrate on higher-level

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features such as expanded brain functions" (p. 35). [Attributing intentionality to a sort of personalized evolution—as if it said, "This is finished, now we can move on to the next task"—is logically contrary to the entire Darwinian program.]

- "Regardless of the nature and derivation of a mental experience, spiritual or otherwise, once we have access to the computational processes that give rise to it, we have the opportunity to understand its neurological correlates" (p. 151). [If we assume that computational processes give rise to a mental experience, we have already assumed its nature and derivation.]

One should also note the highly debatable assumptions inherent in all of the book, for example, that minds are nothing but elaborate computer programs embodied in biological brains, and that minds can therefore be abstracted, read out by a scanner, and re-embodied in other "hardware." Of course, this assumption is a staple of science fiction, but it is hardly an accepted fact. Or again, Kurzweil takes as inescapable the Technological Imperative—what can be done, will. This is possibly a plausible view, but certainly a chilling one.

The oft-told illustration of exponentiation recounts the servant asking his reward from the emperor in the form of a chess board with one rice grain on the first square, two on the second, four on the third, eight on the fourth and so on. This seemingly modest request turns out to be impossible to fulfil because of the gigantic numbers that the series leads to. The natural lesson is that all exponential growth curves must saturate at some point because the resources to sustain the growth are exhausted. Kurzweil tells this story and notes that the early doublings are quite manageable and it was only "as they headed into the second half of the chess board that at least one of them [servant or Emperor] got into trouble." By analogy, digital computers have experienced about thirty-two doublings of speed and capacity and "we are heading into the second half of the chessboard." Rather than draw the natural conclusion that the exponential growth must stop sometime in the not too distant future, Kurzweil prefers to imply that the wonders of artificial intelligence will be the result. He says: "This is where things start to get interesting." The perverseness of this conclusion, like much of the book, reveals more about the world view of artificial intelligence enthusiasts like Kurzweil than it does about what will actually happen with computing in the next century.

There will undoubtedly be further large cumulative increases in computing power before the exponential curve saturates. Also, many fascinating and useful applications will arise that draw on this increased capacity. It may be that computers will pass the Turing test and come to be perceived as possessing intelligence. But, regardless of whether or not this happens in the next quarter century, as Kurzweil predicts, I predict that the artificial intelligence enthusiasts will be as unshaken in their convictions as they were by the disappointment of their early artificial intelligence expectations. The reason is that their convictions rest not so much on sober scientific or historical analysis as on faith in their particular, highly reductionist world view. This faith is, I suspect, as resistant to critical argument as the most fundamentalist religion. Given the ascendancy of computer technology at present, many people believe this faith is justified. But faith it is, not scientific fact.

In the end, then, *The Age of Spiritual Machines* is best seen not as factual or fictional but as a work of popular apologetics supporting the artificial intelligence faith. For all its faults, it is an engaging exposition of that faith, complete with heroes and martyrs, mysticism and humanitarianism, pride and prophecy. Time will tell whether there is any substance to its more apocalyptic visions.

In the meantime, the Christian church badly needs to do its homework. Worked-out theological understanding of the meaning of intelligence, the spiritual significance of apparently intelligent machines (if and when they are built), and the ethical dilemmas that may arise in that situation are almost non-existent. Perhaps it all seems too hypothetical to attract the interest of orthodox Christian theologians. Perhaps the Christian professionals in the computer science field are already stretched too thin to sustain this discussion. Perhaps the Lord will return before this all becomes important. But perhaps not. In any case, we need a response today to give to the artificial intelligence apologists that is more than merely incredulity. Much of what they predict is surely fantasy, and will not come to pass. But many of their imaginings are already in the process of becoming practical. How shall we answer the artificial intelligence apologists? And when it comes to the significance and ethical challenges of machine intelligence, how are we Christians to welcome the good and oppose the evil? ★

Book Reviews

Environment

EARTH RISING: American Environmentalism in the 21st Century by Phillip Shabecoff. Washington, DC: Island Press 2000. 240 pages, index. Paperback; $24.95. ISBN: 1559635835.

Shabecoff is a freelance writer based in Newton, Massachusetts. He worked as a reporter for *The New York Times* for thirty-two years, and was founder and publisher of *Greenwire*, an environmental news daily. He is the author of *A Fierce Green Fire* and *A New Name for Peace*. In 1990, Shabecoff was awarded the American Library Association's James Madison Award for leadership in expanding freedom of information and the public's right to know. He is a committed environmentalist, and this volume is directed at the converted. It is a brief history of the movement in the United States, a perceptive analysis of its shortcomings, and a set of recommendations for future work.

After the first Earth Day in 1970, there was a large surge in environmental concern and memberships in activist organizations. Then the Reagan years, a time of official hostility toward environmentalism, pretty well killed the whole effort. Currently the movement is largely ineffectual, highly fragmented, and disputatious. Times such as these occur in all large concept movements—Christianity has experienced a few of them. There is basic agreement on fundamental principles and goals but a willingness to fight to the death over the details. One of Shabecoff's most insistent recommendations is that Balkanization must end if environmentalism is ever to be a force.

He notes that many have considered the Judeo-Christian tradition as a major cause of the current sorry state of the world. He also asserts that a very important requirement of a revitalized movement is to develop a new moral center for people throughout the nation and the world. Shabecoff comments favorably on some new activities in the religious community, e.g., the National Religious Partnership for the Environment as well as new developments in theology as outlined in the recent series of conferences sponsored by the Harvard Divinity School. Thus, he urges environmentalists to reach out to the religious community. But since there is mutual suspicion between environmentalists and Christians, the reaching out should be mutual. The only way the world will be saved is by the involvement of the people of God. "The movement needs to reignite the transcendental fire, to rededicate itself to the beauty and sanctity of this planet."

Another of his recommendations is a major restructuring of the world economy so that it becomes an instrument for solving human needs rather than oppression. As the Western world is by far the greatest per capita polluter, this may be achieved largely by some revenue neutral tax shifting in the U.S. and Europe, from things that are "good" (income, employment) to things that are "bad" ($C0_2$ or methane or other emissions). It is also necessary to crush the obscene level of consumption in the West. Cornell economist Robert Frank proposed a steeply graduated tax on consumption, defined as the difference between income and savings. Many specific adjustments can be made, each of which will help. Fundamentally, however, a massive redistribution of wealth between rich and poor, both intra- and internationally, must occur or the environment will certainly be driven to collapse. If a new industrial revolution were to occur in the developing world, something like three earth-size planets would be required to support a Western level of consumption for the entire population. As long as personal and corporate greed constitutes the dominant ethos, such redistribution will not occur. The elimination of this behavior is neither simple nor trivial. All individuals must accept the principle of "sufficiency."

One of Shabecoff's more (likely to be) controversial recommendations is that environmentalism should direct the course of the scientific enterprise as well as make use of its results. He quotes Jane Lubchenco, past president of the American Academy for the Advancement of Science. Her new "social contract" calls for the scientific community to urgently address the unprecedented environmental and social changes caused by human activity on the planet. The first assumption of this contract is that scientists will address the most urgent needs of society in proportion to their importance. Although a noble thought, it seems more unlikely than eliminating greed due to the long- term entrenched tradition in science that promotes specialization.

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THE VIRGIN AND THE DYNAMO: Use and Abuse of Religion in Environmental Debates by Robert Royal. Grand Rapids, MI: Eerdmans, 1999. 271 pages. $25.00. ISBN: 0802844685.

"Nothing is farther from the common people than the corrupt desire to be primitive," according to Santayana. This is one of the essential themes of this book. Despite the romantic notions of many, nature is not intrinsically benign, either to humans or to other creatures. People who have experienced it *do not want* to live in "a state of nature." Humans affect the environment, but the environment also affects humans. It has done so throughout human history, often to human detriment.

In the first three chapters, Royal notes that the Bible clearly makes humans not only part of nature, but also responsible for it. For him, the biblical position goes further. Humans are responsible for minimizing the adverse effects of unbridled nature on their neighbors. Human control of the environment is desirable insofar as it serves to protect and serve other humans, and careful study of the environment is required to ensure that such control is wise. But humans *will* control and influence the environment, e.g., by slash-and-burn agriculture, whether they want to or not. Such influence is part of human nature no less than it is part of beaver nature to flood forests, or part of the nature of leaf-cutter ants to kill trees by defoliation. God's gift to humans is the ability to think about and plan the influence they invariably will have. The fact that they are not always wise in their interactions with the world is a reflection of the fallen state of humanity rather than the intrinsic undesirability of human authority over nature.

Most of the book, entitled "Some Case Studies," is a brief overview and dissection of several religious and non-religious approaches to the environment. Naturalism is quickly disposed of, leading to a one-sided view of the world as a mechanistic, tunable Dynamo, which can be controlled, modified, or even plundered at will for immediate human benefit. Royal spends more time with religiously based environmental ideas that see nature as the Virgin and (white, Western male) humanity as a rapist who criminally defiles the Great Mother.

Royal's first concern is to point out heretical theology and confused ethics which follow from—or are the basis for—various environmental positions. He does not fully engage any of these positions, but does show that inadequate theologies can lead to errors on both ends of the political spectrum.

Orthodox theism is seen as the best defense against environmental extremism of the left or the right. Royal directs most of his criticism at the "Virgos" of the radical left, which view the world and economics as a zero-sum game. He seems to believe that Dynamists, whether *laissez-faire* capitalists or classical Marxists, have their hearts in the right place even if their solutions are one-sided.

Royal gives respect where it is due. Nevertheless, he loses his temper often, and a better editor was required to keep him in check. He exposes many idiocies, but often does not properly address them because he considers them beneath refutation. He forgets that those to whom the idiocy is not obvious require persuasion rather than sarcasm. This led to a savaging of his book by *Booklist*: "Royal introduces quite a variety of contemporary thinkers by name, even as he fails to engage them."

The first three chapters are reasonably good; the next several are only partly focused attacks on a variety of left-wing environmental positions. The conclusion, "What did you go out into the wilderness to see?" is not entirely coherent and does not summarize well. It could and should have done a better job of restating the book's thesis.

I found Royal's book entertaining, mostly because I largely agree with him. While I do not think the review by *Booklist* (see the amazon.com listing for this book) was entirely fair, I do think it was deserved because of the shallow level of much of the argument. If you can read only one book on Christian approaches to the environment, this is not it.

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

HARD GREEN: Saving the Environment from the Environmentalists, A Conservative Manifesto by Peter Huber. New York: Basic Books, 1999. 204 pages, index, endnotes. Hardcover; $25.00. ISBN: 0465031129.

Huber, a senior fellow at the Manhattan Institute and a *Forbes* columnist, holds an engineering degree from MIT and a law degree from Harvard. He has taught engineering at MIT and has served as a law clerk for Justices Ruth Bader Ginsburg and Sandra Day O'Connor. Huber wrote this book as a response to the modern environmental movement. In his opinion, the "Soft Greens" base their policies on bad science and even shakier economics. The bad science is a result of their dependence on unverified computer model predictions of the far future. The

Soft Greens predict a "sandpile collapse" for every complex system. In cases where their predictions have been verifiable, the Softs have been wrong. Soft Green economics is based on the Malthusian Scarcity Theory, that is, eventually the Earth's resources will be used up and the population will catastrophically collapse. The Hard Green denies the economics of scarcity. "Hard economics affirms that consumption does not presage exhaustion; the demand side of a market tells us nothing about the future of the supply side."

Soft Greens believe that by promoting efficiency in markets, demand will be lowered, thus reducing consumption and saving the Earth's resources. Huber points out that efficiency does not reduce demand, it only transfers demand to other markets. Drinking diet soda, for example, allows a person to eat chocolate brownies. Overall consumption is not reduced. He points out that, in fact, we have empirical evidence of this phenomenon in economics. As economies become more efficient, consumption rises. The American economy is an excellent example.

Rather than pursuing a vain quest for efficiency, Hard Greens propose to preserve the environment in a radically different way: private and government conservation of land, rivers, and oceans. Huber says that government involvement in markets is inefficient and counterproductive. Instead, he argues that government's legitimate role is to purchase large tracts of land and allow no economic development of that land for aesthetic reasons. This was Theodore Roosevelt's original National Park idea.

Huber says that the Soft Green makes the mistake of mixing categories. Nature is worth preserving simply because it is inherently valuable, not because it has potential for future economic success. To preserve nature most effectively, the areas preserved must have clearly defined boundaries that everyone can see and respect. Ordinary people can understand how setting aside parks for conservation preserves the environment, but it is difficult for them to see how specifying the efficiency of their toilet tanks does.

The great beauty and elegance of the Hard Green position is that it is understandable to common people and, therefore, has a greater chance for success in the political arena. I found Huber's case quite convincing in the big picture, but slightly weak when addressing issues such as trace contaminants causing large environmental consequences in the food chain. Overall, however, I think Huber's Hard Green position should be studied and, in many cases, adopted. It is a common-sense approach to preserving God's good creation. Though Huber's arguments can at times be redundant, they are consistent and coherent.

Reviewed by David Condron, Senior Engineer, Naval Surface Warfare Center, Dahlgren, VA 22448.

Ethics

THE REPRODUCTION REVOLUTION: A Christian Appraisal of Sexuality, Reproduction Technologies, and the Family by John F. Kilner, Paige C. Cunningham, and W. David Hager, eds. Grand Rapids, MI: Eerdmans, 2000. xvi + 290 pages, index. Paperback; $20.00. ISBN: 0802847153.

Kilner is director of the Center for Bioethics and Human Dignity. He has authored or edited many books in this field. This book lists thirty contributors, only one from outside the U.S. Among them are academics, lawyers, physicians, a nurse, and officials of the Family Research Council and the National Women's Coalition for Life. The book does not seem to have been the result of a conference, but some authors had access to chapters written by others.

As the subtitle suggests, *Reproduction Revolution* covers a lot of ground. There are sections on reproductive difficulties, foundational issues (a study of Viagra, a study on the moral status of embryos), specific technologies (donor gametes, surrogate motherhood, cloning), difficult cases (a hypothetical case analyzed by five different persons of a surrogate mother who wishes to have an abortion, a "Debate on Whether or Not the Birth Control Pill Causes Abortions"), the sexual revolution, and "Other Proactive Responses."

One weakness of the book is that there is only one real debate included. Too much of the book presents a view as correct, without considering other viewpoints. For example, in *A Child of One's Own: At What Price?* Gilbert Meilander argues as follows:

> Imagine a case in which a married couple seeks donor insemination because of the husband's infertility. Some might say, of course, that the child whom they produce is, at least, genetically related to the mother—it is *her* own, even if not also *his* own in the same sense. And for Christians that is exactly the cause for worry. The child is to be *theirs*, not *his* or *hers*. The deliberate and willed asymmetry of relation—so like the mutual symmetry that exists in adoption—is precisely the problem (p. 42, emphasis in original).

For some inexplicable reason, Meilander does not even mention the circumstances of Christ's birth here. True, Mary and Joseph did not *will* to have Christ, but God entrusted his Son to an asymmetrical family, Joseph not being his biological father. This suggests that asymmetry might not be as big a problem as Meilander thinks it is.

Robert W. Evans, in "The Moral Status of the Fetus," states:

> It is most plausible to hold that the image of God is imparted to human beings at the beginning of the process of fertilization, and that the right to life is, therefore, conferred at the initial moment of conception (p. 75).

To his credit, Evans does recognize that, biologically, fertilization is a process that takes several hours. But Evans does not consider the question of identical multiples. If identical twins separate at a stage in which there are several cells, when is the image of God imparted to each twin? Did the unsplit embryo also have the image of God? (The best answer, of course, is that we do not know.)

Nowhere does the book discuss Ex. 21:22–23. One possible interpretation of this text is that an unborn fetus was not given personhood status.

Another weakness is that there is little sense of history. For example, Christians used to object to anesthetization during delivery. Is it possible that some objections currently raised by Christians, e.g., about cloning or surrogacy are really resistences to new things, not defenses of scriptural principles, and thus will be accepted by most Christians at some time in the future?

Although I have pointed out what I consider to be the book's weaknesses, it has strengths. Some fascinating chapters included are: the debate on the pill noted above; a chapter on what Viagra tells us about the goals of medicine; and a chapter on what the sexual revolution has done to us, especially what it has done to teenagers. Gracie Hsu Yu contributed a chapter on changing public opinion about abortion, not by passing anti-abortion laws or by demonstrating in front of abortion facilities, but by appealing to people's hearts. Apparently this approach is having some real success, and not just among Republicans.

All Christians seriously concerned about a wide range of bioethical issues should read this book.

Reviewed by Martin LaBar, Professor of Science, Southern Wesleyan University, Box 1020, SWU Box 455, Central, SC 29630.

THE BODY OF COMPASSION: Ethics, Medicine and the Church by Joel James Shuman. Boulder, CO: Westview Press, 1999. 216 pages, index, notes. Hardcover; $25.00. ISBN: 0813367042.

Shuman, a visiting instructor of theological ethics at Duke University Divinity School, undertakes an ambitious treatment of contemporary bioethics. Highly critical of the direction modern medicine has taken in distancing itself from humanity by treatment of disease and deformation rather than treatment of persons, Shuman argues that the problem lies in a lack of understanding of a "teleological concern for the body." For Christians, he says, a body does not belong only to the individual, but is actually one with the community of believers. He proposes a new ethical standard for Christians, one that includes specifics on how we should care for, and receive care from, one another.

The book has four sections and an "afterword." The first sections, which treat current bioethics, are organizationally challenged. While they contain much valuable information, I was convinced, by the time I was halfway through the book, that my review would be unfavorable. But the third and fourth sections, in which Shuman discusses the theology and the practical aspects of Christian caregiving, are superb. In many ways, he echoes the concerns and practices of the Stephen Ministry, an interdenominational service with headquarters in St. Louis, which has taught the concepts of Christian caregiving to over 6,000 congregations in the past twenty years.

Shuman says the caregiver must exercise three virtues: respect, hospitality, and patience. The care receiver, in turn, must also exercise certain virtues, including dependence and constancy. The discussions of these virtues, ones often unknown in the practice of medicine today, constitute a major part of these two sections. Shuman thinks that these virtues "must confront and transform efficiency (technical expertise) when efficiency claims that the capitalist market and its attendant utilitarian logic are the most legitimate vehicles for determining the particulars of care of who receives care, and how much, and of what kind" (p. 155). There is not "a cancer" in room 317; Jane Smith, who is suffering from cancer, is in room 317. Jane is a real person. She needs love and care, treatment for her cancer, and concern for her loved ones.

Shuman ends with these words, which ring: "[I] began trying again, perhaps a little more seriously, to be a faithful member of a people who will care for one another as we would care for Jesus himself as we wait for that day." I recommend this book to my

ASA colleagues who care about these issues. Wade through the first half. Let the second half speak to your heart.

Reviewed by John Burgeson, Stephen Minister, First Presbyterian Church Durango, CO 81301.

Faith & Science

SCIENCE AND THEOLOGY: The New Consonance by Ted Peters, ed. Boulder, CO: Westview Press, 1999. 241 pages, notes, index. Paperback; $26.00. ISBN: 0813332591.

Peters is professor of systematic theology at Pacific Lutheran Seminary and the Graduate Theological Union in Berkeley, California. He chose fourteen scholars to contribute essays to the volume. The contributors consist of six scientists, five theologians, and three with expertise as both scientists and theologians (John Polkinghorne, Robert Russell, and George Coyne).

Peters asserts that in his view of past history, there have been eight ways that science and theology have battled and made peace: (1) *Scientism*, there is no room for God; (2) *scientific imperialism*, knowledge of the divine comes only from scientific research; (3) *ecclesiastical authoritarianism*, God's revelation through the Pope is authoritative over science; (4) *scientific creationism*, espouses a young earth and geological formations due to Noah's flood and denies evolution; (5) *the Two Language Theory*, science and religion are separate domains with no overlap, and no cross-communication is possible; (6) *hypothetical consonance*, the "God" question can be honestly asked from within science; (7) *"Ethical Overlap Theory"* arose initially from the ecological challenge to civilization; and (8) *new age spirituality*, based on meta-religious naturalism. This book seeks to discuss the sixth approach.

The twofold purpose of the book is: (1) to present the ideas of the other invited contributors to explore the presence or absence of a *spiritual dimension* to the natural world as discerned through the scientific enterprise; and (2) to explore the mutual interaction between disciplines in the *growing field* of Theology and the Natural Sciences.

In the Introduction, Peters states: "This book is an exploration in *hypothetical consonance*—that is, an attempt to uncover the domain of inquiry shared by science and theology." Peters asserts *"hypothetical consonance* makes the assumption that there is one God and one cosmos." The book is divided into two parts: Part I, "Physics and Faith"; and Part II, "Evolution, Ethics and Eschatology." Overall, the five essays in Part I meet the purpose of the book. The essay by Russell is the weakest, in my opinion. The other four essays, written by Charles Townes, Polkinghorne, Paul Davies, and Nancey Murphy, emphasize that scientists do their work based on the view that the universe is intelligible. Reductionism fails to explain the results of scientific effort.

All nine of the essays in Part II are, in my opinion, fairly weak in meeting the purpose of the book. Starting with a naturalistic world view (nature is all there is), these essayists (except John Paul II and Coyne) strive by inductive reasoning to see where God, assuming there is one, could fit in. I think this approach is doomed to failure. One essayist tried to find a little "wiggle room" for a God to act in Heisenberg's indeterminancy principle! The best that can come from this approach is either pantheism or panentheism. Many of the essayists do not like the idea of a God who "intervenes" in the regularity of nature.

A virtue of this book is that it has succeeded to some degree in getting scientists and theologians to "talk to each other." We could use a lot more of this in the new millennium. A major weakness in the book is failure to define four key words: *theology, God, science,* and *evolution.* If someone chooses to edit another volume with the same general purpose as this one, I would strongly recommend that these four words be clearly defined and agreed upon at the outset. Most ASA members should enjoy reading the book.

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

SEDUCED BY SCIENCE: How American Religion Has Lost Its Way by Steven Goldberg. New York: New York University Press, 1999. 220 pages, index. Hardcover; $27.95. ISBN: 081473104X.

Goldberg, a lawyer and an award-winning author, teaches in the areas of law, science, and values at Georgetown University Law Center. In this book, he argues that religious leaders, in an effort to gain wider acceptance for religion in a secular world, are accepting science as the dominant ideology and looking for empirical verification of religious phenomena. By contrast, Goldberg suggests that if religious leaders made better use of their religious

freedom, they could regain their independence and return to their advocacy of central moral concerns.

The book is divided into three sections. In the first section, Goldberg provides three examples of "religion's flirtation with science" (p. 5). In the debate over the patenting of the human genome, many religious leaders have argued that patenting is wrong because our genes define who we are. Goldberg argues that such a materialistic and deterministic position is contrary to and inconsistent with a religious world view. Similarly, he argues that efforts to link biblical texts with scientific explanations of our origins not only attempt to test God, but imply that the status of sacred texts will be elevated through scientific verification. With respect to the healing power of prayer, Goldberg is concerned that as medical evidence for its efficacy increases, prayer will lose its religious significance altogether and take its place in the therapeutic arsenal along with aspirin. Through these examples, the author demonstrates quite convincingly that in an effort to be more scientific, religion is becoming less religious. Faith, values, and transcendence are being sacrificed for empirical testing, instant results, and ideological compliance.

In the second section, Goldberg tries to explain how the Constitution provides a freedom for religious expression and involvement in the public square that, if properly understood and applied, would allow religious leaders to escape the restrictions of the scientific world view and speak openly about their own priorities. One chapter contains a description of how free speech and due process provisions not only permit religious arguments to be used in public debate, but also provide for the establishment of religious schools. Goldberg then devotes one chapter to each of the two religion clauses of the First Amendment, namely, free exercise and nonestablishment. In these two chapters, both of which contain a significant amount of case law, issues such as religious doctrine, prayer in schools, and state recognition of religious holidays are discussed. A fourth chapter devoted to the relationship between religious values and law examines issues such as Sunday shopping and abortion. Goldberg's argument throughout this section is not only that "it is perfectly lawful and legitimate for religious values to play a role in shaping legislation" (p. 55), but that science even when used to support a religious position is never going to solve a moral issue.

The objective of the final section of Goldberg's book is to argue that "religion can introduce a sense of humility, faith, and values to our public discourse" (p. 8). Partly because of its prescriptive quality, but also because of the author's deep concern for values education and the precedence of morality in decision-making, this section is unfortunately the weakest in the book. However, the cautionary flag waved throughout the final chapters and the author's plea for humility in the face of religious tradition and scientific accomplishments clearly demonstrate a deep understanding and concern for the future of humanity. The practical advice that readers need in order to apply Goldberg's ideas is contained in the first two sections.

I enjoyed this book and I would recommend it to all those interested in the relationship between religion and science and between church and state.

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

THRESHOLD 2000: Critical Issues and Spiritual Values for a Global Age by Gerald O. Barney. Arlington: Millennium Institute, 1999. 158 pages, graphs, tables, references, notes. Paperback; $13.95. ISBN: 0963789732.

Threshold 2000 offers a "powerful invitation to reflect deeply on the critical issues facing the world." It helps society face up to a profound choice at the millennial crossing: (1) to continue on the path of present beliefs and policies to an increasingly crowded, polluted, and vulnerable world; or (2) to take the path of hope to a more sustainable, healthy, and secure global community. The unique feature of this book is its impassioned integration of ecological analysis with the search for spiritually informed values. *Threshold 2000* offers both a challenge and a vision to people of all faiths and those of no faith.

Barney's work includes all the analysis of *Global 2000 Revisited*, first published for the 1993 Parliament of the World's Religions in Chicago. The audience for this analysis is the world's spiritual leaders; the theme resonates on a quest to define what role religions can play, singly and collectively, in dealing with the challenges and opportunities of our extraordinary age.

The new millennium has come and gone. Barney is concerned with an effort to set a path for the future, a timeless venture. This book points the way to an extensive dialogue between "secular issue" experts and spiritual leaders of all faiths, with a focus on the universal need to promote a culture of peace.

This smartly developed book of both heuristic and equally impressive subjective analyses con-

cludes with a charter that defines an "inspiring vision of the fundamental principles of a global partnership for sustainable development and environmental conservation." It calls for a radical change in humanity's attitudes, which will produce concern for balancing science and technology while maintaining the environment. Additional concerns include the need to secure human rights for everyone as the foundation of freedom and justice and to practice nonviolence in order to be an instrument of peace.

Reviewed by Major Dominic J. Caraccilo, 1212 Whisperwood Drive, Columbus, GA 31907.

SON OF THE MORNING SKY: Reflections on the Spirituality of the Earth by Benjamin W. Farley. Lanham, MD: University Press of America, 1999. 232 pages. Paperback; $29.50. ISBN: 0761815155.

Farley is the Younts professor of Bible, religion, and philosophy at Erskine College in South Carolina. This book is a series of thirty essays, most of which could be read separately. Chapter titles include "The Appalachian Knobs," "Arcadia and the Homeric Gods," "The Phenomenon of Religion," "The Courage to Be," "Religion and Silence," "Sexual Love," "Villemétrie," "The Anasazi of the American Southwest and the Hopi Worldview," "Eden in Paris," and "The Son of Galilee." There is a selected bibliography. The appendix contains some of Farley's poetry, *Poems of the Knobs*, which, also being a son of the South, I found beautifully evocative and quite moving.

Repeatedly Farley insists that religious people must accept the findings of science and that theology must be compatible with science. He does not critique the logic of science or any of its results, and this led him seriously astray in chapter 14, "The Descent of Man." There he has accepted the assertions of Richard Leaky with regard to human evolution. Specifically, the taxon for which Leaky held so much hope, *Ramapithecus*, has been voted out of existence. The consensus view now is that *Ramapithecus*, which has small canines, is simply a female *Sivapithecus*, which is considered to be ancestral to the modern Orangutan. The problem is—and Farley had no way of knowing this without reading the journals (which some consider a single step above hell)—that in hominid paleontology what is true today is false tomorrow, and vice versa. Also at the time he wrote, Leaky argued, based solely on canine size, that *Ramapithecus* was a biped and a tool maker, for which there is, was, never has been, and never will be a scrap of evidence. There are other discussions of scientific issues which, being out of my field, seem correct by my limited understanding.

But the book is not about science. As much as anything, it is the story of a North Carolina farm boy's journey into faith and his dependence on the natural world for periodic restoration and revivification. Academically the journey went from forestry to theology, to a monastery in France, a kibbutz in Israel, and back. Even while knowing that the earth is his home, he recognizes home by the red clay hills and forests of the Carolinas. The book's strength—its extraordinary, brilliant, poignant, thrilling strength—is in the very personal witness of God's presence in the world. This is a message that desperately needs to be declaimed and incorporated into the ethos, especially in the Western world, if there is to be any hope of salvation for the world. Christians frequently display a tendency toward concern for personal salvation at the expense of the rest. This is God's world and Farley knows it and, without ever scolding, he powerfully delivers the message that all creatures that use DNA are brothers, or at least kin. Make no mistake: He is a Christian; one is never in doubt about that though some will, no doubt, accuse him of paganism. He is a man I would very much like to meet and take a hike with. He has written a book that I prize and will definitely re-read.

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

THE WEDGE OF TRUTH by Phillip Johnson. Downers Grove, IL: InterVarsity Press, 2000. 188 pages, endnotes, index. Hardcover; $17.99. ISBN: 0830822674. (See ad in *PSCF* 52:3 [September 2000]: 159.)

Johnson requires no introduction to the readers of this journal. His fifth book takes aim at the metaphysical roots of naturalism and materialism, discussing these roots in biology, theology, psychology, and the power politics of modern society as observed in the Kansas Board of Education decision to remove evolution from the standards. His major point over and over is that scientists are overstepping their data by declaring that science has proved God to be an irrelevancy. In this book, he outlines the wedge strategy his movement intends to use to "get the right questions on the table."

Prior to reading this book, I feared that there would be the usual plethora of factual mistakes seen

in many of his earlier books. While there were some egregious examples (in his Dembski influenced treatment of information theory), in general the book remained in the realm of philosophy and attacked the metaphysical basis for naturalism. Thus, Johnson made the book difficult for a Christian to ignore.

Johnson's plea, that God should be part of the objective universe and not relegated to some imaginary place in reality where he can do no mischief, struck a strong chord with this Christian. Johnson is correct that if God has no place influencing the objective world, how can we understand the incarnation? But this plea is a double-edged sword that Johnson and his Intelligent Design (ID) colleagues have totally failed to understand. If the ID group wants God to be an active agent in the modern world of objective reality, then the ID group is obligated to explain exactly how God influenced the development of life, when God did these items and what materials he used. They need to offer a coherent scenario matching objective reality with God's actions.

But, as Mark Ptashne noted at The Nature of Nature Conference, each member of the ID group offers mutually exclusive solutions to this problem. And in this book, while decrying that evolutionists cannot explain things, Johnson continues to avoid applying the same standard (the other side of the sword) to his own agenda and movement.

Johnson also strikes a deep chord when discussing the origin of the soul. If the soul does not exist or is entirely an epiphenomenon of material complexity, then what is to become of the Christian theology of an afterlife? Johnson rightly argues that those who see our humanness as nothing but the development of a particular circuit in the brain have little to offer in way of explanation for appreciation of beauty or, in our obvious human need, moral values and justice. I find it extremely difficult to see how natural selection can evolve a sense of artistic or even religious feeling. Of what value is art appreciation to survival?

Johnson is at his best and most resonant when he discusses his theological reasons for rejecting naturalism. He quotes John 1:1: "*In the beginning was the Word ...*" as a reason Christians should hold that intelligence and soul are prior to the material universe. What Christian can disagree?

His discussion of the theological modernist is also interesting as he defends a cognitive territory for Christian revelation and teaching. He rails against those in science who wish to relegate religious thought to the realm of the fairies and fantasies, having no connection with objective reality. If that is the place of Christian revelation, we should all go fishing on Sunday.

One of the poorer sections of the book is his treatment of the Kansas Board's decision on evolution. He painted the issue as one of the masses rising up in arms against the educational and scientific elite to bring down the restrictions placed upon them by the scientific nobility. The evil nobility, played by the scientists, were oppressing the people (played by the Board of Education). He waxed jubilant about this decision and one could hear the boos and hisses for that evil scientific nobility. It was wonderful melodrama.

Unfortunately, for Johnson's case, I was reading this chapter the day after the *people* of Kansas rose up and voted all those creationist board members out of office. It seems that the reality is that the three board members were imposing their views on the majority of the Kansans, who refused to play the part scripted by Johnson.

The biggest flaw in the book is the way Johnson treats his adversaries and the way he paints his own horse and hat white. Johnson, the nonscientist, has always viewed the scientific endeavor as being one in which the scientific emperors dictate what the lesser luminaries will believe. And then in the chapter entitled "The Empire Strikes Back," he paints himself as a Quixotic character on a white horse who will bring about the demise of this hated system, which he repeatedly says will fall any minute now. This is a prediction he has made for over ten years, and one must wonder where the evidence is for this impending doom of evolution and why Johnson, who demands evidence from the evolutionist, offers none for this prediction.

All in all, this is an important book and those involved in the creation/evolution issues should read it, indeed, own it. For all his faults, Johnson is a major player in this area and what he says will have a big impact. It is a pleasurable read but it would have been more pleasurable if, upon demanding historical explanations from his opponents, Johnson had actually offered some detailed explanations from his perspective for what God actually did in the world. That is what would achieve his goal of making God part of the objective universe.

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

GOD'S CONTROL OVER THE UNIVERSE: Providence, Judgment and Modern Science by P. G. Nelson. Whittles Publishing, 2000. 77 pages, bibliography, index. Paperback; $9.00, inc. airmail delivery. ISBN: 1870325885. (See ad in *PSCF* 52:3 [September 2000]: 189.)

Nelson is a chemist on the faculty of the University of Hull and a lay preacher. This is not his first book dealing with science and faith; his other books include *Big Bang, Small Voice* and *Reconciling Genesis and Modern Science.*

This book began as a paper published in the November 1988 issue of *Science and Faith,* the newsletter of the RSCF (the British equivalent of the ASA) and reflects the concise style of journals. The book is arranged in nine chapters; references to the literature are given as footnotes. Several of the concepts are illustrated by line drawings.

Nelson's thesis is that the biblical and scientific pictures of the world do not conflict with each other as much as they might appear. He takes as given that the world is as science describes it and that God is as the Bible describes him. He does not look for flaws in the scientific description as evidence for God's role in the creation and preservation of the universe. He argues that science can never prove that the world arose of itself without a creator. For one thing, scientific observations are limited by time. There is no way science can prove that time has always existed.

Scientific models that describe the world as operating totally by natural laws also do not bother Nelson. He gives several examples to show that all scientific models leave room for chance. To him chance is analogous to a golf ball being hit so that it stops exactly on the crest of a hillock. The smallest breeze in either direction will determine whether the ball continues over the hillock toward the green or returns to the golfer. No one can ever know whether the little puff of wind that moves the ball is from chance or from God.

Nelson has done his homework. The volume of scientific literature surveyed in this short volume is staggering. A single chapter may cite twenty to thirty scientific laws or theories. Nelson claims that all technical terms are explained and that his intended audience is "as large an audience as possible." This is true; I did not find undefined terms. Nevertheless, because he covers so much material in so few pages, the reader needs a pretty good background in science to follow Nelson's arguments.

I recommend this book. Nelson's approach to the creation and preservation of the universe is refreshingly upbeat. Readers will gain a good overall view of the current position of scientists with regard to the origin and nature of the universe. They will also see how a scientist with faith can resolve many apparent contractions. This approach goes a long way in preparing ordinary Christians to "give a reason for the hope that is in them."

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

History of Science

WESTERN ATHEISM: A Short History by James Thrower. Amherst, NY: Prometheus Books, 1999. 157 pages, bibliography, index. Paperback; $14.95. ISBN: 1573927562.

The intellectual status of "unbelief" rose significantly in Western Europe as a result of the clash in the Middle Ages between the powerful force of faith and the emerging but still limited influence of reason. Thrower, a professor of the history of religions at King's College at the University of Aberdeen, Scotland, offers an account of unbelief—"the naturalistic alternative." *Western Atheism: A Short History* examines the thinkers (Nietzshe, Epicurus, Philo, Drachmann, Dostoyevsky, Aristotle, and Ayer) and schools by illustrating the leading issues separating the theist from the atheist and agnostic. It sheds light on world events and inconsistencies inherent in supernaturalism and theistic theories.

Exploring a premise that atheism is far from strictly a modern phenomenon, Thrower, who also taught at the universities of Ghana, Durham, Leningrad, and Gdansk, conveys that the thinking of "a world stripped of the divine" is nearly as old as Western thought itself. Furthermore, Thrower discusses "atheism both as a reaction to belief and as a separate and consistent form of belief" apart from theism. He thinks that reason, science, and humanity's endless search for knowledge were the catalysts for the transformation from "disbelief" as a predominant opposition to the religious outlook to "unbelief," a world view independent of all religious interpretations.

Western Atheism explores the thought that deliberate denial of the existence of a Being, who is responsible for the activity of nature and for the course of history, presupposes a systemic analysis

and explanation of natural and historical phenomena as the necessary effects of existing uncreated causes. In short, it is an appeal to ensure that scholars understand that, much like theology, atheism can no longer operate simply within the parameters of Western tradition.

Reviewed by Major Dominic J. Caraccilo, 1212 Whisperwood Dr., Columbus, GA 31907.

THE JESUS PAPYRUS by Carsten Peter Thiede and Matthew D'Ancona. New York: Doubleday, 2000. 206 pages. Paperback; $12.95. ISBN: 0385488898X.

This book affirms a topic very important to evangelical Christians, that is, the trustworthiness of the New Testament. How? It presents evidence that the Gospels were written earlier than critics have assumed, thus eliminating a period of time during which myth and legend might develop and become part of the New Testament. Thiede and D'Ancona make accessible to everyone the story of a manuscript discovery, its implications for dating the Gospels, and what it tells about early Christianity.

The story begins in 1901 when Charles B. Huleatt purchased in Luxor, Egypt, three papyrus pieces of a New Testament manuscript. They were dated by scholars to around C.E. 200. Eventually he donated these to his alma mater, Magdalen College in Oxford, England. They elicited little attention until nearly one hundred years later when Thiede, on the basis of careful reevaluation, dated these three, small papyrus pieces to C.E. 60.

The public first heard of Thiede's reevaluation of these papyrus pieces in an article that appeared in *The Times of London* on December 24, 1996. (D'Ancona is a journalist for *The Times*.) The Jesus Papyrus (as they came to be called) is a recounting and elaboration of the discovery and significance of these three scraps, which Thiede believes are from Matthew 26. This book claims that Matthew wrote the gospel bearing his name, that he wrote it within a generation of Jesus' death, and that the gospel stories are true.

Thieve and D'Ancona discuss some of the myths of New Testament criticism, present an overview of the science of papyrology, and summarize the discovery, dating, and significance of what is now called the Magdalen Papyrus or the Jesus Papyrus. If Thiede is correct in his dating of these papyrus scraps, support is added to the view that the Gospels and much of the tradition surrounding them is true. It also takes away from the John Rylands' fragment of John the distinction of being the oldest extant piece of the New Testament.

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

CARL SAGAN: A Life in the Cosmos by William Poundstone. New York: Henry Holt and Company, 1999. 473 pages. Hardcover; $30.00.
ISBN: 0805057676.

Sagan was probably the best-known scientist of the late twentieth century. When he died in 1996, *Science* hailed him as "the greatest popularizer of the 20th century." In addition to his many accomplishments as a "serious scientist," he was author of several best-selling books, one of which won him the Pulitzer Prize in 1978; another one was adapted into a successful Hollywood movie. He was the creator, writer, and narrator of the award-winning PBS series, *Cosmos*, and a veteran of countless appearances at press conferences and on talk shows. Poundstone's *Carl Sagan* is the story of this tremendously creative and productive scientist, whose flamboyance, ambition, and attachment to the controversial field of extraterrestrial intelligence generated opposition within the scientific establishment.

Sagan was born in Brooklyn, New York, in 1934 to Ukrainian Jewish immigrants. Early in his life, the young Sagan announced to his family that he wanted to be an astronomer. During his undergraduate days at the University of Chicago, the brilliant Sagan met and eventually married Lynn Alexander. It was a stormy seven-year marriage. Both Sagan and Lynn Alexander Margulis, whose own career as a biologist may have been professionally more distinguished than Sagan's, eventually gained reputations for supporting notions like exobiology or the Gaia hypothesis, which were on the fringes of the scientific mainstream.

Sagan's 1960 doctoral dissertation, done at the University of Chicago's Yerkes Observatory, was especially noteworthy in that it contained the first statement of his "greenhouse effect" hypothesis, This model was taken seriously almost immediately and was expanded to explain the properties of many planetary atmospheres including the Earth's. The future work of Sagan and others on global warming and nuclear winter all drew on his greenhouse model. That same year he began his long relationship with NASA, and in 1961 he coined the acronym CETI (Communication with Extraterrestrial Life) that stuck for about a decade until the

more modest SETI (Search for Extraterrestrial Life) was adopted.

Sagan joined Harvard's astronomy faculty in 1963, and entered into an incredibly productive phase of his career. In 1966, he co-authored with Russian astronomer I. S. Shklovskii *Intelligent Life in the Universe*, considered by many to be his best book. By 1967, he was arguably the world's leading expert on extraterrestrial life. But the field had its critics, several of whom were on the Harvard astronomy faculty. Sagan was informed that he should not apply for tenure.

Sagan "landed" at Cornell and soon became its most illustrious faculty member. Even though there were complaints that he was unavailable for undergraduates (there was an "I Touched Carl Sagan" contest to spoof his absenteeism at Cornell), Poundstone notes that "a large fraction of the nation's best planetary scientists funneled through his classes." While at Cornell, Sagan was instrumental in shaping NASA's post-Apollo phase of robotic exploration of the solar system which he framed as a quest for extraterrestrial life.

Sagan staked the most productive years of his life on the success of the Viking craft—to land safely on Mars and to conduct scientific experiments, particularly, to detect the presence of life. Poundstone does a wonderful job of recreating the drama and excitement of the two Viking missions, which provided the first ground-level photographs of Mars and enabled scientists to conduct several experiments. They did not give Sagan much cause for optimism that life would ever be detected on the planet. Especially in light of the recent photographic evidence from the Mars Global Surveyor of water near the surface, this extended treatment of the Viking program was riveting.

The PBS *Cosmos* series, which debuted in September 1980, had an enormous impact on Sagan and his career. In particular, the success of *Cosmos* transformed how Sagan's colleagues perceived him. Some groused that his "fame-to-accomplishment ratio" was anomalously high and that he had become the "Joyce Brothers of astronomy." Despite this, in 1992, he won enough votes to be elected to the National Academy of Sciences. His nomination was challenged, however, and his candidacy became something of a referendum on whether popularizers should be admitted to the Academy. He was denied membership.

Sagan's second marriage broke up in 1980. He had fallen in love with Ann Druyan, the fiancee of Sagan's friend and *Rolling Stone* editor, Timothy Ferris. They were married in 1981, and with Ann's encouragement Sagan reinvented himself as a politically engaged science-popularizer. He spoke out on a wide range of issues, especially on the threat of nuclear war. He called for a radical reduction of nuclear warheads, vigorously opposed the Star Wars anti-missile program, and publicized the concept of nuclear winter, his most politicized contribution to science.

Readers who remember Sagan chiefly for his controversial claim that "the Cosmos is all that is, or ever was, or ever will be" likely will be disappointed that Poundstone does not pay much attention to the criticism that his views generated in Christian and theistic circles. Keay Davidson in his *Carl Sagan: A Life* does a somewhat better job with that topic. Nevertheless, using numerous interviews with family members, friends, and colleagues, Poundstone weaves an utterly fascinating narrative of Sagan's provocative professional and tempestuous personal life.

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

Natural Sciences

NEUROSCIENCE AND THE PERSON: Scientific Perspectives on Divine Action by Robert John Russell, Nancey Murphy, Theo C. Meyering, and Michael A. Arbib, eds. Notre Dame, IN: University of Notre Dame Press, 1999. 496 pages, index. Paperback; $26.95. ISBN: 0268014906.

This is the fourth volume in this series. Earlier titles were *Quantum Cosmology and the Laws of Nature, Chaos and Complexity,* and *Evolutionary and Molecular Biology*. This book departs from the earlier formats in that some participants and one editor (Arbib) are nonbelievers. Many of the other contributors have been well represented in the earlier issues: Murphy, William Stoeger, Ted Peters, and George Ellis. Along with such well-known writers as Arthur Peacocke and Ian Barbour, they saved the enterprise.

In her introduction, Murphy complains about the failure of a meeting of minds, that the two groups (scientists v. philosophers/theologians) were "talking past each other." This shows. The scientists were, for the most part, intent on presenting their results and getting some stroking for what they

have discovered, while the other group focused relentlessly on what the scientists have not discovered. Only one paper—by Wesley Wildman and Leslie Brothers—involved collaboration between a theologian and a psychiatrist. There is no covering theory for neuroscience, and they have not a clue about how to connect the mental with the neurological. Because of this, they are unable to contribute anything of interest to the question of personhood.

I was eager to do this review because of my very high regard for the past efforts of this group and because I am totally innocent of any neuroscience. I am likewise innocent of quantum cosmology and not very sophisticated about chaos, but from those volumes I was well and truly informed on the subjects. I cannot say the same for this volume. Neuroscience is very diffuse and seems to be in an altogether primitive state for all the whiz bang technology that is involved. Chaos would not have been discovered without heavy-duty computing muscle, so the presence of the technology is not necessarily a deterrent to fundamental discovery, though it is all too frequently the case. The difference, of course, is "vision." One must be able to understand what is being computed or simulated. This appears as a serious deficiency among the neuroscientists. Stoeger observes that it is not even clear what an adequate model for explaining the mental, in terms of brain processes, would look like.

Among the philosophers, none are dualists, and most have embraced a form of monism. There are several variations on this theme, however. For example, Barbour argues for a dipolar form as is indicated by process philosophy. Clayton, on the other hand, presents emergentist-monism. Peacocke considers the mental to be an emergent level above the biological. He also presents a panentheistic account of God's relationship with the world such that God is understood to be immanent within the whole of creation yet the world is seen as contained within the divine.

Downward causation received a lot of attention. It is surprising to me that no one treating this problem ever mentions biofeedback. Since the 1970s, this has been used in therapeutic settings, e.g., to lower blood pressure and in research settings, and to raise the temperature of the left hand (even the first finger on the left hand). It clearly involves "mind over matter." Its success seems to me to have put this question into the solved file.

There are some occasional, minor editorial lapses—misspelled words, misplaced punctuation—which I do not recall from the earlier volumes. However, all that said, I do recommend the book for Christians despite the inadequacy of the "scientific" sections. The contributions from the philosophers are excellent—insightful, rigorous—and more than make up for the deficiencies. I hope that the group will not attempt such a foray again and will stick to what they do best, because they do that very well.

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

OUT WALKING: Reflections on Our Place in the Natural World by John Leax. Grand Rapids, MI: Baker Book House, 2000. 144 pages, Hardcover; $14.99. ISBN: 0801011973.

Leax is professor of English and poet-in-residence at Houghton College in Houghton, New York. His work has been widely published in periodicals and anthologies. He is also the author of eight books and three volumes of poetry. He is an avid gardener and caretaker of Remnant Acres, his five-acre wood lot. This collection of short essays and poems is based upon his experiences in his garden, his wood lot, and his travels to other parts of the country. These written reflections are founded upon the assumption that "the earth is the Lord's and the fullness thereof." With this assumption in mind, Leax writes about his own personal experiences in ways that challenge his readers to ponder their own relationships with the natural world.

The book is divided into five sections. The first two sections, "out walking" and "the edible yard," consist of a number of short essays. Section three, "the larger flow," contains twelve poems appropriately referred to as psalms. Leax returns to the short essay format in section four, which is introduced with the simple title, "the wild." The last section, "moonwatching with thoreau and basho," consists of twelve proses composed in the spirit of haiku. Most of the short essays are no more than two or three pages in length while the prose and poetry selections are normally only a page or two. Each contribution though short in length is meant to be read thoughtfully and repeatedly, as each one is an invitation to reflect deeply about our relationship with the natural world from a thoroughly Christian perspective.

In his prologue, Leax sets the tone for the essays and poems that follow by sharing a childhood experience. He once asked his father if he could borrow his hatchet to go "hacking" with his cousins and uncle in a nearby woods. His father replied, "You

don't chop trees without a reason" and turned away. Leax writes: "That day he shaped my conscience. Like Christ speaking a parable, he did not even explain. He spoke instead out of his character and placed in my mind an unshakable sense of the meaning of stewardship: the earth is not mine to use as I please."

In this book, Leax quietly urges the reader to resist the temptation to think that the earth exists solely for the purpose of human use and abuse. Yet he does not advocate that we keep our hands off it altogether. A number of the short stories provide examples of the author's own impact upon nature. He struggles with a proper response to the water snake in his backyard pond and the groundhog in his garden. But the main lesson that Leax is trying to teach through these personal reflections is that the ongoing tension between human culture and the natural world can best be resolved by living in a way that is both respectful and restrained. This involves paying closer attention to the effects that our everyday actions have on the world around us.

Anyone who is already committed to a biblical view of environmental stewardship will enjoy reading this book. It will challenge all Christians to consider more seriously their own interactions with the natural world. This book would be an excellent text for a composition or literature class at a Christian college, as *Out Walking* is an example of nature writing from a Christian perspective at its best.

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

THE HIDDEN HEART OF THE COSMOS: Humanity and the New Story by Brian Swimme. Maryknoll, NY: Orbis Books, 1996. 112 pages, index. Hardcover and paperback. ISBN: 1570752818.

THE HIDDEN HEART OF THE COSMOS with Brian Swimme. Video: color. 80 minutes. Mill Valley, CA: Center for the Story of the Universe, 1996.

Anyone who has heard Swimme lecture knows his passion for the Cosmos. In this lyrical and prophetic meditation, issued first as a book and then captured in a three-part video with Hubble and other space images as Swimme's background, this same passion radiates as he addresses the spiritual peril and promise of our time. Rather than try to summarize each of the book's short fifteen chapters, let me go to his thesis and highlight important elements.

As we have come to the end of the twentieth century, science has presented us with a new story of the beginning and development of the universe and the place of humanity in that story. But this cosmology has yet to be integrated into our larger spiritual visions of creation. Our traditional religious institutions—churches, synagogues, and mosques—rightly imbue believers with their messages of the relationships that ought to exist between God and humanity, and among human beings. But they have failed to place these crucial questions of meaning into the *new* cosmological framework. And all believers face a serious rival in what has become the dominant cultural religion: Consumerism. How can we free ourselves and especially our children from its spiritually desiccating grasp? And how can we revitalize our religious traditions developed under older and now outdated cosmologies, so that the new story becomes an integral part of theirs? Swimme offers an answer to these urgent questions.

He begins with a trenchant criticism of consumerism. "Before a child enters first grade science class, and before entering in any real way into our religious ceremonies, a child will have soaked in thirty thousand advertisements." (The number is probably even higher today!) Immersed as we are in this consumerist culture, in which "the advertisement is our culture's primary vehicle for providing our children with their personal cosmologies," it is not surprising that "nothing that happens in one hour on the weekend makes the slightest dent in the strategic bombing [of advertisements] taking place each day and night fifty-two weeks of the year." What is the sermon relentlessly preached by this religion? "Humans exist to work at jobs, to earn money, to get stuff." And while we may live in the universe physically, the fact that our children can sing commercial jingles but not distinguish the call of a meadowlark and a mockingbird, shows how disconnected we have become from the Cosmos.

In the chapters that follow, Swimme offers an antidote to this perversion of the spirit: the new story of the Cosmos—a story to be learned through experiencing it. Those who would be our new storytellers, like those ancients teaching the young around the tribal fire, will make our children aware of "the magnificent stellar generosity" that pours forth from our Sun, giving life to everything on this planet, including ourselves. Given a "new understanding of the cosmological meaning of sacrifice," the child imbued with these truths understands that a Eke energy in the human heart urges one "to devote one's life to the well-being of the larger community," giving rather than grasping.

Once we emotionally, aesthetically, spiritually, and cognitively understand our place in the solar system, we can look out into the galaxy. Lie on your back, Swimme says, and look *down* at the Milky Way. Imaging this different perspective helps us to sense the enormous power of the gravity that holds the galaxy together. Then, moving beyond our Local Group and the immensity of galactic clusters beyond, we introduce our children to the astonishing story of the creation of our space-time universe. Swimme artfully tells the story of Einstein, Slipher, Friedmann, and Hubble, and the valuable lesson of Einstein's difficulties in re-imagining the universe. This is what we share with our children as we chart the course of the night sky for them: the amazing insight that we are at the center of an omnicentric universe of expanding space; and that everywhere there exists "an all-nourishing abyss" out of which matter spontaneously forms in the foam of the quantum.

"To enter this omnicentric unfolding universe is to taste the joy of radical relational mutuality." Recognizing that atoms of our body created in stellar explosions might have inhabited a sequoia or a pelican or an asteroid can make us more aware of how integrally a part of the whole universe we human beings are. We belong to the Cosmos in the most intimate sense, and the Cosmos belongs to us.

The scientific dimensions of this new story are not the whole story. Many paths lead to truth, "and when these various paths arrive at a common consensual knowledge we have the possibility of a story of the universe that can guide us as a whole species as we enter a new millennium." Swimme invites the committed person of faith to find a way to bring this new universe story and the stories of his spiritual tradition together. This Christian welcomes the invitation.

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

Origins

THE CRUCIBLE OF CREATION: The Burgess Shale and the Rise of Animals by Simon Conway Morris. New York: Oxford University Press, 1998. 224 + xxiii pages with index. Paperback; $16.95. ISBN: 0192862022.

Cambridge paleontologist Morris is a person those involved in the science-theology issues should know. He first came to my attention with the publication of Stephen Gould's book, *Wonderful Life*, in which he was one of the triumvirate who reinterpreted the Cambrian Burgess shale fauna. Gould used that reinterpretation to argue for an evolution that was totally contingent, unpredictable, and totally ruled God out of the picture. If you reran the tape of life, Gould stated, life would be totally different from what we see today. One would think that Morris, whose work was used, would follow suit. It is quite the opposite. He argues in this wonderful book that evolution is constrained to solve problems along certain predictable avenues.

Convergence is the phenomenon in which different lineages evolve similar structures in answer to similar ecological pressures. If life were to start over and evolution proceed again, Morris says that, while we would not get exactly what we have today, what we would get would be very similar. In support of this, he notes that ecological niches in the Cambrian seas are very similar to what we have today. This places certain adaptive constraints upon successful morphology, and different lineages will solve their biological problems along the same lines. The marsupial sabre-tooth "cat" of South America remarkably resembles the placental sabre-tooth cat. Motion through the water seems to be solved in very limited manners by limited morphologies. Because of this, evolution is really predictable and should lead to similar ecologies with creatures filling similar niches and having similar morphologies.

Perhaps the most important aspect of this book for those involved in the creation/evolution controversy involves the development of evidence for the evolution of phyla. Creationists have long insisted that phyla level connections did not exist and that the phyla require divine creation. But like many previous God-of-the-gap assertions, this one, too, has been filled with advancing knowledge.

For arthropods, the story begins with the discovery of a complete *Anomalocaris* fossil. Prior to this discovery, *Anomalocaris* parts had been found separately and ascribed to various animals: the mouth had been called a holothurian, and the legs were seen to be those of a giant arthropod. When the first almost complete fossil was found, it was realized that this had been the superpredator of the Cambrian seas and the arthropod-like "legs" were used to grasp prey, but they were not really legs. Further discoveries showed that this creature had wing-like projections from the sides of its body (which were used in propulsion as well as breathing) and lobopodian legs. A lobopodian is a worm-like animal with legs which are basically muscles surrounding a blood-filled chamber called a lobopod.

These structures provide an efficient means of locomotion. These true legs of *Anomalocaris* showed the connection to the lobopods, and the arthropod-like grasping appendages showed the connection to the arthropods. In *Anomalocaris*, we had the perfect transitional fossil between lobopods and arthropods. And the story of arthropod evolution may go even further back as Precambrian animals, *Spriggina* and *Bokamellia*, have arthropod features, like a head similar to trilobites and lobes similar to *Anomalocaris*, respectively.

For brachiopods, the story begins with the Halkieriids which were animals with characteristic scales, called sclerites, along the body and two dermal plates at each end. The interesting thing about these plates is that they looked just like the plates possessed by the early Cambrian brachiopods. It is surmised that by curling up with the two plates coming together in a defensive move, evolution eventually guided *Halkieria* into a lifestyle in which both dermal plates became the connected shells of the brachiopods.

Morris also follows another lineage from *Halkieria*. The scales of *Halkieria* are identical to the sclerites found on *Wiwaxia;* however, *Wiwaxia* lacked the dermal plates of *Halkieria*. What it had though was even more amazing. The scales (sclerites) of *Wiwaxia* had the microlamination structure characteristic of polychaete annelid worms! But *Wiwaxia* also had a soft sole foot just like the foot seen in molluscs, like the snail, and a feeding apparatus identical to the radula of mollusca! *Halkieria*, thus, is related to *Wiwaxia*, which in turn is related to both annelids and molluscs. Thus *Halkieria* may have given rise to three different phyla: the molluscs, the brachiopods, and the annelids. Creationists can no longer claim that there is no evidence of phyla level evolution. They must deal with this data.

This book is entertaining, informative, and important. Anyone with an interest in the Cambrian explosion should have this book on his or her library shelf.

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

GOD AFTER DARWIN: A Theology of Evolution by John F. Haught. Boulder, CO: Westview Press, 2000. 221 + xii pages, index. Hardcover; $25.00. ISBN: 0813367239.

Haught is a professor of theology at Georgetown University and director of the Georgetown Center for the Study of Science and Religion. He is also the author of *Science & Religion: From Conflict to Conversation.* This is a scholarly, but readable, book with almost no typographical errors. Seventeen pages of notes mention a wide variety of sources, including Hans Jonas, Vaclav Havel, Daniel Dennett, Ernst Mayr, E. O. Wilson, Stephen Jay Gould, Michael Behe, Phillip Johnson, and many others. For the first time, I read of Seyed Hossein Nasr, apparently a contemporary Islamic scholar. There is quite a bit about Teilhard de Chardin, the French Jesuit paleontologist who emphasized that evolution is moving toward a consummation, which he called the Omega point. Haught seems to consider himself a disciple of de Chardin.

So what is a theology of evolution, according to Haught? He says:

> It is not yet evident that theology has thought about God in a manner consistent with the data of evolution (p. 81).

> In any case, the notion of God as an intelligent designer is inadequate. The God of evolution is an inexhaustible and unsettling source of new modes of being, forever eluding encapsulation in orderly schemata. Looking beneath the anxious quest for intelligent design, a theology of evolution seeks to highlight the disquieting—but ultimately fulfilling—presence of a promise and power of renewal ... Such a theology is no threat to what [E. O.] Wilson speaks of as science's own work of "revelation." In fact, by envisaging a universe that satisfies science's implicit need for ever new frontiers of discovery, a theology of evolution points us toward the very soil within which science can forever find fresh nourishment (p. 9).

Consider this statement:

> A considerable portion of Western theology and spirituality is still ruled by a metaphysics of the "eternal present," according to which the natural world is the always deficient reflection of, if not a perverse deviation from a primordial reflection of "being" that exists forever in a fixed realm generally pictured as "above" creation, untouched by time. In accordance with this traditional "metaphysics of the eternal present," the inevitable "becoming" that occurs in evolution can be interpreted only as meaningless straying from a timeless completeness, rather than as genuinely *new* creation (p. 85).

In other words, *God after Darwin* is about what Haught perceives God to be doing in the world through evolution.

Haught is to be commended for his attempt to marry scientific truth with theology. Most readers of this journal who read this book will probably

concede him considerable success. God is at work in the world, in ways we cannot understand or detect, and there should be more emphasis on the future than on the past or the present. Haught is familiar with the most important philosophies of science, and apparently with theology. He writes well, and seems to interpret his many sources fairly.

However, there are problems. The most glaring is that there is not a single Scripture reference in the book, and his theology does not seem to be founded on scriptural revelation. This leads to some strange statements, such as the one on page 133, where he claims it is the evolutionary perspective that connects us to nature. I thought it was the biblical idea of stewardship of God's creation, or an aesthetic appreciation of God's creation, or working in and with the outdoors, or some combination of these, that did that. Another such statement is on page 141, where he says that evolutionary science shows us that there never was an original perfection. Maybe not, but Scripture teaches that the original creation was good, and maybe perfect. In other words, Haught is much more ready to base his thought on scientific discoveries and theories than on revelation.

Reviewed by Martin LaBar, Professor of Science, Southern Wesleyan University, Central, SC 29630.

NEW INSIGHTS TO ANTIQUITY: A Drawing Aside of the Veil by Richard Petersen. Phoenix, AZ: Engwald & Co., 1998. 326 pages, index, bibliography. Hardcover; $27.95. ISBN: 0966213416.

Petersen was born and reared in Phoenix, Arizona, and studied physics at Berkeley. He did graduate research in solid state physics, received his doctorate, and served in the semiconductor industry in research and engineering. Spending his leisure time investigating ancient mysteries, Petersen culminates his historical detective work in this book.

The book is divided into a Prologue, twelve chapters, an Epilogue, and five Appendices. It contains an extensive bibliography, fifty-eight plates, and ten figures. The inside cover is a reproduction of a historic map which is relevant to the subject matter.

Petersen begins the book almost as a mystery novel, attempting to describe the seven Indian cities of Arizona reputed to have been seen by a Spanish missionary. After an extensive discussion of these cities and their "disappearance," he moves on to discuss the loess deposits around the world and how they could not have been formed by glaciers. He uses these points to show why he thinks the Uniformity Principle cannot explain Earth's history. He believes that cometary impacts in conjunction with an extra-dimensional interaction account better for the mysteries of antiquity. He even ties in the Atlantis and Easter Island mysteries.

This book was pure torture to read. Petersen's mystery novel approach to the first half of the book may have portrayed how he came to believe in this form of Catastrophism, but it was exceedingly burdensome to me. He lost my interest after about two chapters. He shows the anomalies of such things as loess deposits and why standard geologic interpretations are faulty, but then presents his solution as if it were the only explanation, even though it flunks Occam's Razor.

He proposes that massive amounts of material are deposited from another dimension interacting with ours. There is no way to test his hypothesis and it conveniently allows him to throw stones at theories while residing in a glass house. His hypothesis is that comets cause these extra-dimensional interactions and also such things as volcanism (the hot comets remain buried in the Earth).

Unfortunately, Petersen does not state his hypothesis up front and then support it, but requires the reader to slog through chapter after chapter of discussing the problems with the current theory before presenting his own. Then, he makes a wild claim like proposing extra dimensions and later refers to this as having been "shown" simply because of all the problems with the other theories! This book is not appropriate for any audience and is not worth the time spent reading it.

Reviewed by David Condron, Aerospace Engineer, Woodbridge, VA 22448.

Philosophy & Theology

DEATH AND THE AFTERLIFE by Brian Innes. New York: St. Martin's Press, 2000. 176 pages. Hardcover; $26.95. ISBN: 0312227051.

Peter Pan said, "To die will be an awfully big adventure." This book examines what cultures and religions think of this big adventure. The discussion of death and the afterlife touches on such items as the tombs of the pharaohs, Mexico's Day of the

Dead, the biblical vision of heaven and hell, and Victorian funeral customs. The colorful photographs are quite impressive, and they provide an emotional experience to the casual reader apart from the accompanying prose.

The book is printed on letter-size, expensive paper. It contains a helpful index and a valuable bibliography. The text was composed by a scientist who worked in biochemical research before becoming a writer. His proclivity toward mysterious phenomena is illustrated by his recent book, *The Catalogue of Ghost Sightings.*

Christian customs, both biblical and traditional, are included on many pages. The index lists ten citings, some with multiple pages. Pictures include Christian visions of both heaven and hell. During the Black Death epidemic plague in Europe, images of the "dance of death" became a popular art form. Representations of decaying corpses, skulls and bones, a skeleton with a scythe (the "grim reaper"), and hourglasses appeared on tombs, in manuscripts, woodcuts, and paintings.

This book might be somewhat unsettling to those fearful of death, which according to Rousseau, includes everyone: "He who pretends to look upon death without fear lies. All men are afraid of dying ..." Some of the pictures are morbid and terrifying. On the other hand, some people might find this book informative and stimulating. It offers a plethora of data and provides a basis for comparing the Christian viewpoint on death and the afterlife with other viewpoints.

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

BIOGRAPHICAL DICTIONARY OF CHRISTIAN THEOLOGIANS by Patrick Carey and Joseph Lienhard, eds. Westport, CT: Greenwood Publishing Group, 2000. 608 pages. Hardcover; $125.00. ISBN: 0313296499.

If you noticed the price of this volume, you will realize that only specialists, theologians, or libraries are likely to purchase it. However, it is worth listing here because part of the title of this journal is "Christian Faith." Just what that is has been written about for the past 2,000 years, and here in one compact volume is a list of the Christian theologians who have devoted their intellects to the task.

My guess is that most readers of this journal will be familiar with the "big names" like Augustine, Barth, Calvin, Hodge, Luther, Machen, and Warfield. But there are more than 450 Christian theologians profiled here (entries include theologians who died before 1994 when this project was started). Only professionals are likely to be familiar with Althaus, Bouquillon, Gomarus, Leclercq, and Soderblom. Articles sketch the theologian's education, career, major works, and contributions to theology. A short bibliography of primary and secondary works concludes each article.

Excluded from consideration are exegetes, canon lawyers, and philosophers of religion such as Descartes, Kant, and Hegel. Theologians from the Catholic, Orthodox, and Protestant traditions are included with particular emphasis on the English-speaking world. The length of each article reflects the editors' perception of the theologian's importance. The primary audience the editors had in mind was graduate students in a master's degree program in theology, although they hope clergy, scholars, and other readers will find this book useful.

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

THE SPIRITUAL UNIVERSE: One Physicist's Vision of Spirit, Soul, Matter, and Self by Fred Alan Wolf. Portsmouth, NH: Moment Point Press, 1999. 352 pages. Paperback; $17.95. ISBN: 0966132718.

Physicist Wolf writes not as a scientist but as a philosopher. He instructs as a charismatic guru. He does well in each category. Modern physics is used in analogy to give understanding and credence to his philosophy. There is a good precedent for using physical analogies for spiritual truth. Jesus used the wind in comparison to the Spirit with Nicodemus. Wolf's arguments are powerfully convincing in the sense of debate rather than in the sense of overwhelming experimental data. Wolf also writes from a background of wide scholarship—his thought is much more than something that came to him one night. He needs to be heard. His analysis of the present day spiritual malaise of Western culture seems almost prophetic.

Like most modern-day thinkers, he assesses the present-day representations of Christianity as having missed the spiritual mark. And I would agree, but I would begin a search within the Bible for a more living faith. Wolf begins his search with an attempt to understand ancient traditions, which are, for the most part, with their pantheistic and

animistic views, not in accord with the biblical message. For example, the statement "In the beginning God created the heavens and the earth" implies to me, at least, that there is only one God, and that something other than God came into being. The something other is objectively real—he created—it is there whether anyone looks at it or not. When applied to the moon, the objectivity question seems foolish, but when applied to the quantum world, it is not foolish. Of the several ways of philosophically understanding the quantum world, one treats light, for example, as having no observable reality until observed. The same thinking can be extended to include the validity of history. In a sense, history is what one's experimental questioning requires it to be. In other words, there is no fixed history before one questions.

By taking quantum mechanics as the expression of all reality, Wolf extends the contingent nature of quantum mechanics to the whole universe. In contrast, I believe that Feynman was correct when he stated that quantum mechanics was to be understood as a "calculus" and no more. Quantum mechanics provides us with the right answer in every experimental situation, but it does not tell us the nature of reality. If this is so, we are severely limited in how far we can go beyond pure analogy to the support of a particular view of spiritual reality. Many times Wolf seems to encourage the reader to hurdle the logical barrier separating certainty from possibility. It is not always clear whether he has taken the leap himself. However, in the final chapter, he greatly clarifies his position. If I understand him correctly, he is essentially a Buddhist whose spiritual insight is expanded by the extension of quantum mechanical understanding of the physical world to the spiritual. He ends with the acknowledgment that he is still on the way to a more perfect understanding.

His presentation of quantum mechanics is necessarily brief and can provide the uninitiated with no more than wide-eyed wonder. From the fact that a vacuum can create particle-antiparticle pairs out of nothing, he posits that is how all things came about, including consciousness. "The vacuum is fundamentally unstable. Anything that comes into existence did so through the soul's desire to manifest" (p. 10). The Soul is God, and there is only one God. It is an illusion that allows us to think of our many individual souls, but each of us has something of the one Soul—something like a piece of a hologram. This is demonstrated by our actions of compassion, as it is the Soul that prompts us into such action. We need to learn to listen to the voice of the Soul. Listening will be our salvation. One of the things we will learn is that all effects have a reason (studied by science) and a purpose (not yet seen by science, but real and understood by the Soul). The knowledge, which the Soul will teach us, will make us free from the bondage the flesh imposes.

Much of what Wolf teaches is in harmony with the "New Thought" movement. A large center of the movement is in Oregon, "The Living Enrichment Center," under the direction of Mary Manin Morrisey who has written a number of books on trusting God. Her books have been a definite help to many Christians and been life changing for others.

As a Bible-believing Christian, I am challenged by Wolf to examine my faith as practiced to see if it is truly Christian. In my stress to uphold the words of Jesus, "*No man comes to the Father but by me*" (John 14:6), have I found no meaning in "*Seek and you shall find*" (Matt. 7:7)? Wolf claims that he has been a seeker. Has he been led to the Father?

Reviewed by George Blount, 12340 Highway 66, Ashland, OR 97520.

COSMOLOGY AND CREATION: The Spiritual Significance of Contemporary Cosmology by Paul Brockelman. New York: Oxford University Press, 1999. xii + 187 pages. Hardcover. ISBN: 0195119908.

This book has as its thesis that "the new scientific cosmology which has emerged over the past fifty years has broad and profound implications for our present situation and possibilities, particularly in the spiritual, moral, and cultural dimensions of our lives." Members of the ASA will certainly agree at this level of abstraction.

Brockelman affirms the value of creation myths as ways of describing the transcendent breaking into the mundane. He sees cosmology as scientifically developing a story of the origin and development of the physical world. He is impressed with the creativity evident in the universe. It is natural to ask whether cosmology provides room for God in its description, and for the author, "what is sacred about all of nature is precisely this welling-forth of Being that we encounter in the perseverance of each and every entity that is." So, for Brockelman, God is not a creator but that which holds the universe in existence, or "the actual existence of the universe." Thus, no God exists, but rather existence itself is God.

He goes on to argue for a religious and ethical orientation to a life of love based on this understanding. Those of us who see the biblical Creator

behind both creation myths and cosmological explanations have long since parted company with this analysis.

Reviewed by David T. Barnard, University of Regina, Regina, Canada.

BIBLICAL HOLY PLACES: An Illustrated Guide by Rivka Gonen. Mahwah, NJ: Paulist Press, 2000. 288 pages. Paperback; $18.98. ISBN: 080913974X.

If you are interested in archaeology, biblical sites, or travel, this book will interest you. If you are a Sunday School teacher, a preacher, a Bible teacher, one who engages in comprehensive Bible study, or a writer, you should buy this book. It is compact, thorough, and reasonably priced.

Biblical Holy Places provides a guide to 210 important places in the Hebrew Bible and the New Testament. The user-friendly format is arranged alphabetically by countries (Cyprus, Egypt, Greece, The Holy Land, Italy, Jordan, Malta, Syria, and Turkey). The places referenced in each country are also listed in alphabetical order.

The two hundred locations are identified with a pertinent quote from the Bible, some explanatory material, and a complete site description. The 250 color photographs, appropriate maps, index, and concise one-page historical outline add to the book's beauty and usefulness.

The front data page reveals that this book was originally produced in Jerusalem. Macmillan Publishers first published it in the United States in 1987. I assume this is a revised and undated edition. Books-in-print lists six volumes by Rivka Gonen, all related to ancient history. This book would make a wonderful gift, so buy two!

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

Social Sciences

MEASURES OF RELIGIOSITY by Peter C. Hill and Ralph W. Hood Jr., eds. Birmingham, AL: Religious Education Press, 1999. viii + 531 pages. Hardcover; $99.95. ISBN: 089135106X.

Psychologists Hill (Grove City College) and Hood (University of Tennessee at Chattanooga), the forty-nine other contributors who reviewed the scales, and the John Templeton Foundation, which gave a grant to support much of the work on this massive double-column compendium, have made an immense contribution to the social and behavioral sciences.

The seventeen chapters describe 126 scales for measuring various aspects of religion. Organized by topic categories, they cover measures of religious beliefs and practices, attitudes, orientation, development, commitment and involvement, experience, religious/moral values or personal characteristics, multidimensional religiousness, coping and problem-solving, spirituality and mysticism, God-concepts, fundamentalism, views of death and afterlife, divine intervention/religious attribution, forgiveness, institutional religion, and, finally, related constructs that overlap with measuring religion (dogmatism, free-will and determinism, purpose in life, self-actualization, etc.).

Each chapter has a general introduction on the relevance, scope, methodological operationalization, and interrelationships of the scales it covers. Then a section on each scale includes a concise discussion of the variable(s) it covers, its description, practical considerations for its use and application, norms/standardization, reliability, validity, location (where it is available), subsequent research, published references, and an appendix with the scale itself.

Nearly all the scales consist of "paper and pencil" items answered by checking such predetermined responses as True/False, Yes/No, five or six categories from Strongly Agree to Strongly Disagree or from Not At All to A Great Deal, or numbers on a scale from Least to Most. Answers are reduced to numbers that combine to form a statistical score for each person.

Only a few scales are interview schedules that consist of questions to ask in oral interviews. For example, the Religious Status Interview by H. Newton Malony of Fuller Theological Seminary has thirty-three open-ended questions on aspects of Christian religious maturity. After the answers have been recorded, the interviewer rates the person on a subscale for each question. Then subscale scores are combined under seven subcategories that in turn are added to give the Christian maturity score. More complicated is James Fowler's Faith Development Interview Guide. It takes one to three hours of contact and ideally at least three readings of the transcript before assigning scores. (It was reduced to a nine-item Faith Development Scale by Barnes,

Doyle, and Johnson with but two alternative responses to each item.)

The main purpose of this book is not to evaluate the quality of the respective measures but "to relieve researchers of the unnecessary task of creating scales for which adequate measures already exist" (p. 3). Unnecessary duplication of measuring instruments hampers the advancement of the psychology of religion and its sister disciplines, so this reference source is a guide to determining whether or not a new instrument is needed. Its information about each scale is sufficient to determine whether further references about it should be explored in depth.

The contributors who reviewed and described the respective scales were instructed neither to report what they considered the best measures nor to critically evaluate each scale. Those evaluations are left to the readers—a wise decision because there are so many diverse perspectives, criteria, values, and research needs by which to judge the quality of any scale that any general overall rating could be misleading. (Much of the measurement work and many of the reviews are by evangelical Christians.)

Every researcher who studies religion or includes religious variables in research on other topics will benefit from this significant volume. On most psychosocial religious variables, one no longer will need to spend hours, or even days, searching for the widely-scattered data-collection instruments or spending even more time developing an original one. Instead of proliferating the measures for religious constructs, one can quickly discover instruments already in use and determine whether they can be adopted or adapted to meet one's research needs.

The book has but one major flaw: It has no indexes, so even some cross-references to other scales within the volume are difficult to locate. Neither can one easily find the numerous mentions of work by theorists and researchers like Gordon W. Allport, Charles Y. Glock, Bernard Spilka, and others that contributed directly or indirectly to the development of several scales. While the Table of Contents lists each scale by its name, author, and year of origin, many other peripheral measures that are tucked away in various scales are hidden because there is no subject index. These include measures of evangelism, faith development, religious feelings or emotions, character, Catholicism, philosophy of life, belief in reincarnation, prayer, humanism, altruism, love, doubt, toleration, motivation, faith development, morality, fanaticism, sinfulness, guilt, attitudes toward the church, and the role of religion in health and illness, among others.

Everyone engaged in social or behavioral research on or including religion should consult this compendium. Every college and university library and social research center should add it to its collection. Even non-researchers can adapt many of the scales for informal use as a means of calling attention to significant issues in adult Christian education or to help focus thinking about particular topics in faith-related discussion groups.

Reviewed by David O. Moberg, 7120 W. Dove Ct., Milwaukee, WI 53223.

PREDICTIONS: Thirty Great Minds on the Future by Sian Griffiths, ed. New York: Oxford University Press, 1999. 352 pages. Hardcover; $16.95. ISBN: 0192862103.

Thirty people with "great minds" were profiled in a series in *The Times Higher Education Supplement* and each person supplemented the interviews with a prediction for the twenty-first century. This book presents the interview and the prediction, together with a photograph, of each person.

The featured people are: Chinua Achebe, French Anderson, Noam Chomsky, Arthur C. Clarke, Paul Davies, Richard Dawkins, Daniel Dennett, Carl Djerassi, Andrea Dworkin, Umberto Eco, Francis Fukuyama, J. K. Galbraith, Daniel Goleman, Stephen Greenfield, Lynn Margulis, Don Norman, Paul Nurse, Roger Penrose, Steven Pinker, Sherwood Rowland, Amartya Sen, Elaine Showalter, Peter Singer, Dale Spender, Chris Stringer, Sherry Turkle, Kevin Warwick, James Watson, Steven Weinberg, and Slavoj Zizek.

While many readers may not be acquainted with all of them, many will be familiar. Scientists dominate the group. One wonders how the "great minds" were chosen, but selection criteria are lacking. Most of those selected are British or American.

Not surprisingly, there is some prediction controversy here, but the relative narrowness of the selection yields less diversity of views than one would find in the broader society from which these people are drawn. There is, for example, little recognition that many people believe in a spiritual reality as well as a physical one and that many people are committed to ethical and moral standards based on revelation.

Nonetheless, the book is interesting recreational reading. These are great minds. Some of the predictions are stimulating; some of the interviews provide interesting perspectives on people that I had known only as authors or as public figures.

Reviewed by David T. Barnard, University of Regina, Regina, SK S4S 3X4.

SHADOW CULTURE: Psychology and Spirituality in America by Eugene Taylor. Washington, DC: Counterpoint, 1999. xii, 317 pages, index. Hardcover; $27.50. Paperback; $16.00. ISBN: 1887178805.

SPIRITUAL MANIFESTOS: Visions for Renewed Religious Life in America from Young Spiritual Leaders of Many Faiths by Niles Elliot Goldstein, ed. Woodstock, VT: SkyLight Publishing, 1999. xviii, 226 pages. Hardcover; $21.95. ISBN: 1893361098.

Spirituality has become a prominent theme in popular culture, but attention to it is actually more "renewed" than "new." In his well-written and carefully documented historical analysis, Taylor, a senior psychologist in the Psychiatric Service of Massachusetts General Hospital, lecturer at Harvard Medical School, and faculty member of Saybrook Institute, shows that spirituality has been an important concern during much of American history. It has been especially evident in the alternative religious movements, healing therapies, and folk psychology that comprise a "shadow culture of Judeo-Christian Protestantism, ... [comprising] a vast unorganized array of discrete individuals who live and think differently from the mainstream" (p. 9). By alterations in consciousness, they live in a transplanted, syncretic, and visionary culture while they participate in daily activities of the dominant culture of normative science and religion.

Taylor calls attention to many visionary streams, including the Puritans and mystics of the First Great Awakening, the visionary communities of Quakers and Shakers, the Swedenborgians and transcendentalists (Margaret Fuller's feminism, Thoreau, Hawthorne, Melville, James Freeman Clarke), homeopathy, phrenology, mesmerism, utopian socialism and the Second Great Awakening (including Mormons and Seventh-Day Adventists), spiritualism, Theosophy, New Thought, Christian Science, psychical research, scientific psychotherapy, the psychology of religion, swamis who came to America from India and Japan, the Americanization of Freud and Jung, Esalen and the counterculture movement of the 1960s, and humanistic and transpersonal psychology. All of these have contributed to the current scene.

Taylor's book in some respects elaborates his previous studies of William James' psychology and *The Psychology of Spiritual Healing*, and it concludes with "Psychology and Spirituality: Another Great Awakening?" He believes that the flourishing of alternative and nonconventional forms of spirituality is due to the failure of traditional religious institutions to address the new scope of people's experience along with hostility toward acknowledging their validity, although evangelicals are beginning to respond and denominational churches may follow their lead, thus swelling the ranks of all forms of institutional religion (p. 289). He expects there soon will be an unprecedented cross-cultural exchange of ideas between the East and West and a dramatic change in the status of psychology that will make it into "psychology as epistemology" and "the foundation of all knowledge accumulation" for the meaning of personal experience. This spiritual psychology is at the heart of the American visionary tradition and the American cultural consciousness as a spiritual democracy (p. 117).

In discussing various movements, Taylor tends to exaggerate their strength. Thus, phrenology swept the American therapeutic scene in the 1830s (p. 105), around 1860 "seances became the rage" (p. 138), psychical phenomena "had reached almost epidemic proportions by the 1880s" (p. 159), and "in general, by the late 19th century, Americans appropriated Asian ideas to fit their own optimistic, pragmatic, and eclectic understanding of inner experience" (p. 189). There is no clear indication that only a relatively small proportion of Americans actually became "spiritual pilgrims" in each movement of "the American visionary tradition." Besides, he usually glosses over the harmful effects of many of them. He completely ignores significant movements that genuinely reached masses of people, like the Methodist circuit riders, the numerous strands of Baptist and Presbyterian churches, the Campbellite movement, the "Americanizing" Roman Catholics, and other relatively conventional Christian groups that also contributed significantly to the psychospiritual revolution, "the freedom of religious expression as a basic human right" (p. 205), and transformation of the American consciousness.

In spite of Taylor's gentle sub rosa advocacy of psychic/mystical perspectives and enlightenment from Eastern religions (especially Buddhism), his analysis of "shadow culture" movements is an innovative analysis of American social and cultural history, a reminder that the science-making process itself has been influenced by those movements, and a strong reminder that the current interest in spiri-

tuality is a recurrence, if not a continuation, of the fascination of Americans with the subject.

Spiritual Manifestos presents the "visions" of eleven religious leaders (three Jewish, five Protestant, two Roman Catholic, and one Buddhist), most under age 35, in ten semi-autobiographical essays. All focus upon expressing the spiritual impulse in new forms, adapting their religion to meet their perceptions of the needs, interests, and styles of our day instead of hiding behind dogma and believing that formal prayers and ancient rites are the best means to improve human lives.

The goal is to show both believers and skeptics that there can be a place for everybody in houses of worship and "that we are infusing our synagogues, churches, and zendo with new creativity and transforming them from the dull and uninspiring institutions that they too often are into welcoming sanctuaries for the spirit where our deepest longings and common needs might be met" (p. xvii). The focus is not upon theology or ideology but upon methods of delivery. Thus, a brief discussion of Bill Hybels and Willow Creek Church in "The Protestant Counter Reformation" by Associate Pastors Lynn and Mark Barger Elliott of First Presbyterian Church in Ann Arbor, Michigan, focuses upon its style and methods, not upon the Gospel it proclaims. Yet Brad Ronnell Braxton, pastor of a black church, asks: "Has our style of worship become more important than the substance of worship? ... Excitement in church on Sunday must lead to empowerment on Monday" (pp. 140, 141). Rabbi Goldstein similarly hopes for "a Judaism that is not just studied but *lived*" (p. 164).

While this is not an apologetic collection to show the superiority of each author's religious group, it definitely is an apologetic for innovation, and it implies that all religions are equally valuable. That goal seems violated by Father Greg Kimura, vicar of the Holy Spirit Episcopal Church Mission in Eagle River, Alaska, who negatively critiques fundamentalist and evangelical churches because, he alleges, they "valorize, a time when outside groups were not seen as an equal part of the community," are "more interested in monologue than dialogue," and try to convert infidels or "drown them in the water of baptism" (p. 59).

Closest to expressions of an evangelical Christian faith is "The Church as Midwife: Ushering in Life and Hope" by Dominican Sister Theresa Rickard who shares what it means to *be* the church: God's compassionate presence in the world, always renewing itself and creating authentic spirituality that goes beyond inner peace and personal healing in commitment to God and a community of faith. This is not a church of fuzzy feelings, nor one that condones all behaviors, but one that accepts people where they are and invites them to a change of heart.

While there is no pretense that these accounts describe the direction in which most religion in multicultural America is moving, they do exemplify significant innovations occurring within the religious groups represented and portend a spiritual scene in which humanistic, relativistic, and pluralistic values dominate what Goldstein labels our "age of intense spiritual yearning" (p. 174).

However one may disagree with some of the theological orientations reflected in these books, many of the trends reported in them are reflected in one's own denomination and congregation. In order to preserve any church's spiritual values and mission in a rapidly changing world, it must continually adapt its organizational structures, worship patterns, credal language, and outreach methods.

Besides intellectual stimulation and even intimations for needed research, Christians can benefit in at least three ways from reading these accounts. They can (1) learn what others are doing, (2) discern well-intended deviations from biblical faith and practice, and (3) pick up hints for their own methods of Christian outreach and service.

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

TOWARD A JUST AND CARING SOCIETY: Christian Responses to Poverty in America by David P. Gushee, ed. Grand Rapids, MI, Baker Books, 1999. 574 pages. Paperback. ISBN: 0801022207.

Christians want a just and caring society. Thus, it is disturbing to see statistics of increasing poverty in North America, while hearing that the economy is booming. Especially in large cities, the contrast between rich and poor neighborhoods is very evident. Scholars are often shielded from seeing this contrast because they work in laboratories and colleges. This book, therefore, can be an eye opener.

In 1996, Evangelicals for Social Action brought together sixteen scholars, mostly professors at colleges and universities. The group included econo-

mists, sociologists, theologians, and statisticians. The introduction states: "We share a passionate desire to see the poor of our nation empowered to enjoy successful participation in the bounty of American economic life."

This book has two parts on empowering the poor: "Foundational Reflections" and "Components of a Civil Society and Policy Response." Each chapter, written by a different scholar, can stand alone. The writers retained the unity of the book through meeting regularly. Due to the strict division of sciences in modern universities, natural scientists often have little contact with colleagues in other areas. Thus, we appreciate reading results of studies that touch all people.

This book is well written, easy to read, informative, and challenging. Christians concerned about poverty and social justice should read it.

Reviewed by Jan de Koning, 20 Crispin Crescent, Willowdale, ON M2R 2V7.

THE EXPLICIT ANIMAL: A Defense of Human Consciousness by Raymond Tallis. New York: St. Martin's Press, 1999. 297 pages, index. Paperback; $18.95. ISBN: 0312224184.

Tallis is a professor of geriatric medicine at the University of Manchester. He has written about 150 medical publications. His writing outside the medical field includes short stories, poetry, reflections on art and science, and philosophy. The reason this book is entitled *The Explicit Animal* is that Tallis believes that *explicitness* is the core of what it means to be human. By *explicitness* he means consciousness; that is, humans are explicitly aware of their own selves and make explicit free-will decisions. In this book, addressed to all those who are interested in the philosophy of mind, Tallis vigorously defends attempts to minimize the incomprehensibility of human consciousness. In particular, he attacks the ideas that (1) consciousness can be explained in biological terms; (2) consciousness can be explained in computational terms; and (3) consciousness can be explained in functional terms. The book is primarily his objections to the philosophies of others rather than positive statements of his own views.

In the first chapter, Tallis presents a summary of modern attempts to minimize or eliminate the existence of human consciousness. The full depth of human consciousness is an embarrassment to those who hold a naturalistic world view because it simply cannot (yet) be explained in purely naturalistic terms.

In chapter two, he attacks the biological explanation of consciousness by asserting that consciousness does not have any evolutionary survival value. An unconscious automaton would seem to function at least as well (or maybe better) than a conscious animal. Not only are there no "how" and "why" explanations for the evolution of consciousness, but Tallis presents several arguments that indicate that there is simply no possibility that consciousness could have evolved naturally.

In the third chapter, Tallis attacks the Causal Theory of Perception, which states that consciousness simply consists of the exchange of information between the outside environment and an animal's nervous system. This is an interesting and highly philosophical chapter that discusses such things as the definition of information, the possibility of objectively measuring sensation, and the relationship between perception and objective fact.

Chapter four attacks the attempt to computerize consciousness. There are those who argue that the mind-to-brain relationship is analogous to the computer software-to-hardware relationship. Tallis insists that a computer will never attain consciousness. Computers may be able to simulate consciousness but they will never possess consciousness. His points here are well taken, but they may be overstated due to his lack of expertise in the field of artificial intelligence.

The fifth chapter argues that consciousness cannot be reduced to a set of input-output relationships. That is, Tallis attacks the functional theory of consciousness, the theory that consciousness is an externally observable phenomenon rather than an internal and subjective quality. There are those who believe that if it looks like a duck, walks like a duck, and quacks like a duck, then it is a duck. Tallis would not agree and spends this chapter asserting that the external manifestations of consciousness do not capture its essence.

Chapters six and seven characterize the nature of consciousness by exploring the qualitative differences between humans and animals. Tallis says that although animals are conscious, human consciousness is qualitatively different from animal consciousness. Some manifestations of human consciousness that are fundamentally different from corresponding animal qualities include rationality, economics, morality, religion, politics, history, technology, speech, and the spirit of exploration. Tallis asserts

that it is clear that the human body has evolved from the bodies of nonhuman predecessors, but the existence of consciousness does not seem to fit into that paradigm.

The book concludes with forty-three pages of notes and references (nearly as interesting as the text itself) that attest to the author's high level of education on this problem of mind. I came away from the book a bit frustrated in that Tallis does not propose any positive explanation for the existence of consciousness. He defends himself in this by stating that, at times, "the truth may be unfruitful." However, he goes on to say that it is necessary to show that existing theories do not work before we can see what the current tasks of philosophy should really be. Tallis has presented a formidable multipronged challenge to those who seek to explain consciousness in purely naturalistic terms.

Reviewed by Dan Simon, Assistant Professor of Electrical Engineering, Cleveland State University, Cleveland, OH 44115.

Letters

Red Herrings and Fatal Flaws

In his communication, "On the Spiritual Danger in Creationism: Drawing a Red Herring Across a Track" (*PSCF*, vol. 52, no. 2 [June 2000]: 123–126), David C. Lahti introduces a fundamental consideration concerning the conclusion reached in my article, "Evolution's Fatal Flaw." In that article I had presented the statements of four evolutionists which included the logical fallacy that evolution has no purpose. I had then drawn the conclusion that since evolution contained a logical fallacy, that the theory of evolution was worthless.

Lahti makes the observation that "the reason why this particular reasoning is a red herring and therefore fallacious is because there is no necessary connection between the views of these particular people and biological evolution per se." Lahti's observation that the validity of the theory of evolution does not depend on the opinions of particular people is certainly correct. But his observation raises an interesting problem. How many evolutionists have to believe that the theory of evolution is purposeless (with a fatal flaw) for the theory of evolution to be considered to be purposeless?

Until September 1997, the National Association of Biology Teachers (NABT) and the National Academy of Sciences defined evolution as "an unsupervised, impersonal, unpredictable and natural process." This definition of evolution incorporates the fatal flaw since it says that evolution is unsupervised and impersonal. In September 1997, the Board of the NABT deleted the words: "unsupervised" and "impersonal" from the definition of evolution, thereby removing the logical fallacy from the definition. However, the vote was divisive; the first vote of the Board was against the deletion of the words (see my Letter in *PSCF* [June 2000]: 147 for an account of the proceedings). And, I have since read that there is a movement among some evolutionists to reverse the vote. Evidently, a large number of evolutionists want to include the logical fallacy within the definition of evolution. If the logical fallacy again becomes an official part of evolution (as it did until 1997), evolution would, again, have a fatal flaw.

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Alternatives to Creation–Evolution Theories

A recent private communication responded to the sentence about "The Great Deceiver" in my article on "The Great Commission and Research" (*PSCF* 51 [March 1999]: 13). It summarized geological and radiometric evidences that allegedly reveal deceptions in evolutionary theory and support certain theories of creationists about *how* in the beginning Elohim (the plural-form name of God in Gen. 1:1) went about the entire process of creation during six "days."

I am sure both creationists and theistic evolutionists acknowledge that they do not fully understand the *how* of God's processes in creating the universe and all of the earth's relatively inert and living "equipment." (The alternative secular theories of agnostic and atheistic evolutionists rest heavily

upon presuppositions and speculations that influence their observations and bias their often-dogmatic allegations about how the universe and life on earth emerged.)

I have a strong suspicion that all Christians, even we who devoutly believe in the literal interpretation of the Bible, will be greatly surprised when our Lord explains creation to us in Glory, if we still care about that in our permanent home. We now see "only through a glass darkly" as we try to piece together the multifarious and increasingly amazing evidence from God's creation with his revelations in the Bible, which, to be sure, is neither a modern research report nor a scientific textbook.

Who is developing a better theoretical integration of the increasingly in-depth scientific knowledge that is expanding so rapidly in astronomy, astrophysics, genetics, geology, sociopsychology, spirituality research, and other areas of investigation? Many more *how* theories of creation may emerge as alternatives to those now widely shared. I am sure that they, too, eventually will lead to as great a surprise as Saul experienced on the Damascus Road when he, who so fervently supported the Hebrew Scriptures and the institutionalized Jewish religion of his day, had his eyes opened to the fact that it was the Lord himself whom he was persecuting, even though Messiah had been revealed repeatedly in Saul's Bible (Acts 9:1-22).

Is there a better alternative than Creationism and Theistic Evolution for Christians while we are in "this vale of tears"? Both theoretical schools have significant flaws, but each tends to stack up evidence for its own views while squelching or ignoring evidences from God's creation to which the other side appeals. Alongside the issues of interpreting evidence from scientific observations of God's creation, there also are important hermeneutical questions about how literally, rigidly, or figuratively we should interpret certain Scripture passages. This is especially true of Genesis 1 through 9, which some Christians read as if they were scripted under modern scientific and historiographical standards, but others as if they simply report prehistoric human myths or poetic accounts of God's work.

As Christians, we should continue "honestly seeking the truth," loving the Lord with our minds and reasoning powers, not only with heart, soul, and strength (Luke 10:27; Romans 12:2). Thank God, our salvation does not depend upon faith in any particular theory of creation, but only on God's grace through Jesus Christ! So let's trust in him and love each other even if we disagree on our human interpretation about *how* he did his wonderful works (see Heb. 1:2; Phil. 2:3-11; Col. 1:14-17; 2:6-3:4, etc.). As we seek scientific evidence to test each tentative theory, let's remember that our differences will be fully resolved only when we are forever present in person with our Lord.

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United States Postal Service
Statement of Ownership, Management, and Circulation

1. Publication Title	2. Publication Number	3. Filing Date
Perspectives on Science and Christian Faith"	0 8 9 2 - 2 6 7 5	October 27, 2000
4. Issue Frequency	5. Number of Issues Published Annually	6. Annual Subscription Price
QUARTERLY	4	$30.00

7. Complete Mailing Address of Known Office of Publication (Not printer) (Street, city, county, state, and ZIP+4): 55 Market Street, Ipswich, Essex County, MA 01938-0668 — Contact Person: Laurie Grover; Telephone: 978-356-5656

8. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not printer): American Scientific Affiliation, P O Box 668, Ipswich, MA 01938-0668

9. Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor (Do not leave blank)

Publisher (Name and complete mailing address): American Scientific Affiliation, P O Box 668, Ipswich, MA 01938-0668

Editor (Name and complete mailing address): Dr. Rowan J. Miller, American Scientific Affiliation, P O Box 668, Ipswich, MA 01938-0668

Managing Editor (Name and complete mailing address): Lyn Berg, American Scientific Affiliation, P O Box 668, Ipswich, MA 01938-0668

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American Scientific Affiliation	P O Box 668, Ipswich, MA 01938-0668

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The purpose, function, and nonprofit status of this organization and the exempt status for federal income tax purposes:
☒ Has Not Changed During Preceding 12 Months
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13. Publication Title: "Perspectives on Science and Christian Faith" — 14. Issue Date for Circulation Data Below: September 2000 — Volume 52, Number 3

15. Extent and Nature of Circulation			Average No. Copies Each Issue During Preceding 12 Months	No. Copies of Single Issue Published Nearest to Filing Date
a. Total Number of Copies (Net press run)			2458	2396
b. Paid and/or Requested Circulation	(1)	Paid/Requested Outside-County Mail Subscriptions Stated on Form 3541. (Include advertiser's proof and exchange copies)	2176	2132
	(2)	Paid In-County Subscriptions Stated on Form 3541 (Include advertiser's proof and exchange copies)	23	25
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c. Total Paid and/or Requested Circulation (Sum of 15b. (1), (2),(3),and (4))			2199	2157
d. Free Distribution by Mail (Samples, complimentary, and other free)	(1)	Outside-County as Stated on Form 3541	185	163
	(2)	In-County as Stated on Form 3541	3	3
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e. Free Distribution Outside the Mail (Carriers or other means)			-0-	-0-
f. Total Free Distribution (Sum of 15d. and 15e.)			188	166
g. Total Distribution (Sum of 15c. and 15f)			2387	2323
h. Copies not Distributed			71	73
i. Total (Sum of 15g. and h.)			2458	2396
j. Percent Paid and/or Requested Circulation (15c. divided by 15g. times 100)			92.12%	92.85%

16. Publication of Statement of Ownership
☐ Publication required. Will be printed in the _____ issue of this publication. ☐ Publication not required.

17. Signature and Title of Editor, Publisher, Business Manager, or Owner: Laurie P. Grover, Financial-Circulation Manager — Date: Sept. 27, 2000

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