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

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Perspectives on Science and Christian Faith

MANUSCRIPT GUIDELINES

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Faith and Science in International Context

More than 150 ASAers will meet shortly with their CiS counterparts at Churchill College in Cambridge, England. The program is jam-packed with papers on a wide diversity of topics. It was in England that many of the individuals important in the science-faith discussion carried out their scientific investigation, that had implications for their faith—and ours. Harvey, Ray, Boyle, Newton, Priestley, the scriptural geologists, Whewell, Darwin, Huxley, the evangelical physicists, Whitehead, Hoyle, Coulson, and MacKay reflect a culture once "Christian" which has moved through three hundred and fifty years to a time where believers are a remnant in scientific life.

Ideas have been exported to the States and assimilated into the American understanding at a pace ranging from that of sailing vessels to that of instant transmission of the internet. It would be an interesting question to compare the positions that our respective "evangelical" communities hold on current issues or even what issues are deemed significant. I suspect that the spectrum of views is skewed a bit more to the right in the United States, but this may reflect the academic/non-academic ratio in the two nations.

As we venture abroad, we should have an understanding of our own heritage on science-faith questions. David Bebbington's *Evangelicalism in Modern Britain: A History from the 1730s to the 1980s* (Unwin Hyman, 1989) is a useful path to understanding the British religious landscape. John Brooke's *Science and Religion: Some Historical Perspectives* (Cambridge University Press, 1991) offers insight on the science-faith issues. Our meetings in England in 1965 and 1985 were fruitful in building new friendships and insights. The August 1998 event can do no less.

Jack Haas, Editor
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In This Issue

We begin with Grace Ju's *Young Scientists' Corner* contribution and word on Bonobo trail marking and professional ethics in *News & Views*.

The theme of the CiS/ASA Conference Symposium "Portraits of Human Nature" is reflected in our first three offerings. Mark A. Strand begins with a biblically-based assessment of *personhood* in asserting that to be created in his very image is to shine forth even more of the character and glory of God than can be seen in even the most spectacular glories found in the remainder of creation. He finds the meaning of personhood in the interworking of human bodily, soulful, and spiritual characteristics which are most fully realized on earth "only as one is conformed to the image of Christ."

Pablo Polischuk argues that postmodern views of the *self* deny any referential anchor in elaborating its reality. He offers a biblical perspective which views God as the ground of being, with humans in need of conversation with their Creator. "The transformed self does not live by its own multivoiced feeding alone, but by digesting in dialogue every word that comes from the mouth of God."

David Snoke's "The Apologetic Argument" moves from his earlier *evidential* apologetic to make a case for the proper *order* of topics in an apologetics and emphasizes "the fundamental basis of a perception that drives all belief in God." He warns us to beware of loudly proclaimed new evidence *for* the God of Christianity with the same force that we contest new evidence *against* our convictions.

Richard Aulie closes with a rich essay on the contribution of the twelfth-century Jewish scholar, Moses Maimonides, to the rise of modern science. His "*Guide for the Perplexed*: An Unforeseen Overture to Science in Twelfth-Century Cairo" describes Maimonides' disputes with Aristotle's cosmology, his monotheistic denial of the eternality of the universe, recognition of the distinction between the Creator and the creation, and the notion that creation exists in a state of contingent dependence on the Creator. By critically examining the prevailing views on astronomy, Maimonides developed an argument for *creatio ex nihilo* by the will of God.

Gordon Mill's Communication continues his series expositing the implications of a theory of theistic evolution which proposes "a continuing provision of new genetic information by an intelligent cause." A strong selection of book reviews follows. We close with several letters which keep the pot boiling in genteel fashion.

Young Scientists' Corner

Caution: Roadblocks Ahead

by Grace C. Ju, Gordon College, Wenham, MA 01984

Many people are convinced that those who study science cannot be committed to Christianity. In my life, however, my spiritual growth has taken place at the same time as my scientific growth. My interest in biology began early. Growing up in the Philippines, I remember the poverty and poor sanitary conditions that surrounded me as I walked to school in Manila. Later in my schooling, I began to wonder if science could alleviate such needs. When I was ten, my family emigrated to Virginia, where I fell in love with the Blue Ridge Mountains and spent much time hiking and backpacking as a Girl Scout. I really wanted to learn all I could about nature: plants, animals, geology, and natural history.

When it came time to choose a college, I picked Duke University because they had a marine laboratory and a forestry program. Just before I left for college, I made a personal commitment to follow Jesus Christ as Lord and Savior. Although I had been raised in a family that faithfully attended the Episcopal church, I had not made a personal choice until then. So as I embarked on my college years, I began to get more and more excited about science as well as my new commitment to Christ.

As a botany major at Duke, I spent many days hiking in the woods with professors and spent a full semester at the Duke Marine Lab. I dreamed of being a park ranger. During this time God was not only shaping my career interests but also my spiritual life. Leaders of InterVarsity Christian Fellowship (IVCF) discipled me and I grew much more familiar with Scripture study, memorization, and apologetics through IVCF small groups. While I was in college it never crossed my mind that a woman should not be a scientist, or that a Christian should not be a scientist.

During my last year in college, while working at a field site, a professor, who was also my mentor, asked me what I was going to do with my life. I was torn between being a park ranger and working to feed the hungry. He suggested that I go live in a developing country and work in a research lab for a while, and then make a more concrete decision. So with his connections and high recommendations, I left for Taiwan to work as a research assistant at the Academia Sinica in the Botany Institute. This was a critical step in shaping my career.

Before I left for Taiwan, I spent the first of several summers at Young Life's Wilderness Ranch in Colorado. I had been very active in experiential outdoor education in college. During my time at Wilderness Ranch, I grew to love and understand community, solitude, and leadership. As I trained to mentor and counsel high school students, God began to smooth out many rough places in my own life and prepare me to be an effective "wounded healer." Part of the process included searching my own heart and self which is always a painful experience. I saw a great need to let go of my will and surrender to God's. Still an ongoing process! These were critical periods of growth in my spiritual formation.

After a year in Taiwan, I got to fulfill my dream of being a park ranger. I worked for a summer at Cape Lookout National Seashore before I started my M.S. in International Agriculture and Plant Physiology at the University of California, Davis. After that I went to Purdue University for my Ph.D.

While attending the University of California, Davis and Purdue University, I was blessed to find very strong and dynamic churches. I joined Bible studies, attended conferences, and listened to solid preaching. A key conference I attended was URBANA 87, a missions conference sponsored by IVCF. Speakers such as Rebecca Pipert, George Verwer, Tony Campolo, and Roberta Hestenes inspired and provoked me to get serious about my Christianity. While at Purdue, I helped lead the Purdue Chinese Christian Fellowship, a group of about 150 students. I led the worship team and an evangelistic Bible study. The Bible study consisted of students primarily from the People's Republic of China. The questions they raised reflected their communist indoctrination and atheistic background. It was amazing to see how studying the Bible changed their lives. Many came to know the Lord as Savior! I read many books by Richard Foster, C. S. Lewis, John Stott, J. I. Packer, Henry Nouwen, Dietrich Bonhoeffer and Andrew Murray. My church's midweek small group, where I experienced real accountability and community, helped me to mature and nurtured my prayer life. I began to help disciple new Christians and gained much from these relationships.

[Two] roadblocks [that I believe many Christians face] discouraged me as I pursued my call to be a Christian, a woman, and a biologist.

In the process of growing as a Christian and working as a scientist, I have encountered two roadblocks that I believe many Christians face. These roadblocks discouraged me as I pursued my call to be a Christian, a woman, and a biologist. The first roadblock is the challenge from unbelieving coworkers who are antagonistic toward the faith. The second one is the challenge from society that women must choose to have either a career or a family.

Neither the church nor my family has ever discouraged me from being a Christian biologist. My parents, who were both professors, greatly encouraged me to pursue my dreams. If anything, I was my own worst enemy. At times I lacked the tenacity to finish the race that God called me to. I remember meeting Carl Henry at a book signing. He asked me a few questions about my Ph.D. program and pointed to my heart and said, "Guard your heart for it is the wellspring of life! God has called you into the field of agriculture and wants you to work in countries like China. He will send you a mate that will add fuel to this dream ... guard your heart." Believe me—this exhortation from a total stranger made a deep impression!

The first roadblock is the challenge from unbelieving coworkers who are antagonistic toward the faith.

While Christians encouraged me to serve God as a scientist, I was really bombarded with attacks from my unbelieving colleagues. Here are two examples of hostility I experienced from the secular scientific community. While I was a post doctoral fellow at the Smithsonian Environmental Research Center (SERC), the Gulf War broke out. In the lunch room several scientists were discussing why there was so much hate between the Jews and the Arabs. No one offered an answer. Although I am no seminary graduate, because of my strong Christian training during graduate school I was at least prepared to answer. Reading passages about Isaac and Ishmael from my NIV Study Bible, I explained that they were the ancestors of the Jews and Arabs. Their response was, "Grace, that is a story from the Bible. We want facts not fiction!" I simply left them with the challenge, "Go up to an Arab in Washington, D.C. and tell him that ... then come back if you are able and tell me their response!"

The second one is the challenge from society that women must choose to have either a career or a family.

My second example of a hostile environment occurred during my sabbatical at the University of Michigan in Ann Arbor. My collaborator was astonished to discover that I was a follower of Jesus Christ. He told me, "No one who is a real scientist believes in God." He must have thought I was not a real scientist. Yet, day after day for a year, he sought me out for hours of debate on science and religion. I finally said, "I believe because I have a personal relationship with God. I have encountered him." He retorted, "If I ever encounter him, I'll be running to a psychiatrist!" Despite his insults to my belief, we were able to work well together and I had the respect of his post docs and students.

I have a few suggestions for getting by the roadblock of hostility. These guidelines have helped me in my scientific career. A Christian scholar must have these three distinctives in life: (1) morality and standards that conform to Scripture, (2) glorification of God, not humans or knowledge itself, and (3) sincere pursuit of truth.

Christian study and the pursuit of knowledge are based on moral codes set forth by God in Scripture. Education is not taught in a value vacuum but is intentionally based on Christian morals and values. This implies a call to excellence, integrity, and high standards. Study is a vehicle to transform and renew our minds, to bring us to think about what is true, noble, right, pure, lovely, admirable, and excellent (Phil 4:8). We must pursue study with God's meter stick in mind. When we look at chloroplasts under a microscope, we are called to admire and praise God's creation. When we study literature, we go beyond just judging the work by its aesthetic value and apply moral standards and values to it. When we offer our scholarship, we offer it with integrity and honesty. Our study then becomes a form of worship and witness. Whatever we do, we should do it all for the glory of God (1 Cor. 10:31).

A Christian scholar must have these three distinctives in life [to get by the roadblock of hostility]: (1) morality and standards that conform to Scripture, (2) glorification of God, not humans or knowledge itself, and (3) sincere pursuit of truth.

A Christian scholar's overriding goal is to bring glory and honor to God. Humility in our study and scholarship is a must. This is a distinctive that makes Christ more prominent with every step we take. When I successfully clone a gene, I must give all the glory and honor to God, who created the gene and gave me the ability to study it. This effort to bring honor and glory to God is in blatant contrast to a secular society which strives to elevate the self, science, and knowledge. We have a clear mandate and goal, "For we are his workmanship, created in Christ Jesus to do good works, which God prepared in advance for us to do" (Eph. 2:10).

Christian scholars should be conducting work that is the epitome of the pursuit of truth. Wherever we are, in Christian schools or secular schools, we pursue knowledge, truth, and excellence with the wisdom and guidance of the Almighty and all knowing God. "You shall know the truth and the truth shall set you free" (John 8:32). In a world held in the bondage of darkness, sin, and despair, my hope is that those who are Christian scholars will be the harbingers of the Good News. I think that when we hold to these standards, we can move past the roadblock of hostility and perhaps bring a few along with us.

The second roadblock I have faced is the pressure to choose between family and career. For me this roadblock became evident during my Ph.D. program when I was engaged to be married. My fiancé called me during finals week from California and called off the engagement because he "couldn't marry a woman with a Ph.D." This shook my world up, but did not convince me to drop my Ph.D. program and my call to serve God in science.

A Christian scholar's overriding goal is to bring glory and honor to God.

While the pressure to choose between family and career is an issue for everyone, it is an especially difficult choice for Christian women. Women in the sciences come to a crossroads between feminism and traditionalism. The road of feminism downplays the family. The road of traditionalism downplays scientific careers. While women ponder this choice, the needy world waits. It is not a matter of marriage *or* mission but a matter of marriage *and* mission. Women need to serve God in the home and in the sciences. However, no one should expect a woman scientist to be identical to a male scientist. As G. K. Chesterton wisely said, "The tragedy of the modern woman is not that she is not allowed to follow man, but that she follows him too slavishly."

We say "women are encouraged to apply." But here is the catch. Women do not apply. They are not trained. They cannot work full time because of family responsibilities and the constraints of their husband's job. If we value the contributions that women give, we need to be willing to make reforms. These may

include expectations on job resumes, work schedules, promotions, and maternity/paternity leaves. If we keep encouraging women to pursue careers in the sciences, then we should seriously look at what needs to be done to keep them in the sciences.

To overcome this second roadblock, I have had to make three choices: (1) choosing to follow God's call for me to serve him in the sciences above searching for a husband, (2) letting God choose a husband for me who would support and encourage my endeavors, and (3) both of us making personal sacrifices to make marriage and mission work together.

In my experience as a professor, I find many women who feel that they must choose between marriage and mission. If God calls a woman to do his work, then she should obey. I am grateful for my husband, Garth Miller, who is an engineer with seminary degrees from Westminster and Gordon-Conwell, who sharpens me like no other iron. He has supported my career with many personal sacrifices. He has encouraged me to do God's will. He has been extremely willing to help with the caring of our daughter, Zea.

I hope that I can continue to move beyond these two roadblocks and serve God in the field of biology. I will continue to focus my research and teaching on sustainable use of resources, on our Christian responsibility to the poor, and on our call as stewards of Creation. I will continue to encourage men and women to enter the fields of science. I hope I can help mobilize half of God's army (women) to do the works he has called them to. I will keep moving ahead with God's help so that I may be used by him to make disciples of all nations (Matt. 28:19) and preach the good news to the poor, bind up the broken hearted, and proclaim freedom for the captives (Isaiah 61:6). ♦

To overcome this second roadblock [to choose between family and career], I have had to make three choices: (1) choosing to follow God's call for me to serve him in the sciences above searching for a husband, (2) letting God choose a husband for me who would support and encourage my endeavors, and (3) both of us making personal sacrifices to make marriage and mission work together.

Books Received and Available for Review

(Please 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 or e-mail to: rruble@acc.jbu.edu

Dan Blazer, *Freud vs. God*, InterVarsity Press, 1998

Scott Burson & Jerry Walls, *C. S. Lewis and Francis Schaeffer: Lessons for a New Century from the Most Influential Apologists of Our Time*, InterVarsity Press, 1998

George S. Howard, *Ecological Psychology: Creating a More Earth-Friendly Human Nature*, Notre Dame University Press, 1998

Edward Larson, *Summer for the Gods: The Scopes Trial*, Basic Books, 1997

Emerson Thomas McMullen, *William Harvey and the Use of Purpose in the Scientific Revolution: Cosmos by Chance or Universe by Design?* University Press of America, 1998

R. P. Olson, *The Reconciled Life: A Critical Theory of Counseling*, Greenwood, 1997

R. Scott Richards & Allen E. Bergin, *A Spiritual Strategy for Counseling and Psychotherapy*, American Psychological Association, 1997

Ron Rhodes, *The Complete Book of Bible Answers*, Harvest House, 1997

R. C. Roberts & M. R. Talbot, Eds., *Lining the Psyche: Explorations in Christian Psychology*, Eerdmans, 1997

Geoffrey V. Sutton, *Science for a Polite Society: Gender, Culture, and the Demonstration of Enlightenment*, Westview, 1997

Max R. Terman, *Messages from An Owl*, Princeton University Press, 1997

Brian Tokar, *Earth for Sale: Reclaiming Ecology in the Age of Corporate Greenwash*, South End Books, 1997

S. Vyse, *Believing in Magic: The Psychology of Superstition*, Oxford, 1997

Michael White, *Isaac Newton: The Last Sorcerer*, Addison-Wesley, 1997

Arne Wyller, *The Planetary Mind*, MacMurray and Beck, 1996

News & Views

Bonobo Trails

by G. R. Morton, Dallas, TX 75248

An Internet news report, *E-VOLUTION*, 2:2, Feb. 1998, reported that Sue Savage-Rumbaugh of Georgia State University has observed bonobos (*Pan paniscus*) marking their trails so other bonobos could follow. During the day, the approximate one hundred members of a bonobo troup will spread out in order to avoid predators. At night the troup gathers once again to sleep.

The report stated that Savage-Rumbaugh observed bonobos placing crushed leaves and stripped branches on the ground where two trails intersected. These markers were used by the lead group as a sign to tell stragglers which trail to take. This was only done when the ground was not muddy enough for footprints to be left by the lead group. To make the case, Savage-Rumbaugh twice used the markers to tell her where the bonobos had gone. She was able to find the assembled and sleeping bonobos. In addition to leaving markers where the trails cross, they also left markers when a tree trunk obstructed the path. If the lead group crossed the trunk, plants would be smashed on both sides of the tree. If the lead troup walked along the top of the trunk to another trail, the plants would be smashed only on one side of the tree trunk.

Obviously, this form of communication raises interesting questions concerning the nature of language in a genetically closely related species. While this is clearly not symbolic communication in the sense that a human language is, it is communication of a complex variety and is obviously an aid in social cohesion. ♦

Having Your Cake and Eating it Too

by Alan McCarrick, The Christian Academy, Media, PA

Steven J. Gould is always an engaging writer who likes to play the "devil's advocate" within the evolutionary community (I believe that the only thing they fully agree on is the enemy—creationists of any flavor!). In the Dec 97–Jan 98 issue of *Natural History*, Gould takes an interesting tack on the popular notion that "... evolution may well be the way of the world, but one has to accept the idea with a dose of faith because the process occurs far too slowly to yield any observable result in a human lifetime."[1] To counter this, Gould cites several examples of "evolution" in action: guppy maturity rates,[2] lizard leg lengths,[3] and snail shell variations.[4]

Then Gould performs his patented double twist: he proposes that these examples cannot provide the correct mechanism for evolution because they are *far too fast* to be right! The authors of the guppy study had recognized that their observed rates were 10,000 to 10,000,000 times the rate inferred from evolution of most fossil ancestries.[5] Gould states: "Evolutionary rates of a moment, as measured for guppies and lizards, are vastly too rapid to represent the general modes of change that build life's history through geological ages."[6]

Gould uses these rates to reinforce his punctuated equilibrium model of species formation. This model explains the sudden appearance of new forms (impling rapid evolution) and the lack of transitional forms.

> Most evolutionary transitions between species are trapped in a no man's land of invisibility. Such events generally require too much time for direct observation, but occupy too short an interval for preservation in the fossil record.[7]

> This study thus indicates that not only can populations rapidly respond to new environmental conditions, but also that the response is in some ways qualitatively similar to large scale patterns manifest on macroevolutionary timescales.[8]

I still find the use of beneficial adaptations and hybridizations as proof for macroevolution to be weak. God has invested his creatures with a robustness to survive changing environments, including the formation of new species. Few now hold the opinion that God created each species uniquely (Darwin's opponent). "[That] macroevolution may just be microevolution writ large"[9] still does not wash with me. ♦

Notes

[1]Steven J. Gould, "The Paradox of the Visibly Irrelevant," *Natural History* 106, no. 11 (Dec 97–Jan 98): 12–66, p. 12.

[2]D. N. Reznick, et. al., "Evaluation of the Rate of Evolution in Natural Populations of Guppies," *Science* 275 (28 March 97): 1934–37.

[3]J. B. Losos, et. al., "Adaptive Differentiation Following Experimental Island Colonization in Anolis Lizards," *Nature* 387 (1 May 97): 70–3.
[4]G. A. Goodfriend and S. J. Gould, "Paleontology and Chronology of Two Evolutionary Transitions by Hybridization in the Bahamian Land Snail Cerion," *Science* 274 (13 Dec 97): 1894–7.
[5]Reznick.
[6]Gould, 62.
[7]Goodfriend and Gould, 1894.
[8]Losos, et. al., 72.
[9]Reznick, 72.

Ethics in the Workplace: What Should the Christian Do?

by Thomas D. Pearson
The University of Texas-Pan American, Edinburg, Texas

Many assume that Christians, of all people, should have a firm barometer when it comes to ethical issues. The Bible is replete with commandments, injunctions, directives, and invitations that speak to the ethical conduct of those who seek to follow God. It would seem that this applies universally, in every aspect of our lives, including the domain of our professional work. In theory, this should be true for those who work in the theoretical and applied fields of science and engineering, no less than any other field. Yet in practice, the results suggest otherwise.

Increasingly, professionals in science and engineering are facing more complex and difficult moral issues in the workplace. It is no longer enough simply to know that we should tell the truth, refrain from taking what does not belong to us, and treat others as we wish to be treated. Advances in technology and scientific competence frequently outstrip the ability of Christians in science and engineering to maintain a biblically-centered perspective on ethical matters. Today critical questions arise in fields as diverse as genetic research and toxic waste management that are not adequately addressed within Scripture or the ethical traditions of our Christian faith communities.

This is not the only problem. In the economic environment within which much of science is carried out, the attitudes of government, corporate management, and our own professional colleagues make a thick muddle of the moral dilemmas. Whether a particular strategic decision, research protocol, or marketing plan is even to be considered as an *ethical* problem is regularly disputed these days. How do we know that a specific action is morally wrong? Perhaps that action raises a new set of questions that have not been encountered before. In professional life, how can Christians tell when we are faced with a moral concern, and when we are not?

These sorts of questions have provoked my own work in the field of professional ethics. My concerns have been twofold. First, how do we best describe the character of contemporary professional life in the sciences and engineering, as they are practiced in Europe and North America? What are the principles in each profession which identify the ideal of ethical excellence for that vocation? What does it mean to be a "good" scientist, or a "good" engineer? Second, how can Christians express their religious commitments in ethically appropriate ways in the workplace? What would it mean for a professional in science or engineering to be faithful to Christ, and also to exercise a high degree of moral competence on the job?

I emphasize the concern for "moral competence" because that is most often where the problems seem to lie for Christian professionals. To address this concern, two years ago I initiated a grant-funded project investigating professional ethics. I have been distributing surveys and conducting interviews with professional researchers (bench scientists), project managers, and project administrators in pharmaceutical and biomedical companies. My intent is to ascertain what ethical resources these people use when making decisions in the workplace, and how successful they are in rendering those decisions.

The survey is carefully designed to elicit responses that would determine which of five specific categories individuals often rely on in making ethical judgments: religious beliefs, family values (values learned at an early age within a familial environment), cultural norms, social and peer pressure, or professional identity. My objective is to find out where people derived the beliefs that motivate their moral decisions. In addition, I am curious to see whether one of these five categories better enables people to reflect on ethical issues.

The interviews, done with a random sample of those who complete the survey, focus on two simulations. I present two very different kinds of scenarios that might arise in the life of a pharmaceutical researcher. Then I ask each respondent a series of questions about what they would do in each simulated situation, and the reasons why they would undertake that action. The interviews provide a much richer source of data for determining the sources of moral decision-making.

My research is not yet complete, and any conclusions are preliminary and tentative. Still, certain pat-

terns appear to be emerging. I confess that some of these patterns have surprised me. When I began this project, I anticipated that Christians would have an easier time resolving moral dilemmas in their professional life than those who identified themselves as non-Christians, or who did not indicate that religious beliefs played a role in their ethical judgments. But this is not so. In fact, those who explicitly affirmed a Christian commitment have been (to date) the group *least* able to work through the ethical issues embedded in the simulations, and are the most inconsistent in their responses. On the other hand, the group that has indicated most strongly that their moral beliefs are derived from those values that pertain to their professional roles and identity have had the most positive responses.

I want to emphasize that this research is still incomplete, and no conclusions can be drawn yet. Nonetheless, these results were unexpected. They have prompted me to reevaluate the relationship between traditional Christian moral teachings and the demands of modern professional life in science and engineering.

I have formulated two suggestions which I think are in keeping with the trends I am noticing in my research. The first is that Christians need to be more active in reflecting on the character of *professionalism* in our society. Professionals (particularly in scientific fields) are a growing segment of our society. The various professions largely function as loosely-organized guilds (or, in the current lingo, as "communities of practice"). Each profession has its own standards of excellence, including moral excellence, which form a model for the individual's conduct within that professional practice. These are frequently articulated in various codes of ethics, or codes of conduct. It appears that when an individual sees herself as a professional, operating within a specific community of practice, she is best able to handle the ethical issues that will arise idiosyncratically within her own profession. But when professional identity is lacking, I suspect that the capacity for assessing and resolving moral dilemmas in the workplace is impaired, particularly in professions related to science and engineering. Christians, then, should direct some attention to the dynamics of professional life, to the demands placed on the Christian professional, and to the encouragement and discipleship of Christian professionals.

The second suggestion is closely related to the first. If the structures of the diverse professions in our society inform the ethical values of many people, then by strengthening those structures, particularly where they address moral concerns, we can encourage stronger ethical awareness by those professionals. This may mean that the codes of ethics developed by many corporations, research centers, institutions, and professional associations will need to be strengthened. Many such codes today are brief, vague, and superficial. If these codes were transformed into clear, specific, and thorough documents, detailing the standards of ethical excellence to which we hold all professionals within that practice accountable, we would strengthen professional life in our society. I also think that Christian professionals, who seek faithfulness to Christ along with professional integrity as separate, but related, aspects of their lives, will benefit. ♦

The Meaning of Personhood

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In contrast to other animals, persons possess bodily, soulful, and spiritual characteristics. The meaning of personhood is found in understanding the coordinated inter-working of these three characteristics, which are acquired by human beings during early development. Therefore, while the possession of a Homo sapiens *genotype makes one a human, personhood is something possessed only by those humans who develop to an adequate measure of bodily, soulful, and spiritual function. One's personhood is fully realized on this earth only as one is conformed to the image of Christ, who alone is fully human (I John 3:2).*

As a university student, I read Paul Tournier's *The Meaning of Persons*. As it turned out, the content of the book failed to satisfy the curiosity the title had created in me, and since then probing the complex question of the meaning of personhood has been a pursuit of mine. I have lived overseas for seven years, which has helped me to identify my own culturally-biased view of what it means to be a person, and to get a more inclusive description of humanity. I have also read and studied widely about cultures and societies. Unfortunately, what I have read often describes persons as merely products of their cultural conditioning. A relativistic bias has prevented writers from making absolute statements about what these societies teach us about the "universal person," as though making such statements would invalidate the experience of those tribes or societies who fall outside or contradict their generalizations. Roger Trigg states: "Many would go so far as to say there is no such thing as 'human nature.' Man is made instead by the kind of culture in which he finds himself."[1]

My academic training is in cell biology, where I have learned that the human person is a complex physiological machine whose existence *and meaning* are found in an organized set of ongoing biochemical processes. Even romance has been described as "the physiological response of increased hormone release resulting in elevated heart and respiration rates in response to a certain satisfying visual stimuli." What?! Virtually every description I have heard of what it means to be a human has left me feeling cheated. Each individual discipline, whether sociology, psychology, theology, or biology, has tended to be naively reductionistic, explaining the person exclusively in terms relevant to that discipline, leaving behind the nagging question of how we describe this creature all put together. In this paper, I aim to provide a holistic description of personhood.

Most definitions of personhood are psychological or sociological and do little more than explain what it means to exist. For example, many describe "personhood" as possessing self-consciousness or awareness of others, being able to look into the future and understand what continued existence means, or being "socialized." These definitions, however, ignore man's universal tendency toward spirituality and disqualify infants, the severely disabled, and some aged people. Following the nomenclature of Richard Bube, the term *human* refers to all organisms which possess a human genotype. Therefore, humanity is assured for all *Homo sapiens* from conception. This is supported by the biblical data, where generally the same terminology is used to describe the prenatal and postnatal states (Jer. 1:5; Ex. 21:22; Acts 7:19; Luke 1:41, 44). The term *person*, however, is a description of a human who has developed be-

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yond the stage at which the biological, soulful, and spiritual correlatives of personhood are formed: namely, a human body, a central nervous system, and the potential for spiritual life.[2] Therefore, all persons must be humans, because they possess a human genotype. Yet not all humans are, and some may never become, persons. A fertilized ovum is already a *human*, but he or she will only become a *person* if able to develop to maturity. Therefore this paper will discuss the meaning of personhood, not humanness. The focus will be to describe what personhood is, or was meant to be, based on scientific and theological data.

From antiquity, people have been curious about what it means to be a person. Early Hebrews tended to see people as animated bodies. True personhood was understood as a synthesis of a living physical body conjoined with a human soul. The Greeks believed that the human's uniqueness was the possession of an *eternal* soul. Greek cynics, on the other hand, saw no unity among all persons which could serve as an adequate description of all humanity. Plato would say that the unity of humans is real and the diversity among humankind can only be described in terms of that unity.[3] Buddhists have argued that there is no such thing as a "person." To them the "self" is a convenient fiction to describe the interaction of various components which function to give the illusion of a self.[4]

The Bible uniquely describes humans as created beings who bear the image of God. All humans (and therefore all persons) bear this image, which serves as the foundation of personhood. The image of God is not something which develops in the human along with development into personhood, nor does it somehow instantaneously appear once the child is born. All fertilized human eggs are wholly human and bear the image of their Creator God.

The Bible gives little *explicit* teaching on what the image of God means. In Genesis 1:26, God said, "Let Us make man in Our image, according to Our likeness; and let them rule ..." The first thing we learn is that in bearing God's image, humans are given responsibility to rule and care for the rest of creation. Though also made of the soil (Gen. 2:7; 3:19), humans were given a station and a purpose within creation and are answerable to God to carry it out. The passage continues, "In the image of God He created him; male and female He created them" (v. 27). In some sense then, human sexuality reflects the image of God. Perhaps it is in the relationship or the union which sexuality affords. The ability to have a relationship with God is also implied by being created in his image. Immediately upon creating the first persons, he spoke with them and entrusted them with responsibility. This implied that as image bearers of God, humans were responsible for obeying God. Satisfaction in life was to be a by-product of living in harmony with God. When the first humans disobeyed God, he spoke to them as if surprised that they had chosen to disobey (Gen. 3:11). This act of disobedience marred the image of God which humans bore.

We can also learn about the image of God by how it is applied in Scripture. For example, in Genesis 9:6 we learn that murder is prohibited since humans were created in the image of God. Therefore, we know that to be created in the image of God is to be imbued with a life of great value, far greater than the life which other created beings possess. In James 3:9, cursing other persons is condemned because to curse a person is to curse one who bears the image of God. Therefore, to bear God's image is to possess dignity. Human worth is found primarily in that humans bear the image of God their Creator.

Millard Erickson has summarized the meaning of the image of God in this way:

> The image refers to the elements in the makeup of man which enable the fulfillment of his destiny.
>
> The image itself is that set of qualities that are required for these relationships and this function to take place. They are those qualities of God which, reflected in man, make worship, personal interaction, and work possible.[5]

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In other words, realized personhood is founded on the fact that all humans have been created in the image of the divine.

One might ask why a perfect, eternal, needless God would create anything at all, much less a human being made in his image, and thereby possessing autonomy and the potential to sin. The answer to the question is really another way of describing the meaning of *imago Dei*. All creation displays a degree of the glory of God by virtue of having been created by him (Ps. 19:1–4). To be created *in his very image* is to shine forth even more of the character and glory of God. Therefore, the reason God created humans was to magnify the pleasure he already knew in his perfect, divine nature by seeing it now stamped upon those whom he had created (Is. 43:7; Ps. 100:3). In creating beings to bear his image, he was creating a mirror which would radiate back to himself his own perfect glory (Ps. 103:20–22; Is. 44:23; Rev. 4:11). What is more, the glory would be increased by the manifold ways it would be worked out in the life and character of each individual (Is. 29:23, I Cor. 10:31).

Personhood ... must be understood in terms of humans having been created in the image of God ... and that by virtue of sin, humans have fallen from the glorious state in which they were created ...

All humans, believer and unbeliever, fetus and adult, bear this divine image. The image of God was severely marred at the fall, but it was not lost. Perhaps an illustration could be used to make this clear.[6] Picture the image of God as a mirror in each person. This mirror can reflect the glory and character of God back to himself. Sin has not destroyed the mirror. However, it has streaked and warped it, so that now the mirror in each person is unable to reflect the glory of God fully. On top of this, each individual refuses to orient his or her mirror to receive the glory of God fully and to reflect it back. This is the disobedience (sin) of each person. Therefore, original sin, combined with personal sin and acts of disobedience, severely violate the original intention of clean, straight, and properly-oriented mirrors. The process of growth in grace and sanctification is largely one of being restored to the divine image which God originally intended (Rom. 8:29; I Cor. 15:49; II Cor. 3:18; Col. 3:9-10; Eph. 4:22–24).

Personhood, then, must be understood in terms of humans having been created in the image of God. To overlook this foundational truth is to forfeit all hope of correctly understanding the meaning of personhood. Additionally, that by virtue of sin, humans have fallen from the glorious state in which they were created must inform our understanding of the meaning of personhood. As G. K. Chesterton cleverly put it, "If it is not true that a divine being fell, then one can only say that one of the animals went completely off its head." (See Ps. 8:5.) Ultimate understanding of the meaning of personhood will rely on these two foundational premises.

To study the human person, one must analyze its component parts. How to do this is a point of some controversy. Its importance was brought home to me as I struggled to teach the gospel to the Chinese. After several frustrating years, it finally dawned on me that we were working from very different anthropologies. While I was teaching a trichotomistic person (body, soul, and spirit), my Chinese friends were trying to understand me from a dichotomistic framework. To complicate matters further, they made no distinction between the spirit, the brain, the emotions, the heart, the "guts," the soul, or the intellect. Anything which was not material was "spiritual," and, therefore, things as diverse as political thoughts, erotic feelings, depression, a difficult physics problem, and "a spiritual sense of the divine" were to be understood from within the same so-called "spiritual" aspect of humankind.

Through this process of discovery, I realized that the trichotomistic framework from which I had been working was not as straightforward as I had originally thought, either in my mind or in the Bible. First, I found the biblical writers to use the words, *soul* and *spirit*, interchangeably (e.g., Luke 1:46–47). Then I discovered that the word *soul* in the Old Testament (*nephesh*) was even used to describe animals (Eccl. 3:21). As I searched for evidence of the three aspects of the human constitution, I found suggestions of dichotomism (Matt. 6:25, 28), trichotomism (I Thess. 5:23) and even quatchotomism (Luke 10:27). How was I to get at an accurate biblical anthropology?

I discovered that the Old Testament writers present the person as a unity, whereas the New Testament writers use the dualistic body-soul terminology, though they do not use it clearly or consistently. Seldom is the human's spiritual nature addressed apart from the body, or from the mind (e.g., Rom. 12:1–2).[7] The Bible seems to teach that the human functions concurrently as a pneumopsychosomatic (spirit-soul-body) unity.[8] That is, the human does

not consist of a body to which a soul and a spirit have been added, or a soul for which a physical body has been provided. The "soul" or the "spirit" is not an immaterial entity that humans possess, rather, "being soulful" or "being spiritual" are expressions describing the kind of creature that a person is.[9] Therefore, the person functions on earth as a unitary being with bodily characteristics, soulful characteristics, and spiritual characteristics. This anthropology does justice to both the biblical and scientific data. These three categories making up the person will now be considered independently.

Humans are not beasts who have been glorified, but glorified persons who have fallen.

First, all persons possess physical bodies. The person's bodily characteristics are the expression of an extremely precise genetic code contained in the DNA of one's cells consisting of maternal and paternal DNA.[10] Based on the "directions" given in the DNA, the various cells of the body go about constructing (and maintaining) the person's body. The possession of a physical body is a requirement for personhood. This is one reason early fetuses do not qualify as persons. They are still wholly human and bear God's image, but they are not persons. Personhood is a process realized by, among other things, the physical development of the central nervous system.

Whatever may be said of the similarity between the DNA of the human and that of the ape, they are clearly two distinct species, separated in body shape and intellect by a far greater distance than their genetic similarities would predict. This itself suggests that humans are unique creatures in the animal kingdom. They are superior to the apes by immeasurable orders of magnitude, despite sharing a nearly identical genetic code. The Psalmist described it well, "What is man that Thou dost take thought of Him? And the son of man that Thou dost care for him? Yet Thou hast made him a little lower than God, and dost crown him with glory and majesty" (Ps. 8:3–4). Humans are not beasts who have been glorified, but glorified persons who have fallen.

As understood from the physical aspect, personhood is seen externally by the possession of opposable thumbs and naked bodies. The few such unique physical traits which can be identified show the relative unimportance of the physical characteristics in defining personhood. As Fox has written, "Biological evidence can *indicate*, but not *define*, the presence of a person."[11] In other words, if an ape were born which appeared for all the world to be a human, external biological characteristics alone would be inadequate to determine that it was not a human. A human being is not merely the sum of the characteristics which an embryologist might observe and measure. The bodily characteristics must be considered along with the soulful and spiritual characteristics.

In the Bible, we learn that all persons in heaven will possess physical bodies (Rom. 8:23; I Cor. 15:42–44). Adam and Eve possessed physical bodies before the fall, so the physical body must be seen as a part of God's good design. The body is not in itself sinful or evil. It is to be enjoyed and used to glorify God as are our soulful and spiritual components.

The physical bodies of all persons bear the curse of sin. This is seen in painful childbirth, the toil of labor (Gen. 3:16–19), disease, and injury. Many of humankind's most disgusting perversions involve the body. Consequently, the physical body is an important factor in one's spirituality. Sanctification involves the physical body as well as the spirit, so humans must sanctify their bodies for God-honoring purposes as well as their spirit (Rom. 12:1; I Thess. 4:3–8). Physical life ends when God removes his breath from the body (Job 34:14–15, Matt. 10:28) and the body's biological functions cease.

Second, all persons are "soulful." In the Bible, the word *soul* (OT: *nephesh*; NT: ψυχη) refers to the personal self, with attributes such as self-consciousness and the ability to think and feel. In modern scientific understanding, this means that all persons have a mind which carries out these processes by way of the physical organ, the brain. In this sense, soulfulness is a physical attribute.[12] From the exclusively scientific perspective, these cerebral functions are the definition of personhood; fetuses who lack the ability to carry out certain neurological functions should be aborted. For a Christian, this reductionistic definition of personhood is inadequate, not because a nine-week fetus is a person, but because neurologic capacity *alone* is insufficient for defining personhood. Both physical and soulful criteria need to be considered.

The possession of a functional human brain is one aspect necessary for personhood. Is the human brain the same as the brain which other animals possess? Though physiologically very similar, these two brains are functionally very different. The expression of personhood is seen in several aspects of brain function. First, the human brain has been made in the image of an omniscient God. Therefore,

the knowledge which persons possess is rooted in the knowledge and wisdom of this God (Rom. 11:33–34). Consequently, persons are able to write poetry, do physics calculations, and create computers. They are *not* constrained to repetitious instinctual animal behavior. Second, the human brain enables people to create and manipulate symbols. These symbols link physical objects with mental concepts. This ability, unique to humans, forms the foundation of language. Third, the human brain can recognize evil, by responding to the witness of the conscience (Rom. 2:14–16). Finally, in the Bible we learn that God turns people loose to the evil which their minds desire (Rom. 1:18–28; Titus 1:15). This natural desire is hostility toward God and a refusal to submit to his laws (Rom. 8:7-8; 14:23).[13] No activity of other animals can be described in these terms. Persons alone are responsible to God for the activity of their brains.

Humans are persons only through their relationships to God. They cannot utterly remove God from themselves without ceasing to be persons.

The person's mind belongs to God and is to be used to honor him (Rom. 12:2). Therefore, we should not fear challenging intellectual activities. We should participate in them with diligence and reverence, not as ends in themselves, but as avenues by which to honor God and serve humankind. Paul points out that many clever minds will never "comprehend" the things of God (I Cor. 2), for Satan has blinded the eyes (minds) of the unbelieving (II Cor. 4:4, 5:16–17). Therefore, all our intellectual activities must be engaged in with a humble, prayerful attitude so that they may be sanctified and used by God, and so that we may be not only intelligent, but wise as well.

The person's mind is very important because the mind is the arena in which all the factors of Scripture reading, prayer, and dialogue with others come together. With the mind choices are made and pursued. Thus, Christians must beware of the temptation to disregard or look down on the activities of the mind as though they were secular or somehow secondary to spiritual activities. Soulful (intellectual) and spiritual activities cannot be so simply divided. They occur concurrently and in cooperation.

My Chinese friends come from a background where soulful and spiritual activities are seen as one and no distinction is made between them. Interestingly, this apparent defect has prepared them to better integrate these activities upon conversion. For example, Christian meditation is for them both a spiritual *and* an intellectual (soulful) activity. I used to find myself struggling to make my meditation spiritual, in other words, trying to circumvent my mind to commune with God. For my Chinese friends, meditation is a matter of entering into communion with God by both controlling the activities of their *minds* and focusing their *spirits* on God. It is a marvelous example of "worshiping God in spirit and in truth" (John 4:23–24).

Being soulful also allows persons to have emotions and feelings. Romantic love is a gift from God reserved for persons. While animals pair up and mate, they do so exclusively by instinct.

God created persons to live in community.[14] An isolated individual cannot live normally and can hardly even survive without other people. Therefore, personhood involves participation in a community. Each person must acquire language, and the knowledge, skills, attitudes, and values that will enable him or her to become a functioning, cultured member of that community. American sociologist Talcott Parsons speaks of the birth of new generations of children as a recurrent "barbarian" invasion.[15] At birth human infants are neither cultured nor socialized. They have no idea of the world, no language, and no morality. This is why the Bible is so clear about the importance of training young people (Prov. 1–7). This training is no mere routine. It is the way God has ordained that his human creatures become persons—through the development of physical, soulful, and spiritual capacities.

From a medical standpoint, death comes when no cerebral function remains ("brain dead"). The Bible speaks of the removal of the spirit as the cessation of physical life (James 2:26), and therefore of "soulful" personhood.

Finally, all persons are spiritual beings. The biblical concept of *spirit* (OT: *ruach*; NT: πνευμα) is generally used to describe the ability of a person to be in a personal relationship with God, to make responsible moral choices, and in general, to be able to interact with the Spirit of God. Scripture teaches that God has given all persons a sense of their eternal nature (Eccl. 3:11) and placed within them the ability to know him (Rom. 1:19; Acts 17:27). This is the origin of all humankind's incurably religious nature. Humans are persons only through their relationships to God. They cannot utterly remove God from themselves without ceasing to be persons.[16] As Blauw states:

> A man without "religion" is a contradiction in itself. In his "religion" man gives account of his relation to God. His religion is a reaction upon the (real or pretended) revelation of God. Man is "incurably religious" because his relation to God belongs to the very essence of man himself. Man is only man as man before God.[17]

All humans were created to enjoy spiritual fellowship with God, but sin resulted in spiritual separation from him (Is. 59:2). Each human is conceived in sin (Ps. 51:5) and born evil by nature. Some people question this opinion, arguing that babies and little children are naive and innocent. Is it not true that young children fear authority and quickly confess their sin when confronted? Are they really as wicked as adults? John Owen believes they are. He argues that depravity evolves and worsens as a person matures, only giving the impression that children are not as wicked as adults. He wrote: "As the capacity of a person develops, so his native corruption is enabled to exert its influence with greater frequency and potency."[18] As persons further develop, they have a greater capacity for sin (can more cleverly dream up sin) and their wider experience gives them greater opportunity for sin, free from parental restraint. This bent on sinning is the fate of all persons apart from Christ, and describes the fractured personhood which resulted from the fall.

All humans were created to enjoy spiritual fellowship with God, but sin resulted in spiritual separation from him.

Persons' spiritual nature will keep them pursuing spiritual contentment. Unfortunately, relying on their own mind or flesh to find spiritual satisfaction will only produce temporary satisfaction and idolatry (Rom. 14:23). Separation from God can only be restored through the blood of Christ (I Pet. 3:18). Only the Holy Spirit can convince people that spiritual satisfaction is found in conformity to the things of God (I Cor. 2:14), and true spirituality is ultimately experienced only when one so conforms. This occurs first, when God calls and spiritually illumines a sinner. The sinner then repents of sin and submits to the lordship of Christ. This lordship is all-inclusive, calling for physical, soulful, and spiritual obedience. By living as God intended, spiritual satisfaction can be found. Furthermore, such spiritual regeneration insures that the person will enjoy eternal bliss in heaven with God and the saints.

Most of my Chinese friends who are not Christians are unconvinced of a uniquely spiritual component to humans and cling to their dichotomistic anthropology.[19] Until their spirits are quickened by God, they are unable to see it. My witness among them is not to convince them to believe in this spiritual component. Rather, I seek to awaken it, by appealing to their basic spiritual needs by means of their mental faculties (soulfulness). Through this "cogno-spiritual" approach, I am honoring their personhood, and acknowledging the symphonic interplay that goes on between one's soul and spirit.

For many of these Chinese friends, as prayer is practiced and worship comes alive, they begin to discover their spiritual component. Through Christian conversion, they recognize this third aspect of personhood, and begin the three-way process of sanctification. I have observed that they usually go on to integrate the three aspects of personhood in their spiritual development in a more balanced way than Westerners. Chinese Christians emphasize a life with physical, mental, and spiritual discipline and routine. They guard against overeating even as they guard their minds from sin. They take the need for adequate rest and exercise seriously even as they establish patterns of Bible study and prayer. They do not view academic prowess as compromising their spiritual integrity or usefulness to God. Rather, they strive to be as learned as possible. I am constantly challenged by the rhythm with which my Chinese Christian friends live out the three aspects of their personhood.

As with the physical body and the soul, spirituality is not an isolated aspect of personhood. Spirituality is experienced in coordination with the activities of the mind and body. In fact, Jesus requires that the mind be used actively in the faith experience (Matt. 22:37). And Paul commands that we be renewed in our minds to recognize God's will (Rom. 12:1–2). The Old Testament teaches that healthy spirituality will contribute to a healthy physical body (Ps. 38:3–8; Prov. 3:8; 4:20–23).

Humans, like animals, are programmed to die physically. In the absence of sin, God blessed humans by exempting them from the death process. When we sinned, God allowed us to take the "animal" course of death and return to the dust from which we had come (Gen. 3:19). Therefore, physical death for humans came into the world because of sin (Gen. 2:17; I Cor. 15:21), not as part of God's original design (Heb. 2:14). Its timing is appointed by God (Eccl. 9:27), not by chance. Negatively speaking, death comes when the person's body and spirit

are separated. Therefore, death is universally feared and hated. But for the believer, this separation is temporary, for when he or she is transformed at the resurrection, the spirit will be reunited with that person's material body. Positively speaking, death marks the defeat of an enemy (I Cor. 15:26, 54–56) and the beginning of an eternal existence with God (Ps. 116:15).

In summary, all persons are "wholly" human, because they possess a human genotype. However, we know that sin has marred humans from what God had originally intended them to be. No person is what she or he might have been without sin, or what she or he might become in heaven. In other words, no person on earth is "fully" human, for to be "fully" human would be to know bodily development, soulful maturation, *and* divine spiritual sanctification. Therefore, only Jesus Christ *is* fully human because he knew no sin. This is why Christ can serve as our divine Redeemer, and as the model Person in whose steps we may follow (I Pet. 2:21).

In conclusion, persons uniquely possess bodily, soulful, and spiritual characteristics; the meaning of personhood is found in a coordinated inter-working of these three characteristics. In a sense, to realize one's personhood is to attain the bodily, soulful, and spiritual peace of *shalom* sought in the Old Testament. God desires that all persons be sanctified entirely—body, soul, and spirit (I Thess. 5:23). Furthermore, one's personhood is fully realized on this earth only as one is conformed to the image of Christ, who alone is *fully* human (I John 3:2).[20] These are the elements of personhood and this is its meaning. ♦

Notes

[1]Roger Trigg, "Religion and the Threat of Relativism," *Religious Studies* 19 (1983): 297–310.

[2]Richard Bube, Stanford Professor of Materials Science and Electrical Engineering, from the series "Science and the Whole Person;" Part 9, "The Significance of Being Human," *The Journal of the American Scientific Affiliation* (March 1979): 37–43.

[3]Os Guiness, *The Dust of Death* (Downers Grove, IL: IVP, 1975), 212.

[4]William H. Jennings, "Life after Death: Christian and Buddhist Views," *Areopagus* (Hong Kong: Easter 1993), 12.

[5]Millard Erickson, *Christian Theology* (Grand Rapids, MI: Baker, 1985), 513–4.

[6]This illustration is a modification of one used by Emil Brunner.

[7]Erickson, chapter 24, 519–39.

[8]Richard Bube, "Penetrating the Word Maze," *The Journal of the American Scientific Affiliation* 42: 1 (March 1990): 45–6.

[9]I am not a monist. I believe that at death the immaterial aspects of humans will live on while his or her physical body will decompose back into earth. Also at the resurrection, there will be a return to a material or bodily condition. At the same time, I am unwilling to simplistically describe the more conventional trichotomistic or dichomistic views while knowing they do not genuinely handle the varied biblical data.

[10]Genetics research in the last ten years has shown us that much more of the human constitution than just bodily characteristics are determined by one's DNA. Considering the scope of this paper, I do not have space to go into this in detail. Suffice to say that human's intellectual characteristics (the next section of the paper) are also largely determined by one's genotype.

[11]F. Earle Fox, "Two Kinds of Personhood: A Reply to Clifford Grobstein," *The Journal of the American Scientific Affiliation* 45: 1 (March 1993): 49–56.

[12]This is another reason why I cannot affirm the trichotomistic or dichotomistic division of the human constitution.

[13]This is the reason for the hundreds of competing religions and ideologies in the world. Persons are endowed with productive minds, but naturally these minds are hostile to God. Therefore, whatever these minds produce has the potential to become idolatrous. Naturally, whatever they concoct in the religious realm will be the most idolatrous, because these most easily become the objects of humankind's worship.

[14]Perhaps this is one reason sexuality is correlated with the *imago Dei*: because sexual union is the most intimate "community" possible.

[15]R. W. Brown, *Social Psychology* (New York: Free Press, 1965), 193.

[16]Christopher J. H. Wright, "The Christian and Other Religions: The Biblical Evidence," *Themelios* 9 (Jan. 1984): 4–15.

[17]J. Blauw, *The Theology of the Christian Mission*, Anderson, ed., 1961.

[18]John Owen, "The Effects of Depravity," vol. 3, 337–45.

[19]The spiritual component of persons in the Chinese language is called the *linghun*. It is a word which combines the two words *ling* (spirit) and *hun* (soul), demonstrating how Chinese view the soulful and spiritual activities of humans as from the same source. Non-Christian Chinese people even contend that dogs have a *linghun*. Christians use the word *linghun* to uniquely represent the spiritual component of humans. When describing a detailed anthropology, the Chinese describe the person as an integrated *ling* (spirit), *hun* (soul), and *ti* (body), just as I have done in this paper.

[20]Scottish writer George MacDonald wrote, "The giving of the white stone with the new name (Rev. 2:17) is the communication of what God thinks about the man to the man ... The true name is one which expresses the character, the nature, the *meaning of the person* who bears it ... Who can give a man this, his own name? God alone. For no one but God sees what the man is ... It is the blossom, the perfection, the completeness, that determines the name: and God foresees that from the first because He made it so (Acts 15:18) ... Such a name cannot be given until the man is the name." (*George MacDonald: An Anthology*, C. S. Lewis, ed. [New York: Doubleday, 1962]).

Perspectives on the Self: Substantial and Dialogical Aspects

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To the individualistic and rationalistic notions which have characterized Western thought in modern times, currents in the psychology of the self have added globalized and dialogical accounts. Several metaphors have been utilized to convey structural and functional aspects of the self, such as the computer (information processing) and the narrative (regarding the self as multivoiced and engaging in intrapsychic and intersubjective dialogue). The latter paradigms tend to render the self as constructive, but unbound to any referential anchor and elaborating its own reality. This paper deals with a redefined substantial/dialogical personhood, which integrates aspects from psychological theory and theological reflection. The self is defined as being grounded in God, in others, and in the cosmos, with a sense of ontological, epistemological, and teleological basis derived from biblical anthropology. Several propositions and implications are provided as derivatives of the notions presented, with implications drawn from such attempts at psychological-theological integration.

The self construct has been an object of concern for philosophers, theologians, and psychologists. Metaphors have been utilized in all these fields to convey notions about the self's structure and function. Hermans, Kempen, and van Loon have alluded to the fact that two metaphors which play a major role in the field of psychological research are the computer and the narrative.[1] The computer metaphor allows for the investigation of the self as an information processing machine, and the narrative renders versions of a multivoiced self which engages in stories, fiction, metaphors, and dialogues of intrapsychic as well as intersubjective natures. These two currents may be compared in view of theological notions of ontological (substantial, essential, or sub-structural) and relational aspects of the self.

In this article, the self is rendered in terms of an interplay between substantial notions and dialogical capacities, with "personhood" defined as the capacity for and the condition of being human, embodied and differentiated from its ecosystem, and relationally grounded. Being human implies the presence of an essential characteristic—a minimum biological criterion manifesting the presence of human DNA—to which psychological criteria are juxtaposed (expressing cognitive, affective, and volitional processes proper to humans). A distinctive element in such a definition is the postulation of a transcendent criterion: a self made in the *Imago Dei* and capable of a personal relationship and fellowship with God.[2] In essence, the self is an aspect of a more comprehensive definition of being human, involving the concepts of body, soul, and spirit. To such essential characteristics, the aspects of dialogical personhood are added. When coupled to the self, the adjective "dialogical" is not necessarily restricted to the meaning conveyed in narrative psychology, but goes beyond such connotations. It is redefined to denote not only the expression of internal dialogues between the different positions of "I" (multivoiced self) and the introjected collective voices of a contextual community, but also the transactions with a transcendent interlocutor (God). The expression "one another" occurs 52 times in the New Testament, and seems to convey relational aspects of a self grounded in a community, which may be considered the anchoring collective voice interacting along the spiritual "resocialization" of the self upon entering into fellowship with such a "family of faith."

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The Self as an Evolved Construct

Present concepts of the self have evolved from philosophical, theological, and psychological notions of pre-modern times, influenced by a bipolar ontology in which Platonic and Aristotelian versions of human nature were postulated. In Plato's terms, every person had a "packaged nature" which contained potentially everything that such a being could be or ever become. On the other hand, the Aristotelian version considered the person as a tabula rasa receiving impressions of reality, but without the capacity to transcend itself, except in the sense of being a "social" animal. The nature of the self was regarded as an objectified substance, with *entelecheia* (inherent capacities to grow into an intellectual entity), or a being endowed with a certain rational potency embedded in its substance.

The Enlightenment added to such notions. It presented the human as a self-determined entity of an autonomous nature. The self was understood as being logical, perceived in terms of cognitive supremacy over the rest of the cosmic order. Descriptions along substantial, structural, topographic, and dynamic notions emerged from this enthroned self, all of which have demonstrated an individualistic, rationalistic, and tribalistic (intersubjective agreement among selves of a particular kind) legacy. In stressing constructs of an individualistic nature, modernism has severed the self from meaningful dialogue with community as well as transcending reality. The loss of an overarching meaningful purpose has deeply affected the considerations of philosophers, scientists, and academicians. The self-critical consciousness and private experience of an autonomous entity became the hallmarks of a solipsistic system.

Anderson alluded to early American thinkers as fostering individualism, citing Emerson's notions of the "internalized god in us" as "the imperial self," talking with itself, about self, to others.[3] Lasch observed that modern culture is inherently narcissistic, dissolving the links by which people have been rooted in time and space, drawing them into impersonal centers of modern tribalism, only to make them prisoners of loneliness in the midst of a crowd, with self-centeredness and drives to enhance self-esteem.[4] Bellah et al. state that our culture has embarked on a "nervous search for the true self," issuing idiosyncratic, extravagant conclusions drawn from such endeavors.[5] They promote a more balanced view between individualism and communalism. Cushman described the ethnocentric claims of the Western world which have advocated "self-contained individualism" that resulted in emptiness.[6] The self in his view should be studied from a broader perspective, beyond ethnocentrism and across times, drawing from social diversity as a vessel that must be continuously filled to be fulfilled. The self of modern times has also been described as a "distinctive whole set" contrasted against other such wholes, "egocentric," "selfish," and "self-reliant and independent."[7] Emerging from its embeddedness in various collectivities, the modern self became the unit of social concern, regarded as a free-standing central unit or "self-contained."[8] Hermans, Kempen, and van Loon summarized these accounts and rendered them as a background for their promotion of a different paradigm: that of a globalized, dialogical, and multivoiced self relating to a social context.[9]

Constructivists dedicated their efforts to render a version of the self as a dynamic, evolving entity which optimizes contingencies. Kelly presented the self as a scientist, a living organism dynamically apprehending data and constructing meaning, with the capacity to be dialogical and proactive.[10] As an active processor, the self builds its own reality in a constant flux of hypothesis testing, rearranging, and reformulating the meaning of constructed reality. In doing that, the self remains autonomous, individualistic, solipsistic, and scientifically aimed at providing sense to an ever changing, relative context for its being. Critical constructivists, such as Guidano, Lakatos, and Mahoney, have argued for a moment-to-moment process that constitutes personal experience, inseparable from and influenced by an active personal knowing process of a tacit nature.[11]

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Maturana, postulating radical constructivism based on natural epistemology, presents a self-created, self-produced, self-organized constructor, seen as a unity of mind and nature and propelled with autopoiesis (the self-organization of living systems).[12]

Cognitive Metaphors and Rational Dialogue

Scientists who approach the human from a biological (physiological, neurological, biochemical) perspective are working toward a better understanding of the working brain and its individual cells, where most of life's choices seem to be made. Computer models (information processing) are taken as metaphors to convey the knowledge about psychological processes. The main question (and a very old one) in such endeavors is: How can a physical entity produce, emanate, or give rise to conscious experience? Attempts to elucidate aspects of sentience, cognition, and emotion as being present in the experiencing human being, have proven to be quite elusive. Those engaged in such pursuit have been divided into "mysterians," who have given up such a search, and those who "naturalize" the mind.[13] The "mind" is considered as the emergent property of organismic evolution which took place in the brain, culminating in a field of events and transactional processes. These are thought to respond to principles of complex cybernetics, developing in a transpersonal context without necessarily having a central administrator. Aspects of the self are translated in terms of transactional capacities between the differentiated organism and its ecosystemic surrounding transduced through multiple channels. Such transactions combine sensory, cognitive, affective, and behavioral processes which follow parallel, convoluted patterns and emerge as chunked, tacit expressions. The optimization of such contingencies takes place due to the organismic capacity to self-regulate and transact with its environment in an adaptive fashion, resulting in "mindful" outcomes.

Discoveries in the natural domain (i.e., gathered from physics) tend to translate rapidly into the social sciences. For example, psychologists may adopt some discoveries and musings, such as Prigogine's revision of the second law of thermodynamics[14] and Waldrop's complexity notions,[15] to draw analogies applicable to human aspects and processes. In open systems, the spontaneous emergence of structures that are self-perpetuating and relatively stable over time is a possibility, thanks to the dissipative structures that scatter their internally generated entropy into their ecosystem, and drain it of its assimilable order (negentropy). Such a notion allows for transformation and renewal in relational systems (i.e., dyadic, family, or intrapsychic voices) which otherwise may be doomed to decay or dysfunction. Also, instead of looking at cognitive-affective or behavioral processes as unraveling along linear causality, open systems may adopt the notion that order may emerge from chaos through nonlinear dynamic processes, raising themselves to higher levels of self-organization. The emerging science "at the edge of order and chaos" is provoking social scientists into construing new paradigms to understand human complexity and renewal. Along such endeavors, the self is reframed in new terms: an entity is endowed with a natural teleological aim, becoming organized as an expected outcome from bottom-up processes starting at the individual living cells. Yet, the field is not unified, as thinkers differ about the possibility of understanding the human as a processor of information.

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Promising and challenging theories have been proposed by Dennett, who claims to have "consciousness explained."[16] His views are rational but counterintuitive. They demand a revision of the strongly held notion of a Cartesian theater (unified view of consciousness) in favor of an array of metaphors with the emergence of multiple drafts and enactments. On the other hand, Penrose argues for a new physics which would approach the study of human consciousness from a yet unknown angle. He believes that human consciousness at the present time transcends computation.[17]

If a science of consciousness proves to be difficult to tackle, the elucidation of the old notion of the "unconscious" is even more so. Freud challenged the rationality of the self early in this century, alluding to the unconscious processes which indicated more primitive, irrational, or unrefined propensities.[18] Ego psychologists who reframed his concepts revised the ego's ingredients with their emphasis on conflict-free spheres and added "ego strength" and rational-social dealings. In his own idiosyncratic

fashion, Lacan took aim at such logicalization of Freudian doctrine and returned to a neo-orthodox emphasis on the irrational nature of personhood. He argued in favor of an unconscious, structured as a language which escapes the control of the individual, a discourse censored from consciousness. His version of the ego was non-empirical, seen as a fundamentally illusory identity, inherently weak, alienating and alienated, a clear hindrance to analysis. The "word" was essential for Lacan, who saw the dialectical grasp for meaning as the main task of analysis. Subjectivity, for him, had an inherently bipolar dialogical structure, as speech always implies a reply: there is no speaking subject without an auditor who replies.[19]

Cognitive scientists have "liberated" such a construct from the exclusive psychoanalytical domain. It is now acknowledged that tacit ordering processes are involved in all aspects of our lives, and in all points of our brain and body.[20] The distinction between higher cortical functions and lower centers in the brain is the legacy of neurosciences that now begin to give credit to the operational structure of the nervous system as a whole. The convergence of cognitive science, evolutionary epistemology, and developmental and relational trends has allowed for a renewed emphasis on the inseparable aspects of the self, with knowing, feeling, and doing as emergent properties of the holistic nature. Scientists are making dedicated efforts to elucidate metacognitive and intuitional processes, focusing on personal, tacit ways of knowing, with "superconscious" emphasis replacing irrational, unconscious labels.[21]

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One interesting aspect of investigation in neural networks is the thrust to elucidate how emergent properties work. Through a natural epistemology, derived, chunked, and emerging properties are introduced with concepts such as "Darwin machines" at work, shaping thoughts in milliseconds rather than millennia.[22] Besides reactive processing, anticipatory capacities and distinguishing properties between self and nonself, born out of biological theories of consciousness, are ascertained.[23] The self, in such terms "is not the self of narrative awareness, constitutive of personal or social identity, but the subject of interoceptive signals that alert the organism to its own homeostatic state: to its automatic, neuroendocrinological and hedonic condition."[24] Therefore, in this camp, computer metaphors and their related robots provide for basic explanations of personhood in ever-increasing refinements along natural, evolutionary lines. Such considerations do not necessarily get stuck on debates about whether the self is individualistic or relational, but rather focus on processes of serial and parallel nature, with analogic and digital "voices." Integration between the individual set and the whole array is desirable, as even "Darwin machines" may profit from being connected to networks instead of being considered isolated units devoid of the benefits of systems at work.

The Self as Multivoiced and Dialogical

As it has already been noted, in terms of metaphoric appeals to describe or understand the self, computer-based models have been countered with narrative analogies. The individualistic and rationalistic notions which have characterized Western thought for centuries are now compared and contrasted with dialogical notions which include personal myths, stories, and intrasubjective, polyphonic voices as valid avenues to investigate.

Current trends among dialogical thinkers go beyond rational, substantial, and propositional notions. Several authors have emphasized the narrative nature of the self.[25] Such notions propose a multifaceted self, a set of contrasting characters (*imagoes*) relating as personified voices of diverse nature, affect laden, and engaging in mutual dialogues, often opposite to each other and yet, cohesively held together in intrapsychic fashion. Beyond rationalism, those who adopt a postmodern view tend to attribute voices to the self which allow for personal myths, stories, and storytelling as guiding principles for the self. Hermans has provided a comprehensive review of such trends.[26]

The notion of an intersubjective dialogue has been credited to William James, the father of American psychology. He emphasized the distinction between "I" and "Me" in which the self was both the knower and the known. James demonstrated continuity in time, distinctness from others, and a will to choose between the aspects of reality being processed.[27] Mead also pointed to this distinction.[28] The ideas of neoanalytical theorists may be recast into updated versions of intrapsychic dialogue. For example, Sullivan regarded the self as part of a social

system, always transacting with others, who represent the most critical factor in shaping the self. In his system, the "good me" and the "bad me" as well as the personified good/bad objects (mother, father, etc.) become "personifications."[29] These are organized patterns of interactions of subjective nature: images, concepts, representations of others, things, or abstracted principles which are introjected and symbolized by the self. Once these personifications are formed, they guide all social endeavors.

Having deprived the postmodern self from a transcendental grounding in a personal God, narrative renderings seek to replace such ground of being with a multiplicity of processes, voices, and images which emerge in evolutive fashion ...

The self in psychoanalytic "object relations" theory has been considered as developing the internalization of significant love objects from birth on.[30] From an autistic phase in which the newborn is one with the socializing object, the incipient self develops into a symbiotic phase in which shared/overlapping selves dialogue in continuous transactions. The love object who nurtures is considered the ground of being for the tentative wanderings of the emerging self. Finally, a third phase (differentiation) allows for a more separate engagement between dialogical selves in relationship. The formation of structures, boundaries, and defenses of the self are embedded in relational terms. The internalized objects may represent the personalized or multivoiced aspects of the self, as they engage in organizing and guiding aspects of relationships of an intrapsychic and an interpersonal nature.

Postmodern thinkers tend to do away with the distinctions between the knower, the knowing, and the known. The emphasis upon verification (confirmed by experience) as the divider between scientific and nonscientific propositions is coupled with justification (quest for authorized knowledge). Yet, the quest for justification with ultimate certainty experienced an erosion, a giving way to more personal, tacit trends. Challenging the notions of "true" objectivity, rationality, or absoluteness in the apprehension of reality, all knowledge is considered to be "personal" and biased in such paradigms.[31] The self in this framework is seen as spatially organized and embodied, social with "the other" not outside but in the self-structure, resulting in a multiphonic array of selves in dialogue. The emphasis is placed not upon a unified center of consciousness (such as the Cartesian theater), but rather upon a multiplicity of "I" positions in an imaginal-affective landscape engaging in dialogue, with emotive voices within the system functioning like interactive characters in a polyphonic narrative.

Social constructivism presents a dialogical self, transacting not only with the particularities of a context, but also with a larger system, a "multiverse," drifting along in the currents of this age with no oars, no anchors, and no particular sense of direction. The voices of this self seem to bounce autistically from the inner walls of a solipsistic container, or to diffuse and get lost among a multitude of other voices that are construing alternative meanings and dialogue without any possible referential anchor point due to the plausibility of a multiuniverse filled with noise.[32]

How is it that a multivoiced self is able to "keep it together"? To provide cohesion and meaning, some theorists have allocated a temporary dominance to a voice, which assumes social authority to regulate such intrapsychic discourse.[33] Having deprived the postmodern self from a transcendental grounding in a personal God, narrative renderings seek to replace such ground of being with a multiplicity of processes, voices, and images which emerge in evolutive fashion—somehow guided by a relentless pursuit of order out of chaos. Meaningful contextualizations for the emergent self are sought in redefinitions of "post-Newtonian tribalism." The self as a unit of study within a context has been qualified by some as being more globalized (relating in a linked world system).[34] The term implies the dialogical aggregate of intersubjective selves who seek to have interlocutors "somewhere there" in the phenomenal field of experience, encompassed in a seemingly infinite expanding multiverse of polyphonic nature. In such a context, the significance of the voice of the collective group (subculture, professional association, etc.) is stressed, as it represents the chunked, implicit collective introjects interacting in the formation and expression of the dialogical self ("It takes a village to raise a child").

Substantial and Relational Aspects in Theology

Early theologians, influenced by Greek thought, showed much concern with substantial definitions. Derived from rational individuality and psychological experience/consciousness, the Augustinian con-

cept of the self was regarded as a receptacle of God-given properties, allocated intrinsically as characteristics, traits, capacities, potentials, and endowments which emanate, irradiate, exude, or convey the reflected *Imago Dei*. The intellectual, moral, and psychological attributes were seen as either reflections or possessions (properties) of the *hypostasis*. This notion was identified as a "substance" and later as a "person." The created *Imago Dei* received attention as a substance that had the capacity either to become like God or to sin. Theologians struggled with the notion of inherent capacities and the loss of such. The *Imago Dei* was either preserved or lost. Natural and liberal theology opted for its preservation; orthodox evangelicalism opted for its loss.

Due to the philosophical emphasis on substance, debates among holistic, dichotomous, and tri-chotomous versions of the human have emerged throughout the history of Christian thought. Most traditional theologians (grouped into mainline Protestant thinkers) prefer a dichotomous (body-soul/spirit), yet holistic view. Some charismatic and pentecostal-type thinkers expand the version of personhood to three "components," (body, soul, and spirit) citing references and interpreting them in a multilevel fashion (e.g., Gen. 2:7; 1 Thess. 5:23; Heb. 4:12; 1 Cor. 2:14–15; Rom. 8:6, 10).[35]

Zizioulas proposed a relational notion by arguing about capacity and incapacity as it refers to the human being made in the *Imago Dei* and to the problem of sin. In his view, the human is endowed with neither total capacity nor total incapacity, but with the "capacity within incapacity" to relate to God.[36] Following Barth's reasoning,[37] Anderson adopted a relational posture in which the human is grounded in God for fellowship, deriving a personhood from this relationship.[38]

Judged by the narratives in Genesis, the relational aspects of the self are juxtaposed with or "above" its physical origins and the individualistic emphasis on psychological personhood. The creation passages present a being who, although embodied and substantially derived from God, received God's expressed will and was "covenanted with" in fellowship. Beyond a romantic story or a hymn alluding to chronological events marking the beginning of things created and the loss of things as they were, the narrative points to the nature and responsibility of the human. The appeal to relate in love is made by a postulating, redeeming, and sustaining God throughout the whole account of Scriptures.

The proposition, *"Therefore a man leaves his father and mother and cleaves to his wife, and they become one flesh"* (Gen. 2:24), is presented as the crucial point in the second creation narrative. Thus, the emergence of the self is narrated in ways that convey the development of an identity and uniqueness (standing alone), pointing to a process of differentiation from a contextual family of origin. Such autonomy is not an end-product, but a prerequisite for establishing intimacy and fellowship (relating in mutuality) as well as being industrious as a steward or stewardess of God.

To be created in the* Imago Dei *indicates a reflection of God's own spiritual nature and power, with a capacity for creativity, spirituality, and transcendence all embodied within a skin and yet, activated through empowered dialogue.

A biblical anthropology, derived from scriptural Hebrew views, presents the nature of the person with descriptive and narrative concepts conveying a dynamic relationship.[39] The term "flesh" is used to denote creatureliness and also employed to label all living creatures. Biological urges and limitations are presented in solidarity with a created order. Such weakness is constantly presented in contrast with God's creating and sustaining power. Thus, the term "flesh" points not so much to the nature or essence of personhood, but to the lack of personal power. Such a notion is a derivative of an emphasis upon God's activity, not just God's essence. Thus, God's activity in creation, redemptive and sustaining movement in history, and relatedness in love and justice are seen as "ingredients" in the interpretations of the *Imago Dei*.

The word translated "spirit" may show breath, air, wind, and properties coming from God to the human, as a relational principle of life, a vital force, the unseen spiritual element in humans. It also refers to a dispositional stance, a mode of thinking, the empowering from God which allows the self to act. Will and counsel are also implied by the concept, as to speak of "self-assertion," the capacity for intellectual endeavors, insight, and self-understanding. All in all, regardless of whether it refers to the breath of life, to the principle of life itself, to the spirit of humans, or to the intellect, personhood is a gift from God. To be created in the *Imago Dei* indicates a reflection of God's own spiritual nature

and power, with a capacity for creativity, spirituality, and transcendence all embodied within a skin, and yet, activated through empowered dialogue. As a contained, interacted with, mutually engaged reflection, such a definition may be regarded in expressive, descriptive, ontological, and substantial fashion without denying the relational capacity for dialogue and fellowship in love.

The self is not a "given" or a static entity, but is endowed with a dynamic movement of a hypostatic-ecstatic nature.[40] The term *hypo-stasis* refers to an ontological, essential, or sub-structural construct, which serves as a "substantial" base which upholds the characteristics of being human. It serves as a defining construct for the unique and emerging self, differentiated from its engendering entities (parents) and socializing systems. This self is endowed with energy to be, and to enact a process of growth without necessarily ending in an isolated state, devoid of grounding. The term *ek-stasis* conveys movement, as if the self is transpersonally "coming out" and targeting ("moving toward") love objects.

Personhood constructs include not only properties defined with "self-" prefixes ..., but also the capacity for relationship, fellowship, and dialogue.

From such considerations, an integrated emphasis is placed upon substantial self-understanding as well as upon relational capacity. Rather than presenting a self which "possesses" an essence (*natura*) as the substance of its existence, the self may be postulated as standing out (*ex-sisto*) as a person toward others.[41] Thus, personhood constructs include not only properties defined with "self-" prefixes (e.g., self-consciousness, self-reflection, self-determination), but also the capacity for relationship, fellowship, and dialogue. Such dialogue may be enacted with past, future, and present objects, both external and internal to the self. Multivoiced events/processes are perceived to be enacted within, in-between, or beyond the boundaries which comprise the life space of the self. From a multilevel, multivoiced perspective, the self may be considered as being both receptive and expressive along its capacities to engage at biological (natural), psychological (soulical), and spiritual levels. The spiritual level may encompass the capacity for intuition, faith, illumination-inspiration, and related states/processes of a "higher" nature.

A twist in the paradigm: Sin and depravity of the self. Theological reflection points to the notion that the original "edenic" (unimpeded, open, mutual) dialogue was impinged upon by the entrance of sin. The concept of sin indicates both the "missing of the target" and the trespassing of God's will. Misdirection in the movement and aim of the self, lack of true self-actualization of God's intended design, and defiance/overstepping the boundaries demarcated by God for the self, are all connotations of this concept.

Although the potential or capacity for a transactional dialogue exists, it has been affected by sin. "The Fall" is defined as the disobedient event-process which rendered the human under the penalty and consequences of trespassing God's boundaries and missing God's targets, with the consequential separation and movement away from God. The result of improper grounding is a condition known as "depravity," or the human incapacity to do what is right at all times (implying the presence of absolute voices "standardized" with moral tones). The separated, autonomous self cannot engage freely or perceive reality with accuracy. Thus, a deep reserve exists about the intrinsic capacities of the self (in terms of observation, perception, inductive or deductive reasoning, judgment, reliability, and validity) to ascertain "the things of God." The narrative of the divisive temptation points to the distortion of the intended meaning of God's dialogue, deviating the person away from the original design and purpose. Thus, left to its own will, constructive powers, and ungrounded faculties, the dialogical self experiences distortions and is incapable of addressing God in an unimpeded fashion.

Inherent in the self's endowment is the limitation imposed by entropic contingencies which ecosystemically filter spiritual reality. Although conscious of its own (self-awareness of) finitude, mortality, and precariousness, the self may be unaware of God's provisions: *"The man without the Spirit ... cannot understand spiritual things"* (1 Cor. 2:14, NIV), which denote a need for acquiring and employing the capacity to ascertain transcending reality from a different basis and point of view. Without being grounded in God, who can provide redemption, meaning, and purpose, life under the sun does not make much ultimate sense. What has been intended for ecstatic movement, becomes apostatic (moving away from the object of love), solipsistic (self-contained), moving in two directions: in centrifugal fashion away from God as interlocutor, while introverting the thrust in a narcissistic, centripetal, or "selfish" fashion. Such an apostatic self, having rejected God as the interlocutor, seeks to find in the

multitude of voices of the multiuniverse someone or something to feedforward (anticipate) and receive feedback for validation and meaning.

It is my opinion that the "multivoiced" aspect of the self emerged as a consequence of separation and departure from God as an interlocutor, leaving the human subject to intrapsychic complexity, disarray, and dialectic endeavors in attempts to make sense out of perceived reality. Dominance among such "voices" would denote the "main character" of the person at a given time, gaining a consolidated and customary way of expressing the self.

An apostatic self, having rejected God as the interlocutor, seeks to find in the multitude of voices of the multiuniverse someone or something to feedforward (anticipate) and receive feedback for validation and meaning.

It follows that "self-justification" (the posture of the apostatic, ungrounded self which declares "I am okay") may deprive a person from a real encounter with God's offer of grace and justification (to be declared as being in good standing before the standards and expectations of the postulator of the self's existence and destiny). An example of this is narrated in the parable of the Pharisee and the tax collector (Luke 18:9–14). The biblical narrative presents a vivid picture, with body language as well as verbal voicing of both selves in dialogue with God. The Pharisee's dialogue was enacted as he *"stood and prayed thus with himself ..."* while the publican, *"standing far off, would not even lift up his eyes to heaven, but beat his breast and said, 'God, have mercy on me, a sinner.'"* The publican's dialogue was markedly self-deprecatory and repentant. And yet, he found grace and mercy, being justified by God; while the Pharisee departed in self-righteousness and was invalidated by the source of justification.

It is due to the consequences of being inoperative and not in tune with God at the level of the spirit (in spite of acquiring intellectual, sensitive, or habitual skills along soulical avenues) that the self engages in self-justification of a solipsistic nature. The internal dialogues reveal the character of the individual engaged in intrapsychic expressions. For example, the account of an ambitious man who *"thought to himself..."* and engaged in an internal dialogue of expansionistic, yet solipsistic nature, is coupled with the statement, *"But God said to him, You fool ..."* (Luke 12:16–21). Another reference is made in Psalm 14:1 to a person who *"says in his heart, 'There is no God ...'"* In this account, the character is also described as being less than adequate.

A multivoiced self is capable not only of self-recrimination, as in the case of the tax collector, but of recognition of isolation, separateness from proper grounding, and the vacuum created by apostasis. One example is found in the narrative of the anticipatory, imaginable dialogues which the prodigal son engaged in while preparing for action. He, according to the parable, reflected upon his predicament and rehearsed his script in his mind before he returned to his father (Luke 15:17–19). The recognition of depravity which generates the internal dialogue and fosters a repentant stance, is coupled to the appeal of the memory of his benevolent father. The dialogue being voiced in feedforward fashion, fostered a relational stance "as if" the father were present. Orienting toward the source of his grounding allowed the dialogical self to move toward the eventual, "actual" encounter.

The need for regeneration. Ignoring God as the ground of being as well as the defining, energizing, and justifying interlocutor who provides meaning, renders the self as an "apostatic" or "introverted hypostasis" animated with centripetal thrust and subject to entropic decay. Hence, the need exists to be reactivated and inaugurated in terms of re-establishing a dialogue with God (commonly alluded to as "to be born again" or "to be born of the Spirit" so as to experience the regeneration of the proper substructure, state, condition, and function).

Such a transforming event is coupled to the self's need to learn to dialogue and "grow up again" (be resocialized by God so as to speak in God's terms, developing spiritual wisdom, and understanding God's definitions of reality). The Bible is a redemptive account of God's transactions with the derived personhood-in-relation. As the New Covenant unravels, more expressed aspects of God's will and design for the human appear. Due to the self's incapacity to be and to do what has been designed and expected, God took the initiative to re-establish the dialogue and fellowship. God acted in an unilateral, unconditional, and proactive fashion, to address the human in propitiatory, redemptive, and transforming fashion. Having eliminated the negative consequences of disobedience, separation, and brokenness in dialogue, God invites the self to relate in Spirit and truth, to know him, and to receive his laws within the heart and mind (Heb. 10:16–18).

Theologically speaking, the redeemed-transformed self is not aimless, adrift, or purposeless. Rather, it is teleologically summoned to fulfill a destiny in fellowship with its postulator who has invited the *Imago Dei* to participate in an ultimate state, condition, and function yet to be actualized.

Hypothetical Constructs of Grounded Selfhood

Structural constructs. This author entertains the notion (and appeals to metaphors) proposed by thinkers who regard the self as standing out as an existing person, yet grounded in God and in others.[42] To represent the multivoiced, intrapsychic, and interpersonal aspects of the dialogical aspects, spatial metaphors are appealed to, somewhat similar to the ones postulated by Lakatos.[43] Such rendering presents the self as endowed with an "inner core" of metaphysically held beliefs and values, surrounded with a "protective belt." The construct is expanded here to include dialogic processes of anticipatory, reactive, and proactive nature, with feedback and feedforward capacities for transaction with inner voices, collective voices, and the voice of God.

This inner core is self-organizing and transactive, and may be open to the coparticipation with the Postulator of its being, at the level of the Spirit after being activated by the will, action, and summoning call of God. The inner core may be conceptualized as being transacted by a zonal boundary which has an "inline" encompassing the tacit, personal knowledge of reality, the intrinsic/ontological endowments, and emergent properties derived from a relationship to God and others. This is the realm of faith, spiritual intuition, and deep awareness of God's Spirit. It is activated, inaugurated, and empowered by God to function in relationship to him and spiritual reality. The "outline" of this zonal boundary experiences accessibility to the "soulical" attributes, the emergent properties derived psychologically from intrinsic motivations, proactive endeavors, and introjected voices and images. Thus, deep-seated tacit knowledge, faith, and capacity for love may be surrounded, amalgamated, or transacted with reason, logic, entrenched attitudes, self-confirmatory bias, stereotypes, and self-pronouncements which comprise the cognitive, affective, and behavioral structures, processes, and events which belong to this zonal construct. Volitional aspects are imbedded as well, representing the motivational, proactive, and purposive dimensions of the self-organizing capacity of the inner core which transacts with its "zonal boundary." The hypothetical protective belt serves as a "semi-permeable membrane" filtering incoming information and allowing the transduction of intuitional, faith-based expressions and spiritual dimensions "from within." It also functions as a "consolidating mechanism" which buttresses and affirms the contents of the inner core.

The core-belt system is a dynamic construct which experiences degrees of strength and functionality to serve the purpose of "holding oneself together." For example, the scriptural expression "gird up the loins of your understanding" (or "gird up your minds" in 1 Peter 1:13 which conveys the act of gathering a loose garment and tucking it under the belt for freedom of movement), in my opinion, represents a metaphorical way of expressing the need to "gather oneself together" or "tighten the belt" to prepare for spiritual or emotional struggles, service, or tasks. In doing so, the self is not just guarding an inner core of metaphysically held beliefs of guiding nature, but is proactive and purposive in action.

... the self [is presented] as endowed with an "inner core" of metaphysically held beliefs and values, surrounded with a "protective belt."

The outline boundary bordering the cosmos "outside the skin" of the embodied self deals with the transactions between the unique features of the amalgamated "inner core/surrounding belt" and the "external reality" (the ecosystemic environment). The self may engage in transpersonal dialogue with the cosmos and its stressors, demands, and contingencies present in the surrounding context, as well as with stressors, activators, or motivators which emerge from the biological sensations and needs of the organism, translated into voiced subceptive, apperceptive, or even perceptive promptings.

Between the inner core and its surrounding zonal-psychological outline, the multivoiced self may engage in intrapsychic-polyphonic dialogue. Whatever sensations, stimuli of varied nature (including "the other"), enter the phenomenal field of the self and in superconscious, conscious, or subceptive fashion, are apprehended, such may be acted upon, processed, and responded to with feedback and feedforward processes. Examples of an intrapsychic struggle are gathered from Paul's letter to the Romans (7:14–26), where he recognizes the internal pull between two positions of the "I": "*... it is no*

longer I (an inner core) *who do it, but sin living in me"* (surrounding entropic zonal aspects intruding and controlling core aspects). *"... so then, I myself in my mind* (an inner core) *am slave to God's law, but in the sinful nature* (unregenerated aspect, natural self juxtaposed to regenerated self) *a slave to the law of sin."*

An example of the dialogical nature of the self is found in Psalm 42, where David sings to God in worship: *"my soul pants for you, O God ..."* (v. 1). Next, he turns to his introjected images of the past, remembering his enemies: *"while men say to me all day long, 'Where is your God?'"* (v. 10). He also remembers his friends: *"how I used to go with the multitude, leading them to the house of God ..."* (v. 4). Then, he addresses his soul, as if from the top: *"Why are you so downcast, O my soul? Why so disturbed within me?"* (v. 11). The many voices of despair were superseded by a metacognitive expression, which appears to be an empowered and dominant voice which reminds him of his grounding in God. Such internal dialogue is intended to serve as a buttressing self-talk aimed at facing the realities of his existence under the sun.

Intrapsychic dialogue is established with the capacity to target or focus and intentionally process reality as perceived (reality-based, distorted, imaginable, or fictional), accommodated through idiosyncratic, mediational processes (attributional, value based) in a proactive, dynamic, and transactive fashion. Thus, a parallel, multi-level/multi-zonal, convoluted, and cybernetic version of the dialogical self emerges, who encounters the cosmos at the boundary of the "me–not me" with the skin acting as a barrier along the physical dimension, and the level of differentiation-individuation along the psychological lines.

Implications of These Views

The views presented in this article allow for some considerations with regard to the substantial-dialogical personhood.

The need for a differential psychology of the self. Difficulties are inherent in any attempts to render a general psychology of the self, as the ontology, epistemology, and teleology which depart from secular propositions allow for an undifferentiated or unqualified definition of personhood, without resorting to "redeemed self" as over "natural self." At "redemptive levels" of explanation, the personhood of a "believer" is regarded to be qualitatively differentiated from the nonbeliever on the basis of grounding, belonging to God's fellowship, empowering and validation of its capacities, and dialogue at the level of the Spirit. The finite "I am" is postulated as being grounded in the ultimate I Am, deriving a qualified personhood from such basis.

The dialogue of redeemed nature is not a given, nor automatically ascribed by culture, tradition, inheritance, or self-prompting, but is presented as an event-process in which the self, summoned by God the postulator, accepts the invitation to reconnect (*re-ligare* in Latin) and have fellowship/rootedness on the graciously provided basis of a vicarious, mediational, and redemptive act of God in history. God, having dialogued in various manners in ancient days, finally did so through the incarnated logos: *"in these last days he has spoken to us by his Son ..."* (Heb. 1:3). So, *"as the Holy Spirit says: Today, if you hear his voice, do not harden your hearts ..."* (Heb. 2:7).

Grounding in the voice of God through Scriptures, plus being grounded in God at the level of the Spirit through redemption and transformation, allows the self to redefine and reattribute meaning to reality ...

Capacity for transcendence. The dialogical self embodied in space and time can transcend both. Beyond spatial limitations, the self may "come out" (metaphorically speaking) and be ecstatic through relationships with God and others, or "bring in" others into voiced, subjective considerations. Beyond temporal boundaries, the self may engage with history: its own introjected and stored past, that of others who may be voiced as memories, or gathered accounts through stories. Reflecting on God's capacity to "call things as if they are when they are not yet," the grounded self may in anticipatory fashion engage in eschatology by rehearsing prognostic notions, expectations, and affirmations made in hope and faith in future events.

Transactions with God's dominant voice. Dialogical personhood expresses itself as well as treasures up the expressions of love objects. *"Let the word of Christ dwell in you richly ..."* was the counsel of St. Paul (Col. 3:16, NIV). Thus, dialogue with the postulations of God (introjected, amalgamated, chunked, and forming part of a superconscious repertoire of voices) is possible, in a constant "renewal of the mind" (Rom. 12:1, 2) to allow for creativity without detouring into apostatic or solipsistic processes. The coparticipation among propositional

truth, existential knowledge, and psychological processes (the awareness of phenomena of subceptive, apperceptive, subconscious, or superconscious nature as well as that derived from the rational processes engaged in cognitive processing of information at "obvious" levels) allows for meaningful internal dialogues in constant flux. The "chunking" of such becomes the substructure for personal, tacit knowledge, which appears as "being there," proceeding from data gathering to abstractions with insight, understanding, and wisdom.

A Christian may regard Scriptures as the multivoiced account of God's instrumental authors (prophets, apostles, psalmists, etc.). Together, such diverse renderings convey an admirable unity of purpose, claiming to be inspired ("God-breathed"). All the writers may be regarded as being in dialogue with the same dominant voice—the eternal, constant, and guiding Logos, the Verb who finally became "incarnated" (*"And the Word became flesh, and dwelt among us ..."* [John 1:14]) so he could address humankind as a relational person. Establishing a dialogue with the Scriptures allows for a fellowship with a living Word, not with a dead letter (Heb. 4:12), taking "to heart" the words of Jesus, *"The words which I have spoken to you, they are spirit and life"* (John 7:64). And, *"Man shall not live by bread alone, but by every word that proceeds from the mouth of God"* (Matt. 4:4). Thus, being grounded in the voice of God through Scriptures, and also being grounded in God at the level of the Spirit through redemption and transformation, allows the self to redefine and reattribute meaning to reality with faith and hope, not as a drifting array of multivoices, but as a cohesive and purposive dialogical self.

Dialoguing with the cosmos. Fine tuning into God's voice may allow a person to dialogue with God's creation in contemplation. "Listening to cosmic dialogue" appears in metaphorical personifications, in narrative fashion: *"The heavens are telling the glory of God; and the firmament proclaims his handiwork. Day to day pours forth speech, and night declares knowledge. There is no speech, nor are there words, their voice is not heard; yet their voice goes out throughout all the earth, and their words to the end of the world ..."* (Ps. 19:1–4). Also, *"Deep calls to deep, in the roar of your waterfalls, all your waves and breakers have swept over me"* (Ps. 42:7).

Dialogue with the cosmos implies not only a reflective stance, but an administrative responsibility as well. Humans have been given the cultural mandate to "name" the rest of the creatures (Gen. 2:20). In ancient thought, the Semitic "naming" implied the capacity to define, discern, investigate, and learn the inner secrets of things, the ontological aspect or the essence of things. As related to inquiry, the human was not given the capacity to name God, but vice versa. Attempts to define, discern, and learn the inner secrets of an incomprehensible God in systematic renderings of logical nature ("to name" or define means to encompass in comprehensive categories) fall short of embracing its most ambitious subject. Yet "humble" theological and psychological dialogue among those in academia is possible. Thus, scientific endeavors are encouraged, sanctioned, and validated to create or to "toil" (in a secondary sense, out of God's *ex-nihilo* created order).

As related to therapeutic work, the dialogical emphasis places communication at the center stage, with rapport building, empathic engagement, working through problems in the context of mutual dialogue.

Dialogue may also assume a unique tone when the self addresses situational constraints and difficulties encountered in the cosmos, abstracted into concepts which are somehow "personified." Observe the case of a person addressing a "mountain" with the faith that it will be removed (Zech. 4:7) or inanimate objects of unfruitful nature (Jesus scorning or cursing a fig tree for not having fruits). Dialogue becomes dialectic and paradoxical when the self encounters dissonant, oppositional, or conflicting voices in its investigation: Data from the cosmos may directly conflict with the metaphysically held beliefs at the core. Yet, without denying the sensical, empirical, or scientific endeavor, the self may hold on to the "girded loins of its understanding" due to the nature of the tacit protectiveness of the hypothesized "belt" holding the self's capacity to tolerate ambiguity. The resolution of cognitive dissonance is possible by the modes employed in bolstering some voices while giving a lesser value or softer tone to others.

Practical considerations: Integrating therapeutic notions. In therapeutic work, the dialogical emphasis places communication at center stage, with rapport building, empathic engagement, and working through problems in the context of mutual dialogue. "Talking cures" may indeed recover their original intention and meaning, employing both rational as well as dialogical discourse in interaction.

Diagnostic considerations may include the understanding of the person's self-dialogue (autistic, idiosyncratic, polyphonic-novel type, introverted-hypostatic, apostatic, etc.). Impressions about the person's troubles are aided by the discernment along introjects in which enmeshed voices appear (symbiotic, judgmental, ambivalent). Dominant voices, as in the case of repetitive obsessions and self-critical, intropunitive stances adopted by the multivoiced self, may be assessed in relation to irrational self-confirmatory beliefs which foster psychopathology.

Conclusion

The creative and sustaining Word of God is seen as postulating a substantial self with dialogical tones, who by virtue of the word can communicate. Such communication may assume logical discourse along symbolic (abstract, condensed meaning) and concrete (specific, literal) lines. Categorical propositions (axiomatic, dogmatic, revelational) as well as scientific (hypothetical, empiric) ones may be enunciated. Such capacity does not preclude nor exclude the capacity to engage in narrative accounts (story, fiction, metaphor), which may convey a deeper, affective and ecstatic emphasis not always available in the "cut and dry" propositional or analytic expressions.

Grounding in God, in history, in fellowship, and in the cosmos, provides a sense of constancy, permanency, and sameness in spite of variations due to fluctuations in mood, sensation, perception or awareness. Holistic growth is possible within the stability that allows for the flexibility of the multifaceted, multivoiced self. Thus, the postmodern dialogical self animated along a nonpurposeful drift, floating without direction or sense, is encountered by the Christian dialogical (yet ontologically-relationally grounded) self. Such a being is eschatologically aimed, with an epistemological basis on God's pronouncements and teleological destiny.

A return to the proper grounding represents an essential feature in considering the self in the cosmos: Inviting the transcending God, or, better said, accepting God's invitation to coparticipate dialogically in everyday life, brings meaning and purpose under the sun. In the words of Ecclesiastes, *"Meaningless! Meaningless! ... Utterly meaningless!"* (1:2). All is vanity "under the sun" unless a point of reference is believed, accepted and adopted as the anchor point for all constructive endeavors in the here and now. Thus, the transformed self does not live by its own multivoiced feeding alone, but by digesting in dialogue every word that comes from the mouth of God. ♦

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The Apologetic Argument

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Where do we start when arguing for the existence of God? Is there a proper order of topics in the discussion? This paper draws together many of the varied threads of evidential apologetics into a single argument as a debate between an atheist and a Christian. I argue that our belief in God starts with the direct perception of his being, and that further evidences come into play primarily as responses to atheist attacks on the validity of that sense of God's existence. This argument ends up in several issues of quantum mechanics and cosmology presently at the forefront of scientific research.

The question of the existence of God is the primary question of human existence. All other deep questions revolve around this one. Questions of ethics and government come down to, "Is there a God who has given eternal moral laws, or not?" The question of the meaning of life comes down to, "Is there a God who cares about what I do and say?" The question of freedom comes down to, "Is the thing that fundamentally controls everything in the universe friendly to me, or unaware of me?"

In this question, the believer, who argues for the existence of God, expresses an "apologetic." No Christian, who wants to follow God's command, "Always be ready to give an answer to everyone who asks you to give the reason for the hope that you have" (1 Peter 3:15), is free to ignore the topic of apologetics. Of course, Christians often disagree about *how* we should give that reason.

I have previously outlined the basis of an *evidential* apologetic.[1] In essence, I simply argued that the critiques which reject evidential reasoning because it does not provide absolute, axiomatic certainty do not hold up because the idea of absolute certainty is nonsense. Any use of language automatically requires some vagueness. Yet, we can become "very" certain of things via empirical reasoning.

Much evidential apologetic, however, seems unsatisfactory because the discussion focuses too narrowly on certain issues. One can get the false impression that those issues are *the* issues of apologetics, and that resolving them will prove the existence of God. For example, much apologetic discussion has revolved around the evidence for design in the universe. While this evidence does hold a crucial place in the apologetic discourse, nevertheless, apologetics does not start and does not end with the argument for design!

In this essay, I wish to make a case for the proper *order* of discussion topics in the apologetic argument. Science enters naturally into this discussion, but science is only part of the discussion.

I see the philosophical discussion of the past two centuries as very much taking the form of a debate. At times, one side has scored points, and then the other side has responded. Although this to and fro has not occurred strictly in sequence, I will cast the discussion here as a debate.

The Starting Point: *Perception*

What is the starting point of the debate? To put it another way, what is our common ground? To have a debate, we must agree on *something*. We simply cannot have a debate if both sides agree on *nothing*! On this question I find near-universal agreement in the Bible, the historical writings and creeds of the Reformers (e.g., the Westminster Confession), and common sense and experience. We believe in God because we *perceive* God directly.

The Bible says:

> The heavens declare the glory of God, the skies proclaim the work of His hands ... There is no speech or language where their voice is not heard (Psalm 19:1, 3).
>
> For since the creation of the world God's invisible qualities—his eternal power and divine nature—have been clearly seen, being understood from what has been made, so that men are without excuse (Romans 1:20).
>
> His sheep follow him because they know his voice (John 10:4).

The Westminster Confession says:

> We may be moved and induced by the testimony of the Church to an high and reverend esteem of the holy Scripture, ... yet notwithstanding, our full persuasion and assurance of the infallible truth, and the divine authority thereof, is from the inward work of the Holy Spirit, bearing witness by and with the word in our hearts (I.5).

Our sense of justice also demands that this be true. If knowledge of God is not universal, then how could God condemn people for rebelling against someone they never knew? Yet, in the Bible, God claims to be the judge of all humanity (e.g., Romans 1:19). Suppose, for instance, that knowledge of God depended on a *deduction* based on abstract philosophical reasoning. Then only intelligent people could believe in God. Dumb people would all stand condemned! Alternatively, suppose that belief in God depended on a *choice*. Then if someone did not happen to make that choice, they could claim, legitimately, that they had no knowledge of God![2]

This argument for perception based on justice is crucial because the debate about God is primarily about whether there is a God who is the universal *Judge*. One can imagine all kinds of other gods who hide themselves and whom most people cannot perceive, but one cannot demand universal ethical absolutes from such gods. If I cannot perceive the lawgiver, he cannot hold me accountable to his law. Paul implicitly recognizes this in his opening treatise in Romans 1. No one feels threatened by remote, clockmaker gods. People rebel when we tell them our God demands that they obey him!

A "perception" in this context is any knowledge which is written directly into our consciousness (by God, but we may not think so) without our fabrication. Perception therefore includes not only our five "external" senses but also our "internal" feelings, such as guilt, fear, and love.[3] It does *not* include propositional statements of language, or theories and ideas from our imagination. (As discussed earlier, all languages are theories, i.e., simplifications which have their source in our imagination.[4]) Francis Schaeffer's analogy holds here: we are like travelers lost in the Swiss Alps.[5] We hear a voice in the dark saying, "I can help you if you do as I tell you." We do not know where the voice comes from, in any absolute sense. We must merely decide how to act in response to it. To do so, we must formulate a theory about the source of the voice. We may change that theory, but we cannot change the fact that we have heard a voice.

Christian presuppositionalists, such as Cornelius Van Til and John Frame, seem to make the same point, although they get things a bit muddled.[6] They insist, correctly, that God must be the starting point and that we do not "deduce" our way to God from abstract principles, but rather, we "know" God already. If we deny that knowledge, it is because we hate God and his laws. Thus, we tune him out, in which case we are not approaching the argument "neutrally." The presuppositionalists muddle things, however, by referring to this prior knowledge of God as a "presupposition," i.e., a proposition formulated in a language. They then wish to justify sense experience as a logical deduction from this proposition.[7] As I have previously discussed, however, a language relies on prior sense-experience.[8] Words in a language come from repeated as-

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sociation of sense experiences. With no sense experience to attach to the words, a proposition like "God exists" becomes empty sounds in the air. Therefore, we must trust our sense experience before we can trust any proposition of language. "Justifying" our sense experience based on logical deduction from a presupposition is not necessary. As Jonathan Edwards said, we trust our perceptions because we must. We have no other source of knowledge.

[Believers'] confidence is the confidence of perception. In the same way, a woman is confident that the chair on which she is sitting exists. She needs no axiomatic arguments, nor would they do any good ...

What exactly do we mean, when we say that we perceive God? Do we mean that from birth we understand the intricacies of the theology of a triune, omnipresent, omnipotent, self-existent, infinite, holy God? Not quite! I think that for most people the perception of God is found in our ascribing meaning to words like "beauty," "justice," "guilt," and "design."[9] When we use such words, we mean that these things exist in the real world, independent of ourselves. We feel that a thing possesses beauty, not merely that it provokes beauty-thoughts in us.

This, then, is the "common ground" and the source of the debate with the nonbeliever. We agree that such perceptions exist. The believer says that such things are *intrinsic* to the universe, basic to the fabric of the universe, and independent of us, while the unbeliever says that they are illusions, things projected forth from ourselves, and are unknown to the universe apart from us. In other words, the believer says that the universe reflects a *personal* touch, while the unbeliever says it is *impersonal*. To the believer, all these things which we uniquely appreciate as persons do not have us as their *source*, but rather as their *receptacle*. In C. S. Lewis' terms, the believer says that the Absolute of the universe is *higher* than we (having greater personality), while the unbeliever says in effect that it is *less* than we (having less personality.)[10]

Almost all believers I know talk of coming to faith because they "knew in their hearts" that God was there. Few believers are familiar with axiomatic deductions or with axiomatic presuppositions! Their confidence is the confidence of perception. In the same way, a woman is confident that the chair on which she is sitting exists. She needs no axiomatic arguments, nor would they do any good—she simply feels the chair. The person with faith in God has the same kind of rest.

Why should we go any further, then? Can we not be satisfied with perception and forget about apologetic arguments? No, we must go further because the issue is pressed on us by others. Let us go back to the chair on which the woman is sitting, which she thinks really exists. A man comes into the room and begins to make very persuasive arguments that the chair is not, in fact, real. Then one of two things must be true. Either (1) she is seriously deluded and in danger of falling on the floor, or (2) the man denying the existence of the chair is a poor fool who deserves pity. Both possibilities deserve some attention. If one is confident that (1) is not true, one must still feel some compassion for the poor deluded fool in the case of (2).

As John Frame has noted, one would not adopt the "presuppositions" (beliefs) of the fool in trying to help him.[11] Frame might want to appeal to axiomatic Christian presuppositions, but a more normal approach would be to appeal to the "common ground" between us: sense perception.[12] An appeal to axiomatic logic (e.g., presuppositions) would not help. What might help would be a jaunt around the room, including an attempt to walk through the supposedly imaginary chair. The man might deny perceiving the chair, but he could not walk through it. His reactions would force reality on him. Even if this did not change his delusion, at least the perception of his reaction would provide a healthy safe check for the woman that (1) is not true.

On the other hand, if we did *not* perceive God, then an apologetic argument would be of little use. Suppose a person tried to persuade someone of the existence of an imperceptible, invisible chair, one which people can walk through and which they cannot sit on. What difference would it make? The argument might be self consistent, but without any perception of the chair it would mean little. In other words, it would violate Occam's razor.[13]

Since this essay will repeatedly use Occam's razor, let me restate this principle here. Occam's razor is one of the most powerful tools of inductive reasoning. In modern formulation, this principle says that given two theories about something, if one requires a substantially greater number of imperceptible entities, it is less likely to be true. Note that *all*

theories require *some* imaginary, or imperceptible, entities. To simplify the vast and complex world of our perception, we must imagine some imperceptible connection between the things we perceive. Thus, we may postulate a causal relationship, or composition from the same kind of elementary particles, or some other unifying relationship. This process of hypothesizing imperceptible entities is essential for the scientific method. But our experience leads us to expect that when someone multiplies imperceptible entities *endlessly*, that person likely has a particular goal in mind that no amount of experience will overturn—theory will be ever altered to conform the facts to the preconceived goal.

We would misuse Occam's razor, however, if we said that we should prefer all simple theories to complex ones. Certain forms of astrology may be simpler than modern general relativity, and the theory of five elements—air, water, fire, earth, and ether—seems far simpler than the modern periodic table! These "oversimplified" theories actually violate Occam's razor, however, because they require us to ignore vast amounts of observational data. Whenever a new experiment violates the "simple" rules of the theory, the "simple" theory requires us to make an "exception." Such an exception is, in effect, a hypothesis of some new, unknown entity that allows this particular data to violate the "simple" rules. The modern theories of astronomy and the periodic table historically grew out of old theories of astrology and alchemy for this very reason. Too many observations failed to find explanation in those simple schemes, so that the list of exceptions became an endless list of inexplicable entities.

The unbeliever argues that the idea of God is an unnecessary hypothesis of an imperceptible entity, whereas the believer argues that the unbeliever must "explain away" too much experience.

The debate between the believer and the unbeliever essentially becomes a debate about who makes a greater violation of Occam's razor. The unbeliever argues that the idea of God is an unnecessary hypothesis of an imperceptible entity, whereas the believer argues that the unbeliever must "explain away" too much experience.

Christian theology may sometimes seem complex and full of imperceptible entities. As I have argued previously, however, theology acts as a theory to explain spiritual "data" in the same way that physical theories explain physical data.[14] We do not expect to directly perceive things like infinity and tri-unity any more than we expect to directly perceive relativistic field equations and hyper-dimensional symmetries. Yet, just as physical theories attempt to explain real experiments, so theology is tied to real experience. This experience of God does not consist of esoteric subtleties, but of the things that scream out at all of us—beauty, guilt, justice, design, etc., and the power of the Bible itself.[15] The Christian argues that the theology of God is the *simplest* way to understand all these things. C. S. Lewis said:

> Theology is in a sense experimental knowledge. It is the simple religions that are the made-up ones ... If Christianity was something we were making up, of course we could make it easier. But it is not. We cannot compete, in simplicity, with people who are inventing religions. How could we? We are dealing with Fact. Of course anyone can be simple if he has no facts to bother about.[16]

The Counter Argument: *Self-Deception*

The unbeliever must have an explanation for these "religious" perceptions. Even if the unbeliever denies perceiving such things himself, no one can deny that some people perceive such things. The existence of blind people, or people who keep their eyes shut tight, does not remove the need to discuss the existence of light. People with sight can describe their perceptions, communicating them to the blind person via the available senses, e.g., by talking. Unless a person has no external senses at all, and therefore no communication, that person must deal with the evidence of sense perceptions by others.

The most successful explanation by the atheist for religious perceptions came in the last century from scholars like Freud, Marx, and Feuerbach, but atheists in previous centuries used this argument as well. These men, and many after them, pointed out that our perceptions are inextricably tied to human *needs*, both physical and social. For humanity to survive, people must procreate, and in order to procreate, they must have a desire to do so. For humans, this desire often takes the form of seeing beauty. If we all looked disgusting to each other, the human race would cease to procreate and would die off. In the same way, for society to survive, it must have limits on individual behavior. If people felt no guilt, honor, or shame, then society could not enforce its rules and would cease to exist. Furthermore, it is possible for people to manipulate these feelings for personal

ends. Rich people can use religion as an "opiate" of the masses. Men can use love to manipulate women; parents can use shame to manipulate their children.

This argument gains strength when a comparison with animals is also considered. Animals, too, have needs and senses that match those needs. People appear more complicated, but not utterly different.

Our perceptions are inextricably tied to human* needs, *both physical and social.

The Christian does not deny any of these physical, psychological, or social needs. In the economy of God, people tend to feel good about things that are good for them, either as individuals or as a society. If God had not set things up this way, we would indeed have a short existence on this planet! Human society would not remain stable for even a few years. The Christian also does not deny the existence of manipulation. Because of sin, sometimes those perceptions become warped and we perceive things as good which are actually bad, or things as shameful which are actually honorable. Evil people can deceive us—no one denies Marx' charge that rich people have used religion as an "opiate" for their own ends. Calvin responded to similar teachings in his day:

> It is utterly in vain for some men to say that religion was invented by the subtlety and craft of a few to hold the simple folk in thrall by this device and that those very persons who originated the worship of God for others did not in the least believe that any God existed. I confess, indeed, that in order to hold men's minds in subjection, clever men have devised very many things in religion by which to inspire the common folk with reverence and to strike them with terror. But they would never have achieved this if men's minds had not already been imbued with a firm conviction toward God, from which the inclination of religion springs as a seed.[17]

In other words, all of the manipulation and wish fulfilment has an explanation in the Christian worldview. In fact, the Christian worldview even has a good explanation for the existence of atheists.[18] This does not settle the issue, however. Occam's razor comes back into play. If all our perceptions of God, honor, shame, etc. are explained simply by psychological need, then why postulate God? This is a strong argument. How can I tell the difference between perceptions of properties which are inherent in something outside of me, and perceptions which are really false projections of my own internal need? Since every act of perception involves both a source and an observer, I cannot decouple my perceptions from myself, to see the "real universe" apart from my needs and desires.

Response: *The Complexity of the Self*

The Christian addresses this problem by noting that it ignores a larger question. Given the existence of humans the way they are, the atheist can perhaps easily find a way to attribute all of our deep, religious perceptions to internal, psychological needs. But whence come such complicated things as people, who can project such sublime feelings onto the impersonal universe? As pointed out by C. S. Lewis, if all these perceptions by persons come from properties found entirely within themselves, then does that not make humans *superior* to everything else in the universe? How could an essentially impersonal universe generate humans which see personality in it?

It is difficult to express in exact terms this "superiority" of humans to everything else. As far back as Augustine, scholars have "ranked" various creations and creatures, putting humans at the top. Is this mere self-centered pride?

Our "common sense" tells us that something must be unique about humans for them to have such subtle thoughts. Several modern scholars have made the argument more precise. Roger Penrose, building on Gödel's revolutionary theorem,[19] has shown that human thought cannot be reduced to any computational process, and therefore he has argued that it cannot be reduced to any known physical process.[20] We can "understand" things that no computer ever will. In fact, the concept of "understanding" is extremely subtle and a unique attribute of humans.

Walker Percy, using modern language theory, has illustrated how humans react differently from everything else in the universe.[21] Rather than responding to stimuli, we respond to *symbols* of the stimuli, which we ourselves have generated. This ability to create fictions in our minds gives us both the ability to create literature and the ability to lie. This ability forms the basis of language, which lumps the universe into vague categories and, therefore, makes absolute certainty of anything impossible.

Both Penrose's and Percy's arguments center around exactly those properties of humans which allow them to conceive of things like "beauty," "guilt," "justice," "design," etc. These kinds of per-

ceptions deal not with the direct stimuli from objects, but with estimations of the overall nature of systems. This systematic, "big picture" perception is difficult to reduce to mathematical terms, but no one can deny its existence.

The Christian argues that personality exists, that it exists in us, and that it is inconceivable for a fundamentally impersonal universe to spawn personality.

On basic philosophical grounds, then, the Christian argues that personality exists, that it exists in us, and that it is inconceivable for a fundamentally impersonal universe to spawn personality. Finding the same attributes of language, etc., to some degree in animals would not affect this argument. Instead of only one fantastically complex and subtle creature, perhaps we will find several!

Counter-Argument: *Chance Evolution*

The atheist's response is well known, going generally under the name of "evolution." The argument is as follows: in an infinite, infinitely varied, but essentially impersonal universe, all kinds of improbable things will occur, including the existence of very subtle and complicated people. The picture is frequently given of millions of monkeys typing randomly at typewriters for millions of years. Given enough time, the laws of probability say that eventually one of them will generate all of the works of Shakespeare. Not only that, but in an infinite time span, they would generate all the works of Shakespeare an infinite number of times!

This argument is essentially correct in its treatment of probability. It is certainly true that many things happen that seem magical, yet which follow directly from simple laws of chance. I and three of my friends may accidentally meet in a shopping mall after not seeing each other for years. Should we conclude the meeting was the result of some unseen, purposeful cause? No. This is known as "statistical clumping," or the "nonpareil" effect. You can see this at home. Put two different kinds of small candies ("nonpareils") in a jar, and mix them up. You will not see an even mix of candies throughout the jar. Instead, you will see "clumps" of one kind of candy in different places, no matter how much you mix the candy.

In another example, suppose you throw a single six-sided die repeatedly. If you threw it just a few times, you would be surprised if it came up "one" five times in a row. If you continued throwing it for hours, however, it would become *probable* to see five "ones" in a row. Not only that, but if you continued for an *infinite* time, there is no limit on the number of "ones" that you might see in a row. You could easily see runs of 100 "ones," 1000 "ones"—if you sat around throwing dice for years!

Note that this argument assumes that *the range of possibilities spans the set of desired outcomes*. It is useless to ask the probability of getting a run of ones, if the dice are labeled "two" through "seven"! Or, in the previous example, if the millions of monkeys all sit at typewriters that do not have the letter "e," no matter how long they type they will not reproduce Shakespeare!

Why belabor this obvious point? The reason is that, as R. C. Sproul has emphasized, randomness is not a causal force, but merely another word for ignorance of causes.[22] What the atheist really says, in the above argument based on probability, is that many uncorrelated, simple causes can lead to arbitrarily complex coincidences. This is true, but it leaves out an important consideration, which is that the "system" must be constructed properly to allow the right kind of coincidences. A "randomly" constructed system will not necessarily allow the kind of coincidences we want to see.

For instance, in an example often used today, it is possible to write computer programs that generate "cellular automata" which reproduce themselves, mutate, and show numerous other characteristics of evolving life, using simple equations. What often remains unstated, however, is the fact that these programs themselves are the products of intricate design. Not all simple equations generate cellular automata. Not even a significant fraction do—most equations generate boring solutions. Without instruction based on previous decades of mathematical research by thousands of brilliant mathematicians, few of us could write a computer program to generate cellular automata. The computer itself must also possess a high level of design. Getting equations to generate the brilliant graphics displayed in these programs requires a complicated code of thousands of lines. "Random" generation of computer code would hardly ever produce cellular automata.

Since the atheist aims to show that intelligent life could arise without prior purpose or design, the evidence must therefore support *both* of the following contentions: (1) that there is no connection be-

tween the construction of the system and the existence of persons (the system is "impersonal"), and (2) that, nevertheless, random correlations in the system have led to the complex patterns of life. In terms of the statistical arguments above, this means that (1) the range of possibilities in the system includes the desired outcome but is not specially related to it (the dice are not "loaded"), and (2) adequate time has passed for the full range of possibilities to be spanned in actuality (there have been enough throws of the dice.)

The [atheist's] argument is as follows: in an infinite, infinitely varied, but essentially impersonal universe, all kinds of improbable things will occur, including the existence of very subtle and complicated people.

The atheist therefore needs no explanation for the existence of life, and for the existence of humans with subtle feelings, if (1) life can be shown to involve only natural processes consistent with impersonal, simple laws, and (2) the universe can be shown to have existed long enough for these laws to actually make intelligent life probable by coincidence. Few people doubt the first premise these days because of the great success of modern science in showing that all kinds of biological processes obey known physical laws. As Penrose and Dembski have argued,[23] however, it is far from proven that brains follow known physical law.[24] A more serious challenge, addressed below, is to what degree known physical laws can be viewed as simple, impersonal, and unrelated to life. From the time of Newton, physical laws have been assumed to have utterly simple form, but as discussed below, many hidden complexities are swept into the values of the physical constants that appear in these laws.

In regard to the second premise, the age of the universe of billions and billions of years, indicated by numerous astronomical measurements, has long been assumed adequate for life to evolve, not only on the earth, but on countless other planets as well.

In the first half of this century, therefore, the atheist's argument of evolution based on probability nearly destroyed Christian philosophy. Almost all Christian theologians accepted the above premises, which imply that belief in God fails in inductive argument because it violates Occam's razor. In response, three Christian schools arose, all of which jettisoned inductive argument and with it, argument based on evidence.[25] The "neo-orthodox" school, represented by Karl Barth, conceded that evolution made belief in God dispensable, but argued for belief in God based on a personal value choice. The "presuppositionalist" school, led by Cornelius van Til, maintained orthodoxy as an axiomatic assumption not open to argument, holding out for a complete reinterpretation of science; the "fundamentalists" held to the Bible axiomatically and rejected science altogether. While these schools differed radically in many ways, they all accepted the idea that the atheist could *consistently* reject God in a scientific worldview, that nothing rationally "compels" a person to believe in God. In contrast, previous Christian thinkers had held that the atheist must "turn a blind eye" toward certain things, i.e., that the *atheist* violates Occam's razor. Only a few scholars like C. S. Lewis and E. J. Carnell maintained an evidential approach, mostly concentrating on the larger philosophical issues and ignoring the details of evolution.[26]

Response: *Probability in a Finite Universe*

The best Christian response amounts to saying, essentially, "Okay, let's roll up our sleeves and calculate the probabilities."[27] Using the non-Christian model of evolution, do the numbers work out to make life probable? It is important here to recognize that this approach does not imply acceptance of the non-Christian model, either in its age of the universe or in its definition of natural law. On the contrary, the purpose for working within the non-Christian evolutionary model is to determine whether it is consistent with experimental and observational evidence and is self consistent. As with any theory, one of the strongest means of refutation is to show that a self contradiction arises while working entirely within the framework of the theory.

Many Christians have shied away from the Big Bang theory because they have assumed that the billions of years involved would provide ample time for chance evolution to produce life. By and large, Christian philosophers have missed the tremendous import of the paradigm shift involved in the Big Bang theory, which requires acceptance of a *finite universe*. As Hugh Ross and others have pointed out, atheists historically have opposed the idea of a finite universe; the Big Bang theory, which implies a universe bounded both in age and extent, received acceptance in this century only after the weight of

evidence overwhelmed years of philosophical opposition.[28] In an infinite universe, the second criterion for the probability argument, above, is manifestly satisfied. If the universe is finite, then the probability for life can, in principle, be very small.

[Strong proofs of the finiteness of the universe] typically were expressed as "paradoxes" before the formulation of the Big Bang theory ...

Although the details of astrophysics provided the impetus for this paradigm shift in atheist philosophy, strong proofs of the finiteness of the universe are available for all to see. These typically were expressed as "paradoxes" before the formulation of the Big Bang theory, since they find their resolution only in the finite-universe model of the Big Bang.

The first is Olber's paradox, or, "Why is the night sky dark?" Simple geometrical considerations, and the assumption of the conservation of energy, show that if the universe were infinitely large and infinitely old, then the night sky would glow with the intensity of the surface of the sun.[29] Although the intensity of stars very far away falls as the square of the distance, the *number* of stars *increases* as the square of the distance. Thus, on average, stars at all distances contribute the same amount of light to the sky. Therefore, in an infinite universe, the infinite number of stars remotely far away would contribute an infinite amount of light to the sky. Although various scholars attempted solutions through the years,[30] the only satisfactory solution came with the Big Bang theory, which says that there are not an infinite number of stars, and furthermore, that the light from very remote stars has not had time to get here, since the universe has finite age.

A second indication of the finiteness of the universe is the paradox of the Arrow of Time, or "why does time only run forward and not backward?"[31] Aquinas touched on this paradox with his argument from Change. The assumption of the conservation of energy implies that the laws of motion must run equally well backwards as forwards. Why then do we experience time running only one direction? The answer comes from the Second Law of Thermodynamics, which states that entropy always increases. The Second Law, in turn, follows directly from the fact that the universe is not in equilibrium, but is expanding. In a static, random universe, a highly ordered state (which could occur due to "statistical clumping") will evolve *toward* a disordered state, but it will also necessarily evolve *from* a disordered state, if the laws of motion are time reversible. In other words, nothing should ever change, on average. To have a *continuous* increase of entropy, the universe must have had an overall entropy minimum at some time in the past, i.e., a beginning.

Both these arguments rely on the assumption of the conservation of energy. This could be doubted, but this would amount to doubting the entire structure of all modern science. Occam's razor comes in to play once again!

Given ample evidence of the finiteness of the universe, one can attempt to calculate the probability of life based on known processes. This "probability of life" involves several different arenas. First, one can ask how intelligent life could evolve from primordial bacteria or other simple life forms ("biological evolution"). Second, one can ask how celled life forms could arise from DNA and other complex chemicals ("abiogenesis"). Third, one can ask how DNA and other complex chemicals necessary for life could arise from simple chemicals ("chemical evolution"). Fourth, one can ask how the simple chemicals came to exist, i.e., how stars and planets formed ("stellar evolution"). Fifth, one can ask how the universe came to have the energy and matter characteristics necessary for stars and planets ("cosmology").

It is beyond the scope of this essay to review all of the work on these topics. Instead, it is sufficient to say that (1) there is growing perception among non-Christian scientists of a "crisis" in the probability arguments, and (2) these calculations ought to be taken seriously by Christian apologists.

Although the view that life appeared spontaneously in primordial pools of slime still appears in many textbooks, recent data on the early-earth environment gives a picture of a much more hostile climate than still pools. The experiments of Stanley Miller are largely discredited as unrealistic.[32] Chemical evolution is presently questioned to such a degree by both Christian and non-Christian biologists,[33] that "panspermia," the idea that previously-evolved spores fell to earth from outer space, now merits serious attention.[34] In the area of stellar evolution, despite the stories in textbooks of clouds collapsing into stars via gravitational attraction, there is still no satisfactory picture of star formation. Although the inward force of gravitational attraction increases as $1/r^2$, conservation of angular momentum implies that the outward centrifugal force increases as $1/r^3$, so that stars can never form unless

some exotic mechanism carries away angular momentum.[35] In the area of cosmology, recent discoveries of large-scale structures in the universe, so large that light would take one-tenth of the age of the universe to cross them, have severely constrained models of galactic formation.[36]

Pointing out the long odds involved in evolutionary cosmology theory ... says that a description of the physical universe which relies entirely on* simple, impersonal *laws fails Occam's razor, because the real universe has the indelible imprint of a Person.

The probability problem does not end with the above, however. As discussed in the previous section, an argument based on "odds" must analyze two things: the probability of the desired outcome given the rules of the system, and the probability of the "system" having rules which allow the desired outcome. In regard to the latter, numerous well-known physicists have drawn attention to the problem of "large number coincidences" in the laws of nature.[37] These arise when various constants of nature, e.g., the mass of the electron and the speed of light, are combined into unitless ratios to make pure numbers. The numbers so formed typically are large, of the order of 10^{60} to 10^{100}. Furthermore, if these numbers differed by some tiny fraction from their actual values, then life would be impossible. Christian authors Hugh Ross and John Templeton and Robert Hermann have drawn attention to these coincidences;[38] New Age authors like Louise Young have also discussed them at length.[39]

In the scientific method, things that are fantastically improbable are considered impossible. This follows from Occam's razor. If you walk into a room with 100 six-sided dice, all showing "one," you "know" that someone has placed them that way. Why? Effectively, to suppose that they had fallen that way randomly would amount to supposing 6^{100} "unseen entities"—i.e., roughly 6^{100} unobserved previous throws of the dice. Note that this argument supposes some connection of the pattern of the dice to you, personally. Any throw of the dice is just as improbable as any other, but most of the possibilities would have no meaning to you—they would be "equivalent" states.[40] Only certain states, e.g., all "ones," connect directly to your experience. Occam's razor insists that if you find an extreme improbability related to yourself, then it is in fact related to you.[41]

The point of calculating the long odds involved in evolutionary theory is therefore not to argue that there are "gaps" in the physical laws, as though the physical universe really has flaws that God must fill *ad hoc*, so to speak. In the scientific method, finding inconsistencies in a theory leads one to look for a new theory. Pointing out the long odds involved in evolutionary cosmology theory does not imply a belief that the real, physical universe has "gaps," or unregulated parts. Rather, it says that a description of the physical universe which relies entirely on *simple, impersonal* laws fails Occam's razor, because the real universe has the indelible imprint of a Person.

Counter-Argument: *Many Worlds*

It may surprise some Christians to learn that modern philosophy of science has largely begun to accept the fantastic improbabilities discussed above and the implication that the laws of nature are, in fact, related to us. The atheist's arguments today have changed direction, in response.

The new atheist's argument allows that the laws of nature and the structure of the universe are related to us based on the "anthropic principle."[42] This argument goes as follows: suppose I ask, "Of all the billions of places on earth, why was I born in Teaneck, New Jersey?" This place is specially related to me—my birthplace—and yet on the face of it, very improbable. We all understand, however, that I had to be born *somewhere*. My individual experience picks out a certain set of parameters that are special only because I am looking at them, a so-called "observer effect." In the same way, the atheist's cosmological argument supposes an infinity of different possible universes. The one universe in which we live has physical laws and structure related to us, only because if it did not, we could not exist to observe it.

This argument is sound, but relies critically on the evidence for multiple experiences. I am not surprised that I was born in a certain place because I see many people born in many places, covering the globe. In a sense, it is the evolutionary probability argument all over again, except that instead of many random occurrences within a system, one assumes the existence of many, random systems. Given an *infinity* of possible universes of infinite diversity, all

manners of coincidences become possible. One has simply embedded our finite universe in an infinite, eternal "macro-universe." The atheist has recovered the eternal, impersonal universe that the Big Bang theory seemed to destroy.

The problem for this kind of theory, of course, is that, unlike the example of being born in Teaneck, in which I can easily see many examples of other people being born, we have no examples of even one other universe. The atheist apparently violates Occam's razor to an infinite degree by supposing an infinite number of imperceptible entities, each of which is an entire universe!

... the atheist's cosmological argument supposes an infinity of different possible universes.

Non-Christian scientists have attempted to find evidence for other universes in at least two different ways. The first hypothesis has relied on a nonstandard interpretation of quantum-mechanics, called the "many-worlds" hypothesis. To resolve certain paradoxes in quantum mechanics, Everitt and Wheeler proposed a view in which at every quantum event (trillions of which occur in a single second, at a single point in space) the entire universe splits into a number of "alternate universes" covering every possible outcome of the quantum events.[43] While this view has received a lot of popularity in the science fiction literature, very few physicists take it seriously. In short, it creates more paradoxes than it solves.[44] How can the entire macroscopic universe light years away "split" at each microscopic event here on earth? Does this not violate conservation of energy to an infinite degree? Why does it only split going "forward" in time, and not backward—what gives the arrow of time?

A more serious proposal revolves around the "inflationary" model of cosmology. This theory, first proposed by Alan Guth, starts with the standard Big Bang theory and inserts, at a very early stage, an epoch of extremely fast expansion of the universe, or "inflation."[45] This epoch then conveniently disguises itself so that the universe looks like it evolved from a simple Big Bang. Only a few trace evidences would remain from the Inflationary era.

The Inflationary model allows two critical changes from the standard Big Bang theory. First, it allows many of the large number coincidences to be combined into one large number coincidence. Second, it allows our universe to be a recently-spawned part of a larger, eternal "macro-universe," so that the remaining coincidences can be viewed as a probable event in an infinite series of random sub-universes.[46]

Most Christian philosophers have missed the import of the Inflationary Theory for cosmology. If proved, it would go a long way toward establishing a "cosmic Darwinism" that yielded persons in an impersonal universe, just as hoped for in the original Darwinism. This aspect explains a lot of the excitement among non-Christian physicists about the Inflationary model in recent years.

The Inflationary model gives very specific predictions for certain observations. Its primary parameter is the total mass density of the universe, usually written Ω. The Inflationary model implies that $\Omega = 1$, i.e., that the total density is exactly equal to the amount needed to make the universe eternal in the future. The density must be neither too little, in which case the universe would evaporate (i.e., expand to zero mass density in the far future), nor too much, in which case the universe would collapse in on itself due to gravitational attraction.

Astronomical observations, however, indicate that the actual mass density is closer to $\Omega = 0.2$. Since observations of the visible universe (light-emitting stars) indicate a mass density too low for the Inflationary theory, many physicists have proposed a search for "Dark Matter," which would make up the remaining 80–90% of the mass needed for the theory.[47] The constraints of nuclear theory imply that this "Dark Matter" cannot be mere chunks of rock or other normal matter. Instead, it must be an entirely new kind of particle which passes through us nearly imperceptibly.[48] Despite the entirely hypothetical nature of "Dark Matter," many atheists are so convinced of its existence, based on the above philosophical considerations, that one frequently reads in the popular literature that "90% of the universe is made of an entirely different kind of matter from us."

The Inflationary theory seems to have received a death blow from recent observations, specifically the Cosmic Background radiation (COBE) study and the observations of large-scale structures, in the universe, clusters of galaxies so large that to cross one, light would take a tenth of the age of the universe.[49] These observations, put together, strongly indicate a value of $\Omega = 0.2$, and do not allow Dark Matter to be hidden. Proponents of the Inflationary theory have not given up yet, however, and continue to attempt new variations of the theory that agree with the observations.[50]

Concluding Remarks

We have ended with several issues at the forefront of scientific research today. This is proper, because much of science today dwells on ultimate questions. Yet we must not put the cart before the horse and dive into scientific issues without addressing the fundamental basis of perception that drives all belief in God. We talk about science in *response* to arguments by atheists which attempt to "explain away" our perceptions of God. I have heard numerous apologetic debates end with the Christian showing strong evidence of something or other, and the atheist finally responding, "But if God exists, why is he so silent?"

If a person feels no guilt, no sense of absolute justice, if a person has no sense of the dignity of humankind, no appreciation of the beauty and design in nature, and if that person remains unmoved by the words of Holy Scripture, then what good is astronomy? As Francis Schaeffer said, "He is there, and He is not silent."[51] To shut him out, a person must stop up his eyes and ears. Yet to those with eyes and ears to hear, the Christian can present credible evidence that the things we perceive do indeed come from God and not from our own self deception.

In the last section I outlined a scientific theory that aims to overthrow the Christian concept of a beginning of the universe. What if it succeeds? In the first half of this century, science seemed to provide a perfectly airtight, Godless view of the world, and Christians mostly retreated into liberalism, presuppositionalism, or antiscience fundamentalism, all of which had the effect of cutting off Christians from meaningful discussion of science. In the latter half of this century, Christianity has seen an intellectual rebirth, even while the number of nominal church attendees in Europe and North America has decreased. Non-Christian scientists and authors have questioned the paradigm of evolution. The disaster of the "new morality" both in the U.S. and in the communist nations has led many to look for moral absolutes. Numerous Christians now claim impressive academic credentials and hold their own in debate with atheists. In a way, it is easy to be an evidentialist. But what if the Inflationary theory suddenly jumps into the public eye with strong evidences of multiple universes? Should evidentialists all say, "You're right, the Bible is wrong"?

Every person should do two things when faced with challenging evidence. First, one should have a healthy doubt about new claims which take into account the presuppositions of the person bringing the message. If a sales agent with an interest in selling me a product shows me an impressive array of statistics, I should still hold out some doubt. Similarly, if people with an interest in becoming a new elite or with an interest in discarding "old fashioned" claims of morality tell me "science has proven ... ," I should take it with a grain of salt.

Every person should do two things when faced with challenging evidence. First, one should have a healthy doubt about new claims ... Second, one should hold on to "internal" evidence ...

Second, one should hold on to "internal" evidence, i.e., "gut feelings." This is valid evidence! For instance, suppose someone tells me my wife has committed adultery, and presents an impressive list of corroborating facts and witnesses. Still, I may say, "I know her, and I know she would not do that!" No Christian should feel ashamed to say, "I know God, and I know his Word!"

Still, one has to leave open the possibility that one has been deceived. As Francis Schaeffer said, "The Christian must have the integrity to live open to the question as to the possibility of his being 'taken in' by his Christian commitment."[52] One must ask, "What level of evidence ought to convince a Mormon to forsake his faith? Am I honest enough to admit error based on the same type of evidence?" This is an uncomfortable idea for many Christians. Yet a person who has looked doubt in the eye, who has examined all the facts and found them to hold up, has a certainty that surpasses all forms of "protected" belief. A man who knows his wife would not commit adultery has no fear of the facts. The man who loudly rejects any examination of the facts is usually the one that fears that they may, in fact, point to a truth he does not want to know!

One thing Christians ought not to do is to take hold of a few scientists of dubious credentials who claimed to have "disproved" all Inflationary theory, trumpet their findings as the final word, and mock all scientists who disagree as members of an international conspiracy to hide evidence. In fact, much "creation science" in this century has taken exactly this form. Evidentialism has taken a beating when numerous apologists had to retract dramatic "evidence" after loudly proclaiming it the definitive

proof of Christianity. In doing so, they ignored good rules of "lawcourt" reasoning. A person who says what you want to hear is not necessarily a trustworthy witness! Sometimes we must simply admit certain things appear contradictory and leave it at that. This is not irrational if we have other strong evidences for believing something.

Sometimes we must simply admit certain things appear contradictory and leave it at that.

In this essay I have only discussed the atheist's position. Christian apologetics must deal not only with the atheist, but also with the pagan. The above discussion of large number coincidences has led not only to support of the Christian position, but also of many other religious but non-Christian views, especially New Age views that make man into God, such as the works of Tipler and Young. In dealing with such views we must dive into the specific evidences we have for God-to-man communication. Apologetics is never-ending, because it must always respond to new challenges to what seems to us obvious: our experience of God. ♦

Notes

[*Author's note:* an * indicates references recommended as useful reviews of science for nonexperts.]

[1]D. Snoke, "Toward the Unity of Theology and Science," *Perspectives on Science and Christian Faith* 43 (September 1991): 166–73 and ——, "The Problem of the Absolute in Evidentialist Epistemology," *Perspectives on Science and Christian Faith* 47 (March 1995): 2–22.

[2]As I have argued previously (see "The Problem of the Absolute"), a survey of Scripture passages indicates that belief in God is essentially *passive*, based on being convinced, not an active choice. Choice in the Bible is always associated with obedience to what we already know.

[3]This distinction between "internal" and "external" senses goes all the way back to Roger Bacon (*Opus Majus* VI, i) but has unfortunately often been lost in subsequent discussion. Restriction to the five external senses artificially excludes a whole realm of our experience. As professional counselors often say, "feelings are facts," though in Western culture we would often like to deny their reality or validity. See, e.g., *A. R. Damasio, *Descartes' Error* (New York: G. P. Putnam, 1994).

[4]*B. Gregory, *Inventing Reality: Physics as Language* (New York: John Wiley and Sons, 1988).

[5]D. Snoke, "The Problem of the Absolute" and F. Schaeffer, *The God Who is There*, in *The Complete Works of Francis A. Schaeffer* (Wheaton: Crossway, 1985).

[6]C. Van Til, *The Defense of the Faith* (Philadelphia: Presbyterian and Reformed, 1955)and John M. Frame, *The Doctrine of the Knowledge of God* (Phillipsburg: Presbyterian and Reformed, 1987).

[7]Alvin Plantinga, another modern presuppositionalist from the Calvinist school of Cornelius Van Til, takes the same approach to "justifying" the senses, e.g., in *Faith and Rationality* (Notre Dame, IN: University of Notre Dame Press, 1983), he affirms belief in God from direct perception, as I do:

> Upon reading the Bible, one may be impressed with a deep sense that God is speaking to him. Upon having done what I know is cheap, or wrong, or wicked, I may feel guilty in God's sight and form the belief, "God disapproves of what I have done." Upon confession and repentance I may feel forgiven, forming the belief "God forgives me for what I have done." A person in grave danger may turn to God asking for His protection and help; of course he or she then has the belief that God is indeed able to hear and help if He sees fit. When life is sweet and satisfying, a spontaneous sense of gratitude may well up within the soul; someone in this condition may thank and praise the Lord for His goodness, and will of course have the accompanying belief that indeed the Lord is to be thanked and praised.

For Plantinga, however, such perceptions are not *sufficient* for belief, and he would supplement them with "properly basic beliefs," i.e., axiomatic presuppositions, which allow organization of these perceptions into meaningful frameworks. Arguing from experience alone would constitute what he calls the error of "foundationalism," the view that beliefs are rational only if based on such sense experience, or on self-evident or otherwise undoubtable propositions (if such exist).

Plantinga, like all presuppositionalists, says that evidentialists are not self consistent since they must "assume" the foundation principle. As I have discussed at length (see "The Problem of the Absolute"), this objection does not stand up since evidentialists do not have to make their "foundation principle" an axiomatic assumption. It simply makes sense as a proper inductive theory based on sense experience. Although our ability to generate theories inductively may involve an irrational leap of the imagination, belief in such conclusions is not irrational because they can be tested by further experience.

Plantinga sounds almost as if he would agree with me in advocating an inductive approach to formulating "properly basic beliefs":

> We must assemble examples of beliefs and conditions such that the former are obviously basic in the latter, and examples of beliefs and conditions such that the former are obviously *not* properly basic in the latter. We must then form hypotheses as to the necessary and sufficient conditions of proper basicality and test these hypotheses by reference to those examples.

In allowing numerous *propositions* to stand alongside experience as "obviously properly basic," however, Plantinga opens the door to all kinds of wishful thinking. We need only apply the test of self consistency to our set of basic beliefs. We do not need to actually test them against experience. It is hard to imagine why *any* religion could not follow the same program.

As I have argued earlier (see note 1), such an approach "protects" Christianity from attack, but leaves it without an argument why Mormons or, for that matter, believers in the Great Pumpkin should not make their claims into "properly basic beliefs." K. Parsons, in *God and the Burden*

of Proof (Buffalo, NY: Prometheus, 1989) has argued the same: Plantinga's views mean the end of rational debate, the end of a common ground for discussion, and open season for all the kinds of nonsensical beliefs seen in bookstores today.

[8]One objection to the idea that all language relies on sense experience is that of Polanyi, that "values" must come from somewhere else. As I have discussed previously (see "The Problem of the Absolute"), all real values come from experience. Of course, one must include "internal" sense experience, which many would like to ignore (see note 3).

[9]Can we perceive God via the five external senses? Although the Bible makes clear that we cannot perceive the "fullness" (or "face") of God via the five external senses—"No one has seen God" (John 1:18), God does not rule out communicating via the external senses. "External" sense experience with God forms the basis for "special revelation"; the prophets heard his voice or saw the pillar of fire; Jesus, who has "made God known" (John 1:18, Col. 1:15, Heb 1:3), was perceived via the same senses (1 John 1:1–4), even after his resurrection (John 20:27). As discussed previously (see "The Problem of the Absolute"), we obtain this special revelation today via testimonies and messengers which come to us via the five senses, e.g., reading. Reformed theologians have always argued, however, that without a confirming "internal" testimony, these messages of special revelation remain meaningless to us. Without prior reason to believe in God, belief in miracles would violate Occam's razor, i.e., Hume's objection.

[10]C. S. Lewis, *Mere Christianity* (New York: Macmillan, 1943).

[11]J. M. Frame, *Apologetics to the Glory of God: An Introduction* (Phillipsburg: Presbyterian and Reformed, 1994).

[12]Some presuppositionalists seem guilty of a logical fallacy. Since the Christian presupposition (the existence of God) implies the reliability of the senses, they would then say that any use of the senses implies reliance on the truth that God exists. But that does not follow. If A implies B, it does *not* follow that the truth of B implies the truth of A!

[13]The failure to address Occam's razor is the reason the presuppositionalist Christian argument remains so unsatisfying. Presuppositionalists may be correct that starting with their presuppositions they can remain perfectly logically consistent, but a person who hypothesizes a room full of invisible, imperceptible chairs could do the same. Self consistency alone never suffices to convince anyone of anything.

[14]D. Snoke, "Toward the Unity of Theology and Science" and ——, "The Problem of the Absolute in Evidentialist Epistemology."

[15]As C. S. Lewis has argued (see note 10), we do not have to agree on exactly what is just or what ought to cause guilt, to agree that justice and guilt are real things. We also do not need to agree on the interpretation of the Bible to agree that it is God's Word.

[16]C. S. Lewis, *Mere Christianity*.

[17]J. Calvin, *Institutes of the Christian Religion* J.T. Macneil, ed., F.L. Battles, trans., (Philadelphia: Westminster Press, 1960).

[18]R.C. Sproul, *The Psychology of Atheism (If There is a God, Why are There Atheists?)* (Wheaton: Tyndale, 1988).

[19]Gödel, *Monatshefte f. Math. u. Physik* 38 (1931): 173 in *From Frege to Gödel*, J. van Heihenoort, ed. (Cambridge, MA: Harvard Press, 1967).

[20]*R. Penrose, *Shadows of the Mind: On Consciousness, Computation, and the New Physics of the Mind* (Oxford: Oxford University Press, 1994).

[21]*W. Percy, *Lost in the Cosmos: The Last Self-Help Book* (New York: Farrar, Straus and Giroux, 1983).

[22]R. C. Sproul, *Not a Chance: The Myth of Chance in Modern Science and Cosmology* (Grand Rapids, MI: Baker, 1994).

[23]*R. Penrose, *Shadows of the Mind* and W. A. Dembski, "Converting Matter into Mind: Alchemy and the Philosopher's Stone in Cognitive Science," *Perspectives on Science and Christian Faith* 42 (December 1990): 202–26.

[24]Penrose has argued that brains could get their unusual properties from quantum mechanical wave function coherence, as seen in things like Bose-Einstein condensation and lasers. He makes no claims about how this could work, but invokes hypothetical, completely unknown aspects of these phenomena. As an expert in wave function coherence (see, for example, *Bose-Einstein Condensation*, A. Griffin, D. W. Snoke, and S. Stringari, eds. [Cambridge: Cambridge University Press, 1995]), I can attest that these ideas are merely wild speculation, and serious students of wave coherence would all agree.

[25]It is only a slight overstatement to say that evolution was *the* fatal blow. Other evidences that weakened evidential apologetics included higher criticism and archeological attacks on the Bible. Yet, these had limited impact before evolution became widely accepted in Western culture.

[26]C. S. Lewis, *Mere Christianity* and E. J. Carnell, *Introduction to Christian Apologetics* (Grand Rapids, MI: Eerdmans, 1955).

[27]It may seem nearly impossible to calculate odds like this, without having complete knowledge of every law of nature in the universe. On the contrary, scientists do this kind of calculation all the time. "Bayesian" probability theory, favored by most practicing scientists, allows the calculation of conditional probabilities based on partial knowledge. In a sense, Bayesian probability is just the codification of inductive logic. John Earman has written a useful introduction to Bayesian probability, in which he also shows that the Bayesian probability methods being developed during the lifetime of David Hume have subsequently rendered Hume's arguments against miracles invalid, in "Hume's Abject Failure: The Argument Against Miracles," (Dept. of History and Philosophy of Science, University of Pittsburgh, 1997).

[28]*H. Ross, *The Fingerprint of God*, 2d ed., (Orange, CA: Promise, 1991).

[29]*P. C. W. Davies, *The Physics of Time Asymmetry* (Berkeley: University of California Press, 1974); see also S. L. Jaki, *The Paradox of Olbers' Paradox; A Case History of Scientific Thought* (New York: Herder and Herder, 1969); and *E. Harrison, in *Bang: the Evolving Cosmos* (Nobel Conference XXVII), Richard Fuller, ed., (Lanham, MD: University Press of America, 1994).

[30]The idea that immediately comes to mind, intervening clouds, is one proposed solution that does *not* work—given enough time, these clouds would absorb so much heat that they, too, would glow like the surface of a star.

[31]*P. C. W. Davies, *Space and Time in the Modern Universe* (Cambridge: Cambridge University Press, 1977); *——, *The Physics of Time Asymmetry* (Berkeley: University of California Press, 1974); and M. C. Mackey, *Time's Arrow:*

Origins of Thermodynamic Behavior (New York: Springer-Verlag, 1993).

[32]*J. Horgan, *Scientific American* (February 1991), 100.

[33]See, e.g., *R. Shapiro, *Origins—A Skeptic's Guide to the Creation of Life on Earth* (New Jersey: Summit Books, 1986) and *M.J. Behe, *Darwin's Black Box: The Biochemical Challenge to Evolution* (New York: Free Press, 1996).

[34]*J. Horgan, *Scientific American* (February 1991): 100.

[35]See, e.g., W. M. Tscharnuter, in *The Birth and Infancy of Stars*, R. Lucas, A. Omont, and R. Stora, ed., (North Holland, Amsterdam, 1985); and T. Ch. Mouschovias, in *Protostars and Planets*, T. Gehrels, ed. (Tucson: University of Arizona Press, 1978).

[36]*Physics Today* 43 (June 1990): 20; *Nature* 348 (January 3, 1991): 14.

[37]*J. D. Barrow and F. Tipler, *The Anthropic Cosmological Principle* (Oxford: Oxford University Press, 1987); *P. C. W. Davies, *The Accidental Universe* (Cambridge: Cambridge University Press, 1982); *A. J. Leggett, *The Problems of Physics* (Oxford: Oxford University Press, 1987); and P. A. M. Dirac, in *The Physicist's Concept of Nature*, J. Mehra, ed., (Dordrecht-Holland: D. Reidel, 1973).

[38]*H. Ross, *The Fingerprint of God* and J. L. Templeton and R. L. Hermann, *The God Who Would be Known* (San Francisco: Harper and Row, 1989).

[39]*L. Young, *The Unfinished Universe* (New York: Simon and Schuster, 1986).

[40]This concept of "equivalent states" formed the basis of the theory of statistical mechanics in the last century. All possible configurations of the atoms in the gas in a room are equally likely, but only a few have special properties discernible to "macroscopic" people, who see things with "coarse grained" perception. For example, to all intents and purposes it is "impossible," according to statistical mechanics, for all the atoms in a room to line up at one wall, causing you to suffocate, although this configuration is just as likely as any other, according to Newton's laws. The reason is that out of all the possible states of the atoms, only a tiny fraction yield this special result, while the vast majority are essentially equivalent regarding your breathing ability.

[41]This is quite different from "cabalism," which finds *a posteriori* meaning in random sequences by applying a large number of trials, e.g., birth dates, Hebrew values of letters, etc., until some match is found. The odds are no longer low in most cases, because of the large number of possible meanings that have been attempted.

[42]*J. D. Barrow and F. Tipler, *The Anthropic Cosmological Principle*.

[43]H. Everitt, *Reviews of Modern Physics* 29 (1957): 454; J. A. Wheeler, *Reviews of Modern Physics* 29 (1957): 463.

[44]See, e.g., J. G. Cramer, *Reviews of Modern Physics* 58 (1986): 684; and *P. C. W. Davies, *The Accidental Universe*, 122–30.

[45]A. H. Guth, *Physical Review D* 23 (1981): 347.

[46]*A. Linde, *Physics Today* 40 (September 1987): 61.

[47]There exists some confusion about the evidence for "Dark Matter." The total of observable, i.e., light-emitting, matter in galaxies gives $\Omega = 0.1$. Estimations based on the rotations of the galaxies indicate a higher number, however, due to nonlight-emitting mass. When this extra (normal, but not light-emitting) mass is accounted for, one gets $\Omega = 0.2$. "Dark matter" must be something entirely new in addition to this.

[48]One may write $\Omega = \Omega_b + \Omega_e$, where Ω_b is the total of all "normal" (baryonic) matter and Ω_e is the total of all "exotic" matter, e.g., "weakly interacting massive particles" (WIMPs), or heavy neutrinos (there is presently no evidence that neutrinos have mass). Nuclear theory combined with astronomical observations gives a constraint of $\Omega_b = 0.1 \pm 0.05$. See E. Rolfs and W. S. Rodney, *Cauldrons in the Cosmos* (Chicago: University of Chicago Press, 1988), 86–9. R. A. Malaney and W. A. Fowler, in *American Scientist* 76 (1988): 472, presented a model based on Inflation which would allow $\Omega_b = 1$, using what they call the "luxury of a large parameter space," i.e., tweaking of the many unknown parameters in the new Inflation theory, not unlike the tweaking of epicycle theory. Since their model has remained unconvincing to most scientists, Inflation theorists continue to hold out hope for observation of exotic Dark Matter. Cosmological theory requires that these particles have neither too much nor too little mass within tight constraints, or they will not help the Inflation scenario.

[49]*Nature* 356 (30 April 1992): 741; *Nature* 356 (9 April 1992): 489; *Physics Today* 45 (June 1992): 17; and *M. Geller, in *Bang: the Evolving Cosmos* (Nobel Conference XXVII), R. Fuller, ed. (Lanham, MD: University Press of America, 1994).

[50]Although the data now seems stacked against it, Inflation theory has become a cottage industry with thousands of adherents, mainly out of philosophical commitments. New versions which allow $\Omega = 0.2$ have been proposed. A useful modern critique of Inflation theory has been written by J. Earman and J. Mosterin, in "A Deflationary Analysis of Inflationary Cosmology," (Dept. of History and Philosophy of Science, University of Pittsburgh, 1997).

[51]F. Schaeffer, *He is There and He is not Silent*, in *The Complete Works of Francis A. Schaeffer* (Wheaton, IL: Crossway, 1985).

[52]As quoted by R. Reymond, in *The Justification of Knowledge* (Philadelphia: Presbyterian and Reformed, 1976).

The Guide for the Perplexed: An Unforeseen Overture to Science in Twelfth-Century Cairo

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Maimonides, 1135–1204[1]

Without the Judaeo-Christian-Islamic doctrine of creation, there could have been no modern science; without creatio ex nihilo, *no theory of biological evolution. Aristotle taught that the world was eternal and had no beginning. The ancient Greeks did not—and could not—conceive the idea that species had an origin. It was the achievement of the Middle Ages to settle the question of whether the world was eternal or had a beginning. This article is an account of Maimonides' contribution to that achievement.*

It was a Spanish emigré, dwelling safely in Cairo and far from his Andalusian heritage, who in the last decade of the twelfth century expressed the great issue of the age:

> According to Aristotle everything besides that Being is the necessary result of the latter; whilst, according to our opinion, that Being created the whole Universe with design and will, so that the Universe which had not been in existence before has by His will come into existence.[2]

Thus did the celebrated Jewish thinker, Moses Maimonides, set before people of all faiths the fundamental distinction between monotheism and Aristotelianism. The tranquil and disinterested reasoning of his works belies the shocks and turmoil that came his way to mold his character. Abu-'Imran Musa ibn Maymun rose above the storms of life to be sought out in Arab society throughout the Mediterranean world for his erudition in law, medicine, philosophy, and theology; and to be acclaimed by the affectionate title of "Rambam," Rabbi Moses ben Maimon. Christian philosophy of the Latin West became a commentary on his pioneering ruminations on faith and reason; his writings were a bridge between Christianity and Islam. To this day he remains one of the most influential sages Judaism has ever produced.

Among the treasures of thought that Maimonides bequeathed to the West, not least, surely, are his magisterial commentaries on Aristotelian cosmology and the will of God. Modern science, of course, could never have arisen if, as Aristotle had said, the world were eternal. In the Rambam's denial of eternality and affirmation of creation, we find a twelfth-century step toward the origin of modern science.

A Time of Wandering

Moses Maimonides was born on March 30, 1135 in the brilliant city of Cordova, in the Andalusian region of Spain.[3] For eight generations his forebears had served as rabbis in the thriving Jewish community which shared with Christians and Muslims in the self-confidence and prosperity produced by the Spanish Umayyads.[4] His family was accustomed to culture, learning, the practice of law, and success; the elder Maimon was an esteemed rabbinical judge.

As a boy, Moses probably wandered about the jasper halls and the forest of stately columns that can be admired today in the sanctuary of the Great Mosque in Cordoba, built in 787 by the Caliph Abd-

**ASA Member*

al-Rahman I, who founded the Umayyad Caliphate in the West.[5] Following the reign of the tolerant Umayyads, the incoming Almoravid dynasty was short-lived, but brought the first of the persecutions that presaged the decline of western Islam and the inevitable eclipse of Spain.[6]

Scholarship Amidst Persecution

Maimonides was thirteen years old when the fanatical Almohades conquered the Almoravids and captured Cordova. Christians and Jews were given the choice of conversion to Islam, exile, or death. For some eight to ten years, the Maimon family wandered across the Spanish countryside. But the locusts did not eat those years. Young Moses wrote two essays that displayed his growing prowess in scholarship: an essay on logic, written when he was the ripe age of sixteen, meant that he was studying Aristotle; and an essay on the Jewish calendar, showing his grasp of Ptolemaic and Arab astronomy, which he finished at age twenty-three.[7]

Fearing forced apostasy, the elder Maimon emigrated with his family to the city of Fez, which nestles today in a narrow valley in the Atlas Mountains of northern Morocco. For several centuries, a Jewish community had flourished in Fez.[8] There the young Maimon continued the study of medicine.[9]

In 1165 the Maimon family took ship, joining the migration of Jews from the Muslim West along the Atlantic seaboard to the more tolerant Muslim East.[10] Landing at Accre, they visited Jerusalem and Hebron to give thanks, and to seek a new home. But the Latin Kingdom of Jerusalem was not a promising haven; Jews were few in number, and still vivid was the collective memory of the horrible massacre of Jews and Muslims by the Crusaders in 1099.[11] After a sojourn in Alexandria, the family joined the vigorous Jewish community residing in al-Fustat, which was the old city of Cairo, and where dwelt some one thousand Jewish families.[12]

Sanctuary at Cairo

The Maimons arrived during the final days of the brilliant Fatimid dynasty, which for two centuries had ruled Palestine, Egypt, and North Africa, and which pointed Egypt to her present ascendancy.[13] Exhausted by calamities and uprootings, the elder Maimon died soon after arriving in Egypt. He had kept his family together when his Andalusian world was collapsing in ruins about him.

At age thirty-three, and only three years after departing Fez, Maimon finished the ten-year project of writing his *Commentary on the Mishnah* in Arabic, on Jewish laws and traditions.[14] Jewish prospects brightened considerably in 1171 when Salah-al-Din ibn Ayyub, known as Saladin, the Lion of Islam, overthrew the Fatimids and brought 'Abassid supremacy to Egypt.[15] The next year Maimonides wrote his *Epistle to Yemen* in which he reassured the Jews of Yemen in the faith of Judaism.[16]

Moses continued to practice medicine for his livelihood. Further medical duties quite likely came his way during the construction of the Citadel, commenced by Saladin in 1176, which stands today on the Mokattam heights overlooking Cairo.[17] In the same year, Moses completed another ten-year project, the writing of *Mishneh Torah* in Hebrew, or the Code of Maimonides. This is his complete code of oral and written Jewish law, which he based on the whole of rabbinical literature, and which embellished the growing fame and legal authority of the sage of Fustat.[18]

All these accomplishments were only the prologue, as it were, for his final masterpiece which he began in about the year 1185 at the age of fifty.

Richard Aulie, a historian of science, having been given his start among cows and chickens on a Michigan farm, earned his B.S. from Wheaton College, M.S. from the University of Minnesota, and Ph.D. in the history of science and medicine from Yale University; having twice sojourned abroad, in the Middle East and with UNESCO in West Africa, having visited the cities and lands referred to here, as a prologue to voyaging on the seas of thought; as an educator promoting the Biological Sciences Curriculum Study, *opposing the introduction into the public schools of "scientific creationism" as inimical to theological orthodoxy and sound science, and supporting the teaching of evolutionary theory as an extension of the Judaeo-Christian-Islamic doctrine of creation; having helped to organize symposia on Lake Michigan ecology, on AIDS, and to mark the Darwin centenary, on creationism; with numerous published articles in the history of science, though now in want of publishers for two volumes finished on the* Voyages of James Cook, *an edited volume of papers on Darwin entitled,* Evolution, Religion and Ideology, *and a volume on* Scrutinizing Aristotle and Creation: Three views from the Middle Ages—Al-Ghazalli, Ibn Rushd, and Maimonides; *with citations in* Who's Who in the Midwest *in 1974 and 1994, and* Who's Who in American Education *in 1996–67, now writing, "Intelligent Design Revisited: a Reader's Guide to* Of Pandas and People *and* Darwin's Black Box"; *credits a generous Providence for an ideal past and a vigorous, though harried present.*

Religion Versus Culture

In Kroch and Brentano's bookstore in Chicago in 1984, I purchased my copy of *The Guide For The Perplexed*, a Dover 1956 reprint of the Friedländer edition of 1881. The *Guide* is found in bookstores today because Maimonides wrote this work not for specialists, but for the person "whose studies have brought him into collision with religion."[19] In his day the collision was occurring between Aristotelianism and monotheism. For the learned Jew, this meant that the religious values of Judaism were being challenged by the worldview emanating from Greek philosophy and science, and by the Islamic interpretation of that worldview. He wished therefore to enlighten those who, while seeking to harmonize the principles of their own religion with the cultural values of society, had become lost in perplexity and anxiety. Hence the sense of immediacy for our day—he was addressing secularism and the life of faith.

Style of the Guide

The *Guide* is written in a direct, personal, and almost conversational style—another reason for its accessibility today. In fact, Maimonides wrote it for a student of his, Joseph ibn Aknin, who was born in Morocco in about 1160 and who was possessed of a commodity rare in any epoch, "a thirst for knowledge."[20] Perplexed as he was about philosophy and theology, ibn Aknin came to Cairo in order to study under the Rambam's direction.

Ibn Aknin's teacher, having guided him through a curriculum of biblical studies, Greek and Arab science and mathematics, and Islamic theology, and in order to assuage his perplexity, composed the *Guide* for him and others like him.[21] When ibn Aknin left Cairo to settle in Aleppo, Maimonides continued to teach him by means of a kind of correspondence course. As each chapter was finished, he explained, he mailed it to his student.[22] This meant that in the next five years or so ibn Aknin received a total of some one hundred eighty-three chapters in letter form, all written in Maimon's spare time.

The Meaning of "God" and "Nature"

Ibn Aknin was perplexed about passages in the Bible (the Old Testament) that seemed to conflict with Aristotelian thought concerning the doctrine of creation and the nature and attributes of God. What sharpened his perplexity were the answers given to his questions by the Islamic theologians and philosophers.

Maimonides was happy to oblige. Although he remained a staunch Aristotelian, he developed a strong case for *creatio ex nihilo*, not because he thought the Bible explicitly taught this doctrine, for on the contrary, he maintained that various biblical passages were entirely consistent with Aristotelian eternality as well, but simply because the reasons for *creatio ex nihilo* were, in his view, far better.[23] Islamic theology, called the "*Kalam*," meaning speech or scholastic theology, might seem to have been congenial to Judaism with respect to the doctrine of creation, and to the attributes, existence, and incorporeality of God. After all, Islam was monotheistic, was based on revelation, and had strong historical roots in Judaism. Nevertheless he opposed the *Kalam*, and left no doubt among his Muslim readers that he stood for Judaism.[24]

A belief in the incorporeality of God was required by a belief in the absolute oneness of God, which Maimonides took care to distinguish from the "unity" of God.[25] Incorporeality implied creation and providence, and also God's will, perception, and knowledge; all of which, he readily acknowledged, were difficult problems.[26] Step by step he showed that, in forming a mature understanding of the incorporeal nature of God, the seeker need not choose between faith and reason, and indeed a choice was not possible.[27] The twentieth-century Christian student of the Bible can reap nothing but profit from consulting his myriad interpretations of Old Testament passages.

Attributes and Essence

It was actually the doctrine of transcendence, not incorporeality *per se*, to which Maimonides gently led his readers through his discussions. Anyone who wished to "rise to a higher state" of knowledge concerning the transcendent and incorporeal God he worshipped first had to understand that God has no attributes.[28] Neither qualities nor characteristics; no, not even existence, nor even unity, are part of the divine essence. Anyone who wished to be serious about his religion, it would appear from the *Guide*, had to strive for the rigor of thought which Maimonides possessed to an awesome degree.

In ordinary speech, he said, an attribute of an object is "superadded to its essence, and is consequently an *accident*"; that is, the attribute is a quality, or property, such as the white color of a white piece of cloth. Thus, when we say that "man is a speaking animal," we mean that the subject, man, has the attributes of life and speech.[29] Maimonides insisted that this manner of describing God is completely inappropriate, inasmuch as God is immaterial, has no relationhsip to space and time, and is completely other than human experience.

Maimonides observed that when "our Teacher Moses" prayed: "Show me thy way, that I may know thee, that I may find grace in thy sight" (Exod. 33:13), he was asking that God should let him know God's attributes and God's essence. God answered both petitions. The utterance, "show me thy glory" (Exod. 33:18), meant that Moses prayed in particular for a knowledge of God's attributes. God replied: "'I will make all my goodness to pass before thee'" (verse 19).[30] From time to time, Maimonides expressed ideas that were picked up and developed in later centuries. His recondite ruminations on the attributes and essence of God were the occasion of two prescient insights into the way the natural world is organized.

First, "all my goodness" meant that God would show Moses the entire creation, of which it was written: "And God saw everything that he had made, and, behold, it was very good" (Gen. 1:31). And second, this definition of "goodness" implied that God would give Moses the ability to understand how the parts of the natural world work together; that is, Moses would have the ability to "comprehend the nature of all things, their relation to each other, and the way they are governed by God both in reference to the universe as a whole and to each creature in particular."[31] In other words, Moses could know his actions—as distinguished from his attributes—but not his essence.[32] There was, the Rambam was convinced, "no possibility of obtaining a knowledge of the true essence of God."[33]

Maimonides, who had seen his share of calamities, persecutions, and sufferings, filled his pages with biblical instances where God guided those who had no claim on his guidance, and where his actions were therefore typically called, "merciful and gracious, long-suffering and abundant in goodness" (Exod. 34:6).[34] The formula that he devised was that "all attributes ascribed to God are attributes of His acts, and do not imply that God has any qualities."[35] For that reason, he declared that we should say "the Lord liveth" (Ruth 3:13), rather than "the life of the Lord."[36]

The Origin of Science

His discussion is pertinent to understanding the rise of modern science because, in one of his breaks with the Aristotelian view of the cosmos, he recognized a clear distinction between the Creator and the creation. This he did in explaining what he meant by the absolute otherness of God.

> There cannot be any belief in the unity of God except by admitting that He is one simple substance, without any composition, or plurality of elements; one from whatever side you view it, and by whatever test you examine it; not divisible into two parts in any way and by any cause, nor capable of any form of plurality either objectively or subjectively.[37]

Nor was this all. Maimonides saw that this complete distinction between the Creator and the creation meant that the creation existed in a state of contingent dependence on the Creator. He wrote:

> All we understand is the fact that He exists, that He is a Being to whom none of His creatures is similar, who has nothing in common with them, who does not include plurality, who is never too feeble to produce other beings, and whose relation to the universe is that of a steersman to a boat; and even this is not a real relation, a real simile, but serves only to convey to us the idea that God rules the universe; that is, that He gives it duration, and preserves its necessary arrangement.[38]

Creation Versus Eternality

That the *Guide* could have been written and rapidly distributed in the latter part of the twelfth century speaks much for the freedom of expression found in Saladin's Egypt. Maimonides was a Jewish believer, writing primarily for a Jewish audience, and he agreed with Christians and Muslims on the fundamental tenets of monotheism—the existence, oneness, transcendence, and the incorporeality of God. But he was questioning the particular arguments for creation put forward by the orthodox Muslim theologians, known as the Mutakallimun—arguments by which they sought to uphold their own Islamic faith.

Critique of the Theologians

The *Guide* (I, chaps. 73–76) reveals that one school of Muslim theology, the Kalam, had a unique and rather strange picture of nature.[39] The Mutakallimun (the theologians) began with creation, and went on from there to their belief in the existence, unity, and incorporeality of God. To establish the logic of creation was, therefore, a principal objective. But to do that, they interpreted nature according to their own theological preconceptions of revelation. In so doing they did not hesitate to give out radical views concerning geometry, time, and the structure of matter and space.

The creation of the world did not occur just at the beginning, these theologians announced, but was occurring all the time. Nature was subdivided and fragmented into individual instants and bits of time and matter, each bit of which God was repeatedly

creating. The Mutakallimun were willing to rewrite the science and mathematics of the day. No particle of time or matter survived more than an instant, but was immediately recreated by God in a continuous process. God kept on creating atoms, time, "accidents" (qualities or properties), and therefore even knowledge in the mind. Maimonides simply could not believe that nature was organized in such a way.[40]

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He had a question for the Aristotelian theologians: How could either creation with a beginning, or continuous and repeated creation with *no* beginning, be advanced as a basis for faith?[41] He asked the Mutakallimun this question because philosophers themselves had disagreed for the previous thousand years on whether the universe was eternal or had a beginning. In either case, the existence of God would be an open question. His chapters on the Kalam (I, 73–76) are the most outspoken in the book, and were directed to Muslim theologians who were his contemporaries.

Qualities and Accidents

Causation came under particular scrutiny. Qualities were not properties of the whole, according to the Kalam, but each atom had its own accidents of color, smell, motion, and even life; absence of an accident was itself an accident. When a piece of cloth was treated with indigo, he said, by way of opposing this view, the "accident" of black color did not last, but God kept on creating the blackness of each atom. Knowledge we have today, we did not have yesterday.

If the Muslim theologians were correct, he continued, God repeatedly created the properties of an object "without the intervention of a natural force or of any other agency." In fact, most of the theologians held that "it must never be said that one thing is the cause of another."[42] Since death was also an "accident," this meant that death was constantly being replaced by death.[43] The repeated creation of every particle and accident meant a denial of Aristotelian causation, which he could never abide.

A couple of times the theologians were reasonably correct. For one thing, they posited the existence of a vacuum; otherwise, they said, how could atoms move?[44] In view of the venerable Aristotelian *horror vacui*, an idea that would be cherished for centuries to come, it is curious to find the idea of the vacuum in the twelfth century; Maimonides objected. They also said that the individual atoms of different objects were all the same; the atoms of iron were like those of cream, the differences residing in their "accidents."[45] This belief, that the basic particles of nature were fundamentally alike, would last well into the nineteenth century.[46]

As often as not the atomism of the Mutakallimun led to absurdities. Anything conceived by the imagination was possible: an elephant as small as an insect, a man as tall as a mountain; this was so because of the equality of atoms and accidents. "They do not ask whether the reality confirms their assumption," sighed Maimonides.[47] According to their atomism, they believed that time could be divided indefinitely. But, he wanted to know, how could time consist of instants that had no duration? or objects and space consist of particles that had no magnitude or extension?

The probing criticism of Maimonides notwithstanding, the Muslim theologians with their bizarre talk of instants of time, space, and matter may have been on to something, at least in one area of knowledge. In the seventeenth century the concept of divisibility would be taken up anew and developed into the calculus.[48]

If we apply the time-honoured metaphor of the so-called two books, God's Word and God's Works, to this twelfth century debate, it might be useful to say that Maimonides's method was opposite from that of the Mutakallimun. He was interpreting revelation according to his own Aristotelian conception of nature. On the other hand, the theologians were interpreting nature according to their own views of the Qur'an. "Their sole object is to fashion the Universe according to their peculiar opinions and beliefs," which were derived from the Kalam—their brand of theology.[49]

However laudable their efforts in the defence of creation, those theologians had abandoned the regu-

larity of nature and the possibility of scientific prediction, and in so doing had left no basis for theism:

> They denied the nature of the existing things, misrepresented the properties of heaven and earth, and thought that they were able, by their propositions, to prove the creation of the world, but in fact they were far from proving the *creatio ex nihilo*, and have weakened the arguments for the existence, unity, and the incorporeality of God. The proofs of all these doctrines must be based on the well-known nature of existing things, as perceived by the senses and the intellect.[50]

Critique of the Philosophers

"We do not reject the Eternity of the Universe, because certain passages in Scripture confirm the Creation; for such passages are not more numerous than those in which God is represented as a corporeal being." Ibn Aknin was still puzzled. He had just learned that Muslim theology did not have sound arguments for creation; and that sense experience was a basis for theism. His mentor was now writing to tell him that in fact it was as easy to harmonize certain passages of Scripture with Aristotelian eternality.[51] Moreover, in letter after letter from Cairo, he was being informed that an absolute "proof does not exist in Nature" for creation. For Maimonides, the job therefore still remained to establish a sound basis for creation; otherwise someone would come along and shake ibn Aknin's faith, whereupon he would take up Aristotelian eternality, which, Maimonides warned him by mail, "is contrary to the fundamental principles of our religion."[52] What was poor ibn Aknin to do?

Whereas the Muslim theologians were arguing from the creation to their belief in theism, the Muslim philosophers, who of course were Aristotelian, looked at the night sky and declared that the heavens were eternal. At any rate, the world certainly was either eternal or had a beginning. That much was plain. It was also plain that in either case the existence, unity, and incorporeality of God could be assumed. That meant that faith in the eternality of the world was as religious as faith in the creation, possibly more so, since for the Greek mind nature was deified. At least with respect to the existence of God, it would seem that the philosophers and theologians were in agreement. But that is essentially why ibn Aknin was perplexed.

The Bible and Aristotle's Spheres

When Maimonides the puzzle-solver gazed at the night sky, he saw every reason to suppose that "the well-known nature of existing things" had been amply explained.[53] Indeed, for fifteen hundred years Aristotelian cosmology had held sway. On only one point did Maimonides disagree with the twenty-six proofs put forward by the philosophers for the existence of God: the eternity of the universe.[54] In the next stage of this twelfth-century debate, he examined what they had to say about the eternity of the world.

While disagreeing with the contention of the Muslim philosophers that the world was eternal, Maimonides agreed with them that the prevailing cosmology was perfectly consonant with Scripture, whether the Bible or the Qur'an. According to Aristotle's thought, all the celestial bodies, that is, the sun, moon, planets, and stars, rode on the crystalline, transparent, and corporeal spheres which revolved eternally in perfect, Aristotelian circles around the Earth.[55] The outer sphere, which was composed of the quintessence and had no stars, was kept in motion by God, who was the "Prime Motor," he explained, and from this sphere emanated the influences to control all events on Earth, such as the Aristotelian cycles of "genesis and destruction."[56] Maimonides was obviously well read in the astronomy of his day.

While disagreeing with the contention of the Muslim philosophers that the world was eternal, Maimonides agreed with them that the prevailing cosmology was perfectly consonant with Scripture ...

The Bible gave abundant evidence that those spheres were animate, intellectual, and capable of comprehension. For example, when the Psalmist wrote, "The heavens declare the glory of God" (Ps. 19:2), the verb he used always applied to intellectual beings.[57] This and other passages were said to be fully in accord with the opinion of Aristotle. When Aristotle had further investigated the subject, he found that the spheres had different velocities and directions, and their action was transmitted by spiritual and incorporeal "Intelligences," which moreover did not reside in the spheres and whose number probably agreed with the number of the spheres. Maimonides thought the number of these Intelligences might be ten. Of these, nine corresponded to the spheres—the outer, the spheres of the stars, and the seven planets—and the innermost "Active

Intellect," which controlled the transitions on Earth from potentiality to actuality and transmitted Aristotelian form to matter.[58] He was apparently adopting the ninth sphere, just outside the fixed stars, that had been added by Arab astronomers.[59]

In the biblical passage, "And to rule over the day and over the night" (Gen. 1:18), the verb referred "to the power which the spheres possess of governing the earth." Since the biblical term "angel" was a synonym for "Intelligences," or "intellectual beings," Aristotle's Intelligences were therefore angels, and the said power of the spheres was undoubtedly transmitted actually by angels, although the cosmos probably had more than ten of them. Because these spheres acted collectively as one, it was clear that "we can prove the Unity of God from the fact that this Universe is one whole."[60] It was a rational and biblical view of nature that Maimonides was presenting, one that was sublime and coherent: the crystalline spheres revolving around the Earth, and God superintending the sublunar regions through the mediation of ministering angels. "It may be that by Nature the Divine Will is meant."[61]

Faith, Reason, and Sense Experience

But the more that Maimonides gazed at the night sky the more he was convinced that the philosophers' arguments, however venerable and weighty, were not conclusive. Even Aristotle himself was "well aware that he had not proved the Eternity of the Universe." In his book, *The Heavens and the World*, Aristotle had represented his theory as an "opinion" and his proofs as "arguments."[62] Was Aristotle ignorant of the difference between opinion and demonstration? between argument and proof? Certainly not; he was only intending to show his preference. In fact, continued Maimonides, Aristotle said: "'There are things concerning which we are unable to reason, or which we find too high for us; to say why these things have a certain property is as difficult as to decide whether the Universe is eternal or not.'"[63] Maimonides could do worse than to agree with Aristotle.

Moreover, the present state of an object, "perceived with our senses," gives no clue whatsoever as to its past condition. "Take, e.g., the human ovum as contained in the female's blood."[64] Just by looking at the adult body we cannot tell how it grew as a fetus:

> We therefore do not reject as impossible the opinion of those who say that the heavens were produced before the earth, or that certain species of animals have been in existence, and others not. For the state of the whole Universe when it came into existence may be compared with that of animals when their existence began.[65]

Strange words, these are, appearing as they did in the twelfth century. It was monotheism, was it not, that was prompting Maimonides to say that irreversible changes could occur in the universe? Where else did he get this idea? From Aristotle? In sum, he was affirming that the philosophers' arguments for eternality were as faulty as those of the theologians for creation. Yet he still wanted to show the possibility and even probability of *creatio ex nihilo* in which he firmly believed. And whatever was he to do about ibn Aknin's perplexity? He turned again to the night sky.

Critique of the Astronomers

Although Maimonides took obvious delight in contemplating the revolutions of the celestial spheres, he was not so much of an Aristotelian that he was unable to subject Aristotelian cosmology to critical scrutiny. Nor, as an orthodox Jew, was he unable to see the fundamental difference between Aristotle's Prime Mover and the God of Abraham, Isaac, and Jacob. There, in his monotheism, of course, was the crux of the debate. He took another look at the night sky and came up with insights and questions that would be of consequence in the history of science.

Why did one sphere move from east to west and another from west to east? Why did they move with different velocities? His monotheism had conditioned the operation of his mind so that he was able to look at nature in a new way. He was able to raise questions that could not be answered by Aristotelian thought. It would not have occurred to the strict Aristotelians of the day even to ask such questions as these, or at least not in the bold manner in which he posed them; for the differences in direction and velocity were said to be a necessary part of the heavens, and these variations were to be explained by the Aristotelian "forms" that had been imparted to the spheres.[66]

Maimonides saw a difficulty with Aristotle's two kinds of motion, which were rectilinear and circular. In the case of rectilinear motion, which occurred only in the sublunar regions, the motion was basically of two kinds—upward and downward. The inference could therefore be made safely that these two directions were caused by two different "forms" that were imparted to the elements. But the motion of the spheres was all of one kind—circular—and hence their "forms" should be the same.[67] The

spheres ought really to move in one direction and at the same speed. Why, then, had the spheres, while displaying circular motion only, received these obviously different forms? Even Aristotle had not been able to give a satisfactory answer. To Maimonides, the explanation was easily given by the creation: God had chosen the direction and velocity of each sphere, and these variations were therefore not a "necessary" part of the heavens.[68]

Causation and Design

According to Aristotle, explained Maimonides to ibn Aknin, "the Universe is inseparable from God; He is the cause, and the universe the effect; and this effect is a necessary one." Therefore in the Aristotelian conception, the question about why the universe exists in one way and not in another did not even arise. "The nature of everything remains constant, that nothing changes its nature in any way, and that such a change is impossible in any existing thing." But according to theism, "all things in the Universe are the result of design, and not merely of necessity; He who designed them may change them when He changes His design."[69]

An even more striking mark of this "voluntary determination" could be found in the concentration and distribution of the stars themselves. Some were large, others small; here we notice two stars, over there ten close together; elsewhere we find a place empty of stars. Why should the stars be distributed as they are? How could this be explained by Aristotle's "laws of Nature" by which everything emanated from the Prime Mover by necessity?[70]

Of course, Aristotle did believe in design. The Prime Mover, as the most perfect Intellect and First Cause, was eternally pleased and delighted with everything that derived its external existence from itself. But this had nothing to do with design in the biblical sense, said Maimonides, for design and choice applied only to things not yet in existence. According to Aristotle, he continued, God's relationship to the universe was such that he could not change anything even if he tried.[71] Indeed, if he could make a change, it would only diminish his perfection.

The thought did cross Maimonides's mind that with all the doubts he was raising, he might be setting in motion the overthrow of the entire Aristotelian system. He quickly dismissed that eventuality for it was clear to him, he wrote, that everything Aristotle had said about the region between the sphere of the moon and the center of the Earth was entirely correct. The more he thought about these matters, however, the more he was convinced that whatever Aristotle said about the regions above the moon were for the most part "mere imagination and opinion," and this included even parts of the *Metaphysics*. Still, he admitted, Aristotle might be excused for not fully explaining those stellar variations.[72]

Epicycles and Eccentrics

Ibn Aknin, meanwhile, had been studying the *Almagest*, in which Ptolemy had described a system of epicycles and eccentrics in order to explain the observed variations in direction, luminosity, and velocity of the planets. Maimonides devoted an entire chapter (Part II, 24) to this celestial machinery—a quite wonderful chapter it is—and as he warmed to this subject he waxed unhappy and showed some perplexity of his own. Those two explanatory devices, it appeared, were also unsatisfactory.

Take epicycles. Basic to physics was the principle that the universe had only three kinds of motion—"from the center, towards the center, and round the center"—and the reason why the Earth remained stationary was to provide a center round which the heavens could move.[73] But an epicycle moved neither away from, toward, nor round this center; it moved round an imaginary point which itself revolved.

The eccentrics did not help either, because an eccentric sphere moved round an imaginary point that was at some distance from the center of the universe, that is, from the center of the Earth. Thus the center of the sun's sphere was not the center of the Earth, but it was located undoubtedly between the moon and the sphere of Mercury.[74]

"Now, consider how improbable all this appears according to the laws of Natural Science," by which Maimonides meant Aristotelian cosmology. Why should the paths of Venus and Mercury be inclined at an angle? "It is impossible to imagine material beings under such conditions."[75] On the other hand, astronomy had no alternative to the Aristotelian-Ptolemaic explanation. How could the variations in direction and velocity of the planets be described without recourse to epicycles and eccentrics, which produced results that in the case of the Moon were "perfectly correct, within one minute"?[76]

Maimonides' reasoning makes Chapter 24, Part II of the *Guide* an instructive lesson in what constitutes a useful scientific theory. Arab astronomers probably did not really think that a planet revolved on a circle which itself revolved on a larger circle (rather

like a Ferris wheel), whose center was some distance from the center of the Earth. For them, as for present-day astronomers, the question was: what theory best explained the phenomena?

Quite likely during weeks of watching the night sky, Maimonides often wondered why certain luminous points, that is, the planets, in moving east through the constellations, would stop, move westward, and then east again. For example, Mercury requires 116 days for retrogression; Venus 584 days.[77] The intricate mathematics of epicycles did explain the retrograde motions of the planets—the wandering stars, as they were called—and to increase the match between observation and theory various Arab astronomers heaped epicycles on epicycles.

By invoking the will of God, [Maimonides] was able to identify weaknesses in the physical principles of Aristotelian cosmology. In so doing, he inadvertently set the agenda of astronomy for the next half millennium.

The Arab astronomers had settled on a theory that would explain what they saw; a "true" theory was not required. Maimonides agreed: "The theory of Aristotle, in explaining the phenomena in the sublunar world, is in accordance with logical inference." He was perfectly aware that astronomy did not "profess to tell us the existing properties of the spheres" but was rather a theory that was "in agreement with our observations." He was struggling with a second feature of an acceptable scientific theory; in addition to saving the phenomena, the theory must do so with the least possible complications. Astronomy was not quite ready for that. We really know nothing about the heavens, he admitted, "except for a few mathematical calculations, and you see how far these go."[78]

By critically examining the prevailing views of astronomy, Maimonides was able to argue to the admissibility and probability of creation. Because of the numerous inconsistencies he found in the cosmology of his day, he believed it was utterly impossible to reconcile Aristotelian eternality and monotheistic creation—"that of necessary existence by causality, and that of Creation by the desire and will of a Creator." In his view, it was absurd to say that the relationship of the universe to God was a permanent and necessary connection of effect with efficient cause, and to turn around and say at the same time that the universe resulted from the will of God.[79] The better explanation for the observed variations in the heavens was therefore *creatio ex nihilo* by the will of God.

For Maimonides in the twelfth century, it was only when he applied the theological concept of the will of God that he was able to question the prevailing views of astronomy. In Chapters 19–24, Part II of the *Guide*, he raised thirty-three separate questions concerning planetary and stellar phenomena.[80] By invoking the will of God, he was able to identify weaknesses in the physical principles of Aristotelian cosmology. In so doing, he inadvertently set the agenda of astronomy for the next half millennium.

Epilogue

The *Dalalat al-Hairin*—Maimonides wrote the *Guide for the Perplexed* in Arabic—recalls the writings of Augustine in the fourth century. A statement of a mighty and sublime faith, the *Dalalat* also presents a vision of a City of God in which the divine will that called forth the world is expressed with justice and mercy in the affairs of humankind. As for creation and eternality, the reader can usefully begin with Books 11, 12, and 13 of the *Confessions* and Books 11 and 12 of the *City of God*, which were written without the benefit of Aristotle's works; and go on from there to Chapters 68–76, Part I and the Introduction and Chapters 1–26, Part II of the *Guide for the Perplexed*, which were written with the benefit of Aristotle's works. Or one can begin with Maimonides and go back to Augustine, because their works complement each other.

Before the *Dalalat* was finished, meanwhile, the presence of the Jewish sage was brought to the notice of Saladin's vizier, al-Qadi al Fadil, who in about 1187 appointed him as a physician to the court in Cairo.[81] With his name on Saladin's payroll and his days becoming busier than ever, he assumed the medical post he would hold for the rest of his life.[82] Whenever Saladin was in town, Maimonides had to wait on him every day. The Jew from Cordova advised the Sultan of Egypt to get his rest, take exercise, eat right, and bathe regularly.[83]

Besides his official duties, Maimonides wrote at least ten treatises on medicine; he carried forward these projects even while he was working on the *Dalalat al-Hairin*.[84] He also provided leadership to the Jewish community and on the sabbath participated in the synagogue. Apparently he married

twice; his only son, Abraham, was born in 1187 and became a leader in the Jewish community in Egypt.[85]

As soon as the *Dalalat* was finished, in about 1190, the Arabic text was quickly copied and distributed far and wide. Before long learned Jews were teaching the work in mosques and learned Muslims were explaining what he meant to Jewish congregations.

In his arguments for* creatio ex nihilo, *in the numerous critical references to Aristotle, and in the emphasis on the will of God, the* Guide *may be construed as a pivotal commentary on Aristotle. By thus questioning the authority of Aristotle, the* Guide *played an unheralded and unforeseen role in making possible the rise of modern science.

The sage of Fustat was at the zenith of his fame and prestige. From Jerusalem came an invitation from Richard the Lion-hearted to serve as his physician, an honor he respectfully declined.[86] His *Dalalat* aroused delight and perplexity; in due course, consternation and controversy; and inevitably, learned commentaries. In all cases, it aroused further respect for its author. In 1205 his friend Rabbi ibn Tibbon brought out a Hebrew translation, entitled *Moreh Nebuchim*.[87] This edition was rapidly copied and distributed to far-flung Jewish communities. Many copies, made in succeeding centuries, are extant, some with brilliant, multi-color illuminations that turn up today in elaborate library exhibits and are reproduced in expensive greeting cards.

The first Latin translation, the *Doctor Perplexorum*, came out in 1232. Shortly thereafter, theologians in Paris were eagerly comparing Arabic, Hebrew, and Latin editions. Thus the *Guide* passed into western thought, most prominently into the work of Thomas Aquinas.[88]

The Friedländer edition, the first in English, in 1881, lists forty commentaries that were written, mostly by Jewish scholars, before the introduction of printing. One awe-struck writer declared that "there is no searching to his understanding," but that all the same a new commentary written by himself would undoubtedly help the young. Another wrote a commentary for his edification so that in his old age he might refresh his memory. A nineteenth century rabbi, perplexed by the *Guide*, gave it as his opinion that Maimonides was not the author after all, since he could not have written such heresy.[89] Today, scholars contentedly devote goodly portions of their lives to the sage of Fustat, and count the time well spent.[90]

When Maimonides denied Aristotelian eternality, he inelectably lodged a fundamental doubt at the heart of Aristotelian cosmology. The question that he was astute enough to perceive was this: if Aristotle were mistaken about eternality, might not his other assertions about nature be mistaken as well?[91] In his arguments for *creatio ex nihilo*, in the numerous critical references to Aristotle, and in the emphasis on the will of God, the *Guide* may be construed as a pivotal commentary on Aristotle. By thus questioning the authority of Aristotle, the *Guide* played an unheralded and unforeseen role in making possible the rise of modern science.

Having finished his work and having become the friend of Christians, Jews, and Muslims of all the ages, Moses Maimonides died on December 13, 1204 at the age of sixty-nine. A day of mourning was announced in Alexandria and Cairo.

The Rambam had expressed the wish to be buried in Tiberias. It is said that as the funeral cortege was slowly wending its way across the desert, a pack of thieves suddenly descended on the mourners. When the bandits learned who was in the casket, they fell back in shame and remorse, and begged that they might be allowed to accompany the procession as a guard of honor.[92] Little wonder that it is said of him: "From Moses to Moses, there was none like unto Moses." ♦

Acknowledgments

I am obliged to George T. Scanlon, Professor of Islamic Art and Architecture at the American University at Cairo, for his informative letter to me in November 1984. Under his leadership, the excavation of Fustat in recent years has revealed a good deal of what life was like in that medieval town.

I also very much appreciate the cordial assistance given me in locating Maimonides references by Dan Sharon, of the Asher Library, Spertus Institute of Jewish Studies, in Chicago.

And I also received prompt assistance in other Chicago libraries: the Harold Washington, the Newberry, and the Regenstein.

Notes

[1]No one knows what Maimonides looked like. Here an unknown artist has given him a wise mien, though one thinks the famous sage is rather melancholy and sad in this pose, as though he were thinking of all the writing he was not getting done. The autograph, though, likely is authentic. From "Moses ben Maimon," *Jewish Encyclopedia*, vol. 9 (1905): 73.

[2]Moses Maimonides, *The Guide For The Perplexed* (New York: Dover Publications, 1956 [1804, 1881, ca. 1190]), 192. Translation by Michael Friedländer, in 1881. This is the second English edition, hereafter referred to as *Guide*. For an excellent introduction to the thought of Maimonides, I suggest Lenn E. Goodman, *Rambam: Readings in the Philosophy of Moses Maimonides*, with commentaries and translation (New York: Viking Press [Jewish Heritage Classics, Series], 1976); and Oliver Leaman, *Moses Maimonides* (New York: Routledge, 1990).

[3]Solo W. Baron, "Maimonides," in Simon Noveck, ed., *Great Jewish Personalities in Ancient and Medieval Times* (B'Nai B'rith Department of Adult Education, Clinton, MD: Colonial Press, 1965), 204–31; Goodman, *Rambam*, 1–15; *Guide*, xv–xxv; Abraham J. Heschel, *Maimonides* (New York: Farrar, Straus, Giroux, 1982); "Moses ben Maimon," *The Jewish Encyclopedia* vol. 9 (New York: Funk and Wagnalls, 1905), 73–86. Much seems to be known about the life of Maimonides, due in large measure to the work of the thirteenth century Arab historian and physician, Ibn Abi Usaibia (IAU), whom Hitti called "the most distinguished historian of medicine the Arab world produced" (Philip K. Hitti, *History of the Arabs* [New York: Macmillan and Co., 1956], 686). IAU wrote biographies of some 400 Arab and Greek medical figures. Nineteenth-century studies of Maimonides relied on IAU and those biographies are frequently cited by present-day writers, whom I cite here. Also, see August Müller, *Über Ibn Abi Oceibia und seine Geschichte der Arzte, Studies on Ibn Abi Usaibia (d. 1270) and his Uyun al-anba fitabaqat al-atibba*, Pt 2 (Frankfurt an Main: Institute for the History of Arabic-Islamic Science at Johann Wolfgang Goethe University, 1996 [1885, 1883]); and Hitti, *History of the Arabs*, 525–7.

[4]The Umayyads are named for Mu'awiyah who, in A.D 661–750, founded in Damascus the line of 13 caliphs that formed the first dynasty in Islam. Stanley Lane-Poole, *The Story of the Moors in Spain* (Baltimore: Black Classic Press, 1990) and Hitti, *History of the Arabs*, passim.

[5]Hitti, *History of the Arabs*, chap. 37, "The Umayyad Caliphate of Cordova" and chap. 40, "Intellectual Contributions." Philip K. Hitti,"Abd-al-Rahman I: Maker of History on European Soil" in *Makers of Arab History* (New York: Harper, 1971), passim. On the mosque of Cordoba, see Keppel Creswell and Archibald Cameron, *A Short Account of Early Muslim Architecture* (Baltimore, MD: Penguin Books, 1958), 213–28; John D. Hoag, *Islamic Architecture* (New York: Harry N. Abrams, 1978), 77–83; Don A. Halperin, *The Ancient Synagogues of the Iberian Peninsula* (Gainesville, FL: University of Florida Press, 1969). On the Jewish section of Cordova, see Eliyahu Ashtor, *The Jews of Moslem Spain*, 2 vols. (Philadelphia: Jewish Publication Society, 1973), I (1973): 291–300.

[6]The Almoravids are named for the Murabits who were a religious and military brotherhood (ribat: a fortified monastery; Rabat—the capital of Morocco); the dynasty flourished from A.D. 1090 to 1147. See also Hitti, *History of the Arabs*, passim.

[7]The two essays, "Treatise on Logical Terminology," and "Essay on the Calendar," are in Isadore Twersky, ed., *A Maimonides Reader* (New York: Behrman Press, 1972).

[8]Fez was founded under Idris II who allowed the settlement of many Jews and Christians. Haim Zeev Hirschberg, *A History of Jews in North Africa*, vol. I: *From Antiquity to the Sixteenth Century* (Leiden: E. J. Brill, 1974), 99. See also Didier Madras and Boris Maslow, *Fes, Capitale Artistique de l'Islam* (Casablanca, Morocco: P. Bory, 1948).

[9]Sami K. Hamarneh and Glenn Sonnadecker, *A Pharmaceutical View of Abulcasis al-Zahrawi in Moorish Spain* (Leiden: E. J. Brill, 1963), 110, 127 and Geoffrey L. Lewis and Martin S. Spink, *Abulcasis (936?–1013?) on Surgery and Instruments*; Arabic text and English translation of the *Kitab al-Tasrif*, also known as *Kitab al-Zahrawi* (Berkeley, CA: University of California Press, 1973).

[10]On the relationships between Jews and Muslims during the Middle Ages, I suggest: Merlin Swartz, "The Position of Jews in Arab Lands Following the Rise of Islam," *The Muslim World*, 60 (1970): 6–24; Solomon Dob Goitein, *Jews and Arabs: Their Contacts Through the Ages* (New York: Schocken Books, 1964), especially chaps. 3–7; Abba Eban, *Heritage: Civilization and the Jews* (New York: Praeger, 1983) and Bernard Lewis, *The Jews of Islam* (Princeton: Princeton University Press, 1984).

[11]On the massacre during the First Crusade, see Hitti, *History of the Arabs*, 638.

[12]Some 1,500 Jews lived in Cairo during the Middle Ages; see Eliyahu Ashtor, "The Number of Jews in Medieval Egypt," *Journal of Jewish Studies*, vol. 18 (1967): 9–42; vol. 19 (1968): 1–22. See George T. Scanlon, et al., "Preliminary Report: Excavations at Fustat," *Journal of the American Research Center in Egypt* (1964).

[13]On Fatimid life and times (named for Muhammad's daughter, Fatima), see Hitti, *History of the Arabs*, chap. 44, "Life in Fatimid Egypt." On Fatimid architecture, see Creswell, *A Short Account of Early Muslim Architecture*, 30, 215; Hitti, *History of the Arabs*, 630; and Hoag, *Islamic Architecture*, 136–51.

[14]Fred Rosner and Süsseman Muntner, *The Medical Aphorisms of Maimonides* (New York: Yeshiva University Press, 1970–1971); Arthur David, trans., *Commentary to the Mishnah Aboth* (New York: Bloch Publishing House, 1968).

[15]Stanley Lane-Poole, *Cairo: Sketches of its History, Monuments, and Social Life, with Illustrations* (London: J. S. Virtue & Co., 1906), 95 and passim. Also Heschel, *Maimonides*, 66–79. "Mishnah" means instruction, as developed chiefly before A.D 200.

[16]The "Epistle to Yemen" is in Twersky, *A Maimonides Reader*, 443–62.

[17]On the Citadel, see Hoag, *Islamic Architecture*, 152–3.

[18]*Code of Maimonides*, or *Mishneh Torah*, in 14 Books, in English translation, Books I and II: *The Commandments*, (Soncino Press, 1967); Books III–XIV, (New Haven, CT: Yale University Press, 1956–1963 [variously]). For an informative analysis of the *Mishneh Torah* see, Isadore Twersky, ed., *Introduction to the Code of Maimonides (Mishneh Torah)*, vol. 23 (New Haven: Yale University Press [Yale Judaica Series], 1980).

[19]*Guide*, 9. Leo Strauss, "The Literary Character of the Guide for the Perplexed," in Joseph A. Buijs, ed., *Maimonides, A*

Collection of Critical Essays (Notre Dame: University of Notre Dame Press, 1988), 30–58; and Joseph A. Buijs, "The Philosophical Character of Maimonides' *Guide*—A Critique of Strauss' Interpretation," in Joseph A. Buijs, ed., *Maimonides*, 59–70.

[20]*Guide*, 1.

[21]On Omar Khayyam, see Carl B. Boyer, "The Arabic Hegemony," chap. 13 in *A History of Mathematics* (Princeton University Press, 1985); Louis Charles Karpinki, *Robert of Chester's Latin Translation of the Algebra of al-Khowarizmi* (New York: Macmillan, 1915); Daoud Kasir, Ed., *The Algebra of Omar Khayyam* (New York: Columbia Teachers College, 1932).

[22]From the letter of Maimonides to ibn Aknin, *Guide*, Introduction, 1.

[23]Some devout Christians and Muslims, who were influenced by neo-Platonism as put forward by Plotinus, thought of creation as a kind of allegory, as a continuous emanation of the world by the will of God from his own inexhaustible essence. See Harry Austryn Wolfson, "The Meaning of *Ex nihilo* in the Church Fathers, Arabic and Hebrew Philosophy, and St. Thomas," in *Studies in the History of Philosophy and Religion*, vol. I (Cambridge: Harvard University Press, 1973), 209 . On Muslim chronology, *creatio ex nihilo* not present in the Qur'an, and views of Averroës, see Harry Austryn Wolfson, "The Meaning of *Ex nihilo* in the Church Fathers, Arabic and Hebrew Philosophy, and St. Thomas," 207–21; "The Platonic, Aristotelian and Stoic Theories of Creation in Hallevi and Maimonides," 234–49; and "The Twice-Revealed Averroes," 371–401 in *Studies in the History of Philosophy and Religion* vol. I (Cambridge: Harvard University Press, 1973).

[24]Harry Austryn Wolfson, "The Kalam According to Maimonides," chap. 3 in *The Philosophy of the Kalam* (Cambridge: Harvard University Press, 1976).

[25]*Guide*, 13–14. Wolfson, observing that neither the Bible nor the Qur'an describe God as "incorporeal," traced this designation to the first century Jewish philosopher, Philo Judaeus, in a very full discussion of this question, in *Philo: Foundations of Religious Philosophy in Judaism, Christianity, and Islam*, vol. 2 (Cambridge: Harvard University Press [Series: Structure and Growth of Philosophic Systems from Philo to Spinoza], 1947), 94–101, 149–64. Wolfson is a *sine qua non* for studies of this sort.

[26]Ibid., e.g., 28, and Part I, chap. 35.

[27]Ibid., I, chaps. 1–70, 1–107.

[28]*Guide*, 67; from Part I, chap. 5.

[29]Ibid., 68. On a discussion of Aristotelian "accidents," see E. J. Dijksterhuis, *The Mechanization of the World Picture* (Princeton: Princeton University Press, 1986), 19–20.

[30]Ibid., 75.

[31]Loc. cit.

[32]Loc. cit.

[33]Ibid., 83.

[34]Ibid., 75.

[35]Ibid., 78.

[36]Ibid., 100, in chap. 68 of Part I.

[37]Ibid., 69.

[38]Ibid., 83.

[39]Ibid., 120–44.

[40]Ibid., 123–6.

[41]Ibid., 111.

[42]Ibid., 124, 125. Maimon was finding that the Aristotelian explanation of "secondary qualities"—color, magnitude, extension, and the like—would not do. See Robert Boyle, *Origin of Forms and Qualities* (Oxford: H. Hall, 1966); and discussions by Dijksterhuis, *The Mechanization of the World Picture*, 434–41; Edwin A. Burtt, *The Metaphysical Foundations of Modern Physical Science* (Garden City, NY: Doubleday Anchor Books, 1954), 180 ff.

[43]Ibid., 126–7.

[44]Ibid., 120, "Proposition II"; 121.

[45]Ibid., 129.

[46]On the concept of the atom through the ages, see Herbert Butterfield, "The Postponed Revolution in Chemistry," chap. 11 in *The Origins of Modern Science* (New York: Free Press, 1960).

[47]*Guide*, 128.

[48]Ibid., 81, 87. For the calculus, see E. T. Bell, *Men of Mathematics* (New York: Simon and Schuster, 1965 [1937]), on Isaac Newton, passim. On the interesting "*minima naturalia*," see Dijksterhuis, *The Mechanization of the World Picture*, 277–9.

[49]Ibid., 127.

[50]Ibid., 144.

[51]Ibid., Part II, chap. 25, 199; see also 111.

[52]Ibid., p. 195.

[53]Ibid., p. 144.

[54]Ibid., Part II, Introduction, the proofs: pp. 145–9. On the medieval view of the universe, I suggest C. S. Lewis, *The Discarded Image* (Cambridge University Press, 1964).

[55]Ibid., pp. 163–4.

[56]*Guide*, Part II, Chapters 10–12; quotes: pp. 151, 159.

[57]Ibid., 159.

[58]Ibid. On "Intelligences," see 100–2, 155–8.

[59]Thabit ibn Qurra, a ninth-century astronomer in Baghdad, invented the ninth sphere; see George Sarton, *Introduction to the History of Science*, vol. I: *From Homer to Omar Khayyam* (Baltimore: Carnegie Institution of Washington, 1927), 599.

[60]*Guide*, 159, 160, 162.

[61]Ibid., II, chaps. 4–10; 154, 166.

[62]Ibid., 176. Maimonides was referring to Aristotle's *De Coelo*, 1.10, 279b–280a35.

[63]*Guide*, 177. He was referring to Aristotle's *Topics*, 104b15.

[64]*Guide*, Part II, chap. 17, 178–80.

[65]*Guide*, 180–1.

[66]Ibid., Part II, chap. 19; especially 185–6 on forms. From Aristotle's many references to the "forms," as part of his theory of causation, I suggest: *Posterior Analytics*, 79a7; from the *Physics*, 198a30–35; *Parts of Animals*, 640a15–30; and the famous passage from the *Generation of Animals*, 729 a11.

[67]Ibid., 186.

[68]Ibid., 187. By "necessary," he meant the Aristotelian concept of something that could not be other than it was.

[69]Ibid., 184. Maimonides' affirmation of "design" does not, of course, make him a twelfth-century "scientific creationist," as that term is used today.

[70]Ibid., 188, quotes: 187, 186.

[71]Ibid., 194.

[72]Ibid., 187, 194, 198.

[73]Ibid., 196. For Aristotle on rectilinar motion: *Physics*, 263a2–5, passim; for circular motion: *Heavens*, 269a25–270a13, passim.

[74]Loc. cit.

[75]Ibid., 196, 197.
[76]Ibid., 198. I do not know how Maimonides arrived at this margin of error of only "one minute," or if it is correct. I suspect it was by a mathematical calculation rather than by a visual observation. Would a reader have an idea?
[77]Laurence W. Frederick and Robert H. Baker, *An Introduction to Astronomy* (New York: D. Van Nostrand, 1974), 120, 131–2.
[78]*Guide*, 198.
[79]Ibid., 190, 211.
[80]I counted the questions; 186–200.
[81]Bernard Lewis, *The Jews of Islam*, 100, 208; giving credence to this report and citing Arabic sources. Further to this question, see also Richard W. Bulliet, *Conversion to Islam in the Medieval Period* (Cambridge: Harvard University Press, 1979) and Nehemia Levitzion, ed., *Conversion to Islam* (New York: Holmes and Meier, 1979).
[82]On the famous and revered Saladin, see Hitti, *History of the Arabs*, 645–53; Philip K. Hitti, "Salah-al-Din: Hero of the Anti-Crusades" in *Makers of Arab History*. Not to be overlooked: Hamilton Alexander Rosskeen Gibb, chap. 5, "The Armies of Saladin" and chap. 6, "The Achievement of Saladin" in *Studies in the Civilization of Islam*, (Boston: Beacon Press, 1962), and ———, *The Life of Saladin* (Oxford: Clarendon Press, 1973); Stanley Lane-Poole, *Saladin and the Fall of the Kingdom of Jerusalem* (New York: G. P. Putnam's Sons, Ltd., 1926.
[83]Heschel, *Maimonides*, 221.
[84]Meyerhof, "The Medical Work of Maimonides," in Salo Wittmayer Baron, ed., *Essays on Maimonides, an Octocentennial Volume; 800th Anniversary of the Birth of Maimonides* (New York: Columbia University Press, 1941), 265–97. Fred Rosner, "Maimonides the Physician: a Bibliography," *Bulletin of the History of Medicine*, 43 (1969): 221–235; Fred Rosner and Süesseman Muntner, trans., *Treatise on Hemorrhoids* (Philadelphia: Lippincott, 1969); A still useful survey is: Harry Friedenwold, *The Jews in Medicine*, 2 vols., Introduction by Henry E. Sigerest; Vol. 1, chap. 12, "Moses Maimonides the Physician" (Baltimore, MD: Johns Hopkins University Press, 1944); Levy, in Charles Singer, ed. *Studies in the History and Method of Science* (New York: Arno Press [History, Philosophy, and Sociology of Science Series], 1917).
[85]On Abraham, Maimonides's son, see Heschel, *Maimonides*, 219.
[86]"Moses ben Maimon," 80. Heschel, *Maimonides*, 218–21. Bernard Lewis, "Maimonides, Lionheart, and Saladin," *Eretz-Israel*, I (1964): 70–75.
[87]*Guide*, xxxii-xxxvii; Goodman, *Rambam*, 34, 35, 40. "Letter to Samuel ibn Tibbon" (in 1199), in Leon D. Stitskin, trans. and ed., *Letters of Maimonides* (New York: Yeshiva University Press, 1977). 130–6.
[88]A mine of thoughtful information: Jacob Haberman, *Maimonides and Aquinas: A Contemporary Appraisal* (New York: KTAV Publishing House, 1979); Also, Isaac Franck, "Maimonides and Aquinas on Man's Knowledge of God: A Twentieth Century Perspective," in Buijs, ed., *Maimonides*, 284–305; Etienne Gilson, "Homage to Maimonides," in Baron, ed., *Essays on Maimonides*, 19–35. Also, see Jacob I. Dienstag, *Studies in Maimonides and St. Thomas Aquinas* (New York: KTAB Publishing House [Bibliotheca Maimonidica], 1975). *Aquinas*.
[89]*Guide*, xxxiii, xxxv, xxxii.
[90]Leaman, *Moses Maimonides*.
[91]Ibid., 194: "It may perhaps be asked why I have enumerated all the doubts which can be raised against the theory of Aristotle." But then he hurried on to explain why "This is certainly not the case."
[92]Heschel, *Maimonides*, 246–7.

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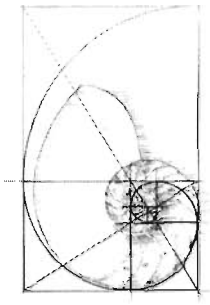

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Communications

Possible Role of Protein Modules in a Theory of Theistic Evolution

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In my previous proposal of a theory of theistic evolution, I discussed briefly the question of protein families. At that time I noted: "... groups of similar proteins, often with similar functions, share certain structural and sequence similarities, although some portions of the molecules may be quite different."[1] I also noted that I would not include each protein in these family groups as new genetic information. In the present paper, I wish to evaluate more recent studies on protein families and the similarities noted in portions of these protein molecules. In a great many protein families, the similarity is a consequence of having a particular *modular group*. It has been proposed that new functions of protein molecules may arise by transfer of gene segments in the DNA coding for these protein molecules.[2] These gene segments are expressed in proteins as modules, polypeptide units containing in most cases, 80–250 amino acids. Bork and Bairoch define protein domains and modules as follows:

> The term protein domain is often used to describe a spatially distinct structural unit that has characteristic features, but does not have to be contiguous in sequence ... Protein modules can be thought of as a distinct subset of protein domains ... modules are contiguous in sequence, and are repeatedly used as "building blocks" in functionally diverse proteins.[3]

Bork and Bairoch also note that:

> ... the most propagated genetic spreading mechanism is believed to be "exon shuffling"... It assumes that modules are encoded by exons that are flanked by introns. If such exons are "shuffled," the introns function as buffers, preventing gene destruction. This requires phase compatibility of the flanking introns and those of the receiver gene.[4]

This theory of exon shuffling has limitations, however, since bacterial genes, which do not have introns, also appear to contain some modules in their protein molecules. However, bacterial genomes could have other types of recognition sites that would permit the "shuffling" of modules.

The evidence for this concept of module transfer comes from the finding that there are many diverse proteins with portions that are quite similar in amino acid sequence. In many cases, there is no significant amino acid similarity in remaining portions of the protein molecules. It is clear that the extent of amino acid similarity varies quite markedly in these protein modules, ranging from as low as 25% similarity in some comparisons to 80 or 90% in others. Nevertheless, even similarities of 25% cannot be explained as due to purely chance arrangements. With 20 different amino acids, chance arrangements would be expected to give similarity values of ca. 5%. It should be noted that reported amino acid similarity values are often maximized in computer matching by either insertion or deletion of one or more amino acids. The examples described below illustrate the different types of experimental findings that have led to the concept of "modular building blocks" in protein molecules.

Extracellular protein modules. Protein modules appear to be quite prevalent in mammalian extracellular proteins. In a recent summary, Bork and Bairoch indicate that about 60 different examples fit strict criteria for classification as extracellular protein

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modules.[5] The extracellular proteins in which these modules appear have a wide variety of functions in organisms, ranging from the complement cascade for defense against infectious agents to components of the blood clotting system.

Intracellular protein modules. Ponting and Phillips scanned databases looking for a particular module, 80–90 amino acid residues long, called DHR. They identified the DHR module in 27 different proteins. Some of these proteins were involved in signal transduction at synaptic junctions. Others had a catalytic site, functioning as protein kinases, guanylate kinases, protein tyrosine phosphatases or neuronal nitric oxide synthases. All of the above catalytic proteins are involved in cell signaling.[6]

An interesting illustration of the use of modules in diverse organisms involves the eukaryotic initiation factor (EIF-2). Phosphorylation of the α-subunit of this factor by an EIF-2α kinase regulates protein synthesis during the process of translation. This regulatory kinase was studied in humans (RNA-dependent, designated PKR), in rabbits (heme regulated, designated HRI), and in yeast (designated GCN2).[7] Although the greater portions of these three different protein kinase molecules have no amino acid similarity, each does contain two smaller modules in the amino acid sequence that do have similarity in the kinase catalytic domains. Each of these three different kinases has a different molecular size and each has a different regulatory mechanism.

Recent studies have shown the importance of a rapid breakdown of certain proteins by eukaryotic cells. A major pathway of removal involves a 26S (2000 kilodalton) tunnel-like structure which has, as a key catalytic component, a 20S proteasome. This eukaryotic proteasome is a barrel-shaped particle of four stacked seven-membered rings made up of 14 different, but related protein subunits.[8] In an archaebacterium, *Themoplasma acidophilum*, a similar 20S proteasome carries out the same proteolytic function. This latter structure has only two types of subunits in the stacked rings. Studies of Seemüller, et al. have shown structural and amino acid sequence similarity of a ß subunit (a threonine protease) in the *T. acidophilum* proteasome with some subunits of human proteasomes.[9] However, despite a high degree of three dimensional structural similarity, the amino acid sequence similarity for the ca. 210 amino acids of the two modules is only 28%. (Subunit HS-LMP7 of *Homo sapiens* vs. Ta-beta of *T. acidophilum*). Nevertheless, the amino acids in conserved positions that are required for catalytic activity are the same in the HS-LMP7 and Ta-beta subunits. Despite the low degree of amino acid similarity, these subunits are considered to be examples of modular structures, presumably arising from an ancestral modular sequence.

Other illustrations of modular transfer are given by Miklos, who has proposed that transfer of modules is one of the primary sources of new genetic information in eukaryotic organisms. He includes examples of modules in developmental genes, which could possibly have a role in morphologic changes in organisms.[10]

Significance of the concept of modular transfer. An interesting facet of the concept of transfer of genetic information as modules is the suggestion that gene cleavage sites for these transfers are not random, but would involve some kind of recognition site such as an exon-intron border, for cleavage and for transfer to another gene coding region. The mechanism for recognition would then be similar to that utilized in the specific cleavage of DNA introns in the process of forming messenger RNA. One should note that the concept of transfer of gene segments is limited to linear portions of those segments. Yet, when one speaks of protein domains, one is often thinking of a site on a three-dimensional molecule that might involve amino acids at remote positions on a linear chain. These positions would also be far apart on the corresponding gene as well. Consequently, the idea that one could have a transfer of genetic information for a complex protein domain with noncontiguous amino acids seems implausible at the present time. On the other hand, linear portions of a complex domain might still be transferred. This type of modular transfer could cause a change in the specificity of an enzyme for certain substrates without causing a change in the general nature of the reaction catalyzed by an enzyme.

There appears to be relatively little direct evidence for module transfer between genes; the evidence at present is primarily circumstantial and is based on module similarities as noted above. Whether transposable elements, which are involved in the movement of genes within cellular genomes, might be utilized for gene segment transfer is not clear at present. If future investigations provide additional support for the concept of providing new enzymatic activities by the transfer of gene segments (modules), can this concept be incorporated into my theory of theistic evolution?[11] A partial answer to this appears to reside in the apparent requirement for specific cleavage and reattachment of the segment to be transferred. One may postulate that some source of intelligence (an intelligent cause) would be necessary at some level to provide the required

specificity of transfer. This gene segment transfer would involve both DNA cleavage (endonucleases) and DNA reattachment (ligases) or possibly nucleotidyl tranferases, with each enzyme having a high degree of specificity. Whether this activity and this specificity might be achieved by protein molecules (enzymes) or by highly specific RNA molecules (ribozymes), or both, is certainly not clear at present. It appears that these gene segment transfers cannot be explained as events of pure chance, such as those involved in usual mutations, since they appear to require specific cleavage and joining sites. There is no evidence to suggest whether gene segment transfer might occur during the process of cell division or whether it might occur when DNA strands of the cell are separated during processes of transcription or repair. Since these types of module transfer would be expected to occur only rarely, they may not prove to be demonstrable by direct experimentation. Certainly there is the possibility that genetic information controlling gene segment transfer might be present in the genome of cells and only rarely be expressed. It could remain dormant (repressed) for many years, with subsequent expression possibly, but not necessarily, being triggered by chance events. Possible triggering events might include highly stressful situations, such as starvation or major environmental change which are believed to have occurred during several major extinctions.

A key point in my proposed theory of theistic evolution was the need to distinguish carefully between *transfer of genetic information* and *introduction of new genetic information*.[12] When one considers the concept of transfer of gene segments (modules) from one gene to another, this would appear to fall clearly in the category of transfer of genetic information. However, in some cases there appears to be a new functional capability in protein molecules as a consequence of a transferred module. Often, this functional capability is due to an increased binding or a unique physical association with some other cell component (protein, membrane, organelle, etc.). In other cases, the new functional capability may be evident as a new capacity for catalyzing enzymatic reactions. Consequently, the concept of modular transfer of gene segments somewhat blurs the distinction I have previously made between transfer of genetic information and the provision of new genetic information.

Difficulties with the concept of modular transfer. Some recent studies illustrate the problems in interpreting proposed modular transfers. Aminoacyl-tRNA synthetases are absolutely essential to all organisms in the translation of genetic information in nucleotide sequences of messenger RNA into amino acid sequences of proteins. These enzymes catalyze the attachment of the twenty different amino acids to either the 3'OH or the 2'OH of the terminal adenosine of a specific transfer RNA (t-RNA). Structural studies by Nurecki, et al. have shown the three-dimensional similarity of some of these t-RNA synthetase molecules as well as their similarity in amino acid sequence. They especially compared modular portions of a glutamate t-RNA synthetase from *Thermus thermophilus* with a glutamine t-RNA synthetase from *Escherichia coli*.[13] Although the two different enzymes have a high degree of structural similarity, the amino acid similarity of modular portions (277 amino acids long) of these two synthetases is only 23%. Did modular portions of these two synthetases arise from some archetypal module? If they did, it would have required the insertion of three short segments of 8, 12, and 14 amino acids each in the *T. Thermophilus* glutamate t-RNA synthetase; also four short segments (7, 2, 12, and 16 amino acids each) would have been inserted in *E. coli* glutamine t-RNA synthetase. Each of these insertions would have required precise recognition signals at each end for insertion. In addition, there would have to be amino acid changes to account for the 213 amino acid differences in modular portions of the two synthetases. The nonmodular portions of the two synthetases (86 and 235 amino acids, respectively) have no significant similarity. The comparison of these two synthetases provides an indication of how complicated this postulated modular change becomes when one examines the data carefully.

In this case, there is a change in function since the *T. Thermophilus* enzyme acts with glutamate and the *E. coli* enzyme with glutamine. A similar difficulty is seen when one examines closely the two modules in proteasomes described earlier, which have only 28% similarity. It should be noted that what constitutes a significant modular similarity is not always clear. Traut notes that subtilisin, a bacterial protease, and chymotrypsin, a proteolytic enzyme secreted by the pancreas, have a catalytic pocket that has both the same structure and critical amino acid residues, but otherwise their sequences are entirely different. Traut refers to this as an illustration of convergent evolution, since the two enzymes do not appear to have a common origin.[14] Possible alternative explanations for postulated modular transfers and modular changes will be considered subsequently.

Theological aspects. Although much of the content of this paper is favorable to the concept of modular transport of gene segments, a word of caution should also be expressed in regard to interpretations from similarity data. As a Christian I have often noted that similarities, whether they are of function, met-

abolic processes, morphology, or amino acid or nucleotide sequences, need not always be interpreted as indicators of close (i.e., ancestral) relationships. Similarities must surely be an expression of the will of the Creator, who could work through chance events. I believe it is a mistake, however, to limit divine agency by insisting that only naturalistic explanations be considered. God's governance and direction could certainly be involved at a higher level. If a particular amino acid sequence and structure work in one organism, why should they not also be utilized by the Creator in some distantly related organism for a similar function? In comparing groups of modular sequences, the extent of similarity is quite variable, with many modules having similarities of only 20–30%. Does a 25% similarity mean that there was some ancestral sequence in the distant past for a particular module, from which all current sequences for this module have been derived, with the differences being a consequence of random mutations in variable portions of the modules over millions of years? No direct proof of this thesis appears possible. There have been some studies of fossil DNA sequences, but it appears unlikely that we will ever have enough fossil sequences of the types of modules described herein to provide any final answer to the question of possible ancestral relationships.[15] Is there not also an alternative explanation for these modular similarities that considers the possibility of a creator providing a continuing infusion of genetic information into organisms as needed? Or at a higher level, could divine agency act as suggested by Van Till:

> ... every one of these processes and every connective pathway in the possibility space of variable creatures is itself a mindfully designed provision from a Creator possessing unfathomable intelligence.[16]

The answer to these questions may lie somewhere among these three differing views, but I believe a Christian should be careful not to reject by definition possible interpretations that consider the action and direction at some level of the creator. An openness to possible alternative explanations is essential for any research scientist.

Although the experimental evidence reviewed in this paper suggests that modular transfer of gene segments may indeed play some role in providing increasing complexity in higher eukaryotic organisms, the number of instances where this may be the case is still a small fraction of the total 50,000 to 100,000 genes in the human genome. Also, in most proteins that do contain modules there is a considerable portion of the protein molecule that is not modular. One must still account for the genetic information in these portions of protein molecules. Consequently, I believe the basic thesis of my theory of theistic evolution, *that in the history of the origin and development of living organisms, at various levels of organization, there has been a continuing provision of new genetic information by an intelligent cause,* to still be valid.[17] ♦

Notes

[1]G. C. Mills, "A Theory of Theistic Evolution as an Alternative to the Naturalistic Theory," *Perspectives on Science and Christian Faith* 47 (1995): 112–22, p. 116.

[2]G. L. G. Miklos, "Emergence of Organizational Complexities during Metazoan Evolution," *Mem. Ass. Australas. Palaeontols.* 15 (1993): 7–41.

[3]P. Bork and A. Bairoch, "Extracellular Protein Modules," an insert distributed within *Trends Biochem. Sci.* 20, no. 3 (1995): 95–131, produced on behalf of the participants of the International Workshop on Sequence, Structure, Function and Evolution of Extracellular Protein Molecules (Sept. 24–28, 1994 in Margnetetorp, Sweden).

[4]An exon is a coding region of DNA; introns are intervening sequences of noncoding regions that often occur within DNA coding regions of genes. P. Bork and A. Bairoch, "Extracellular Protein Modules."

[5]P. Bork and A. Bairoch, "Extracellular Protein Modules."

[6]C. P. Ponting, and C. Phillips, "DHR Domains in Syntrophins, Neuronal Synthases and other Intracellular Proteins," *Trends Biochem. Sci.* 20 (1995): 102–3.

[7]Eukaryotes include all organisms whose cells contain a nucleus. This distinguishes them from prokaryotes, which include eubacteria and archaebacteria. J. J. Chen, and I. M. London, "Regulation of Protein Synthesis by Heme-regulated eIF-2 Kinase," *Trends Biochem. Sci.* 20 (1995): 105–8.

[8]A. L. Goldberg, "Functions of the Proteasome: The Lysis at the End of the Tunnel," *Science* 268 (1995): 522–3.

[9]E. Seemüller, A. Lupas, D. Stock, J. Löwe, R. Huber, and W. Baumeister, "Proteasome from *Thermoplasma acidophilum*: A Threonine Protease," *Science* 268 (1995): 579–82.

[10]G. L. G. Miklos, "Emergence of Organizational Complexities," 13, 30–2.

[11]G. C. Mills, "A Theory of Theistic Evolution as an Alternative to the Naturalistic Theory," and ——, "Theistic Evolution: A Design Theory Utilizing Genetic Information," *Christian Scholar's Review* XXIV, 444–58.

[12]Ibid.

[13]O. Nurecki, D. G. Vassylev, K. Katayanaga, et al., "Architectures of Class-defining and Specific Domains of Glutamyl t-RNA Synthetase," *Science* 267 (1995): 1958–65.

[14]T. W. Traut, Book review of *Proteolysis and Protein Turnover*, J. S. Bond, and A. J. Barnett, eds. (1993), in *American Scientist* 83 (1995): 377.

[15]For a critique of these, see G. C. Mills,. "DNA Sequences in Miocene and Oligo-miocene Fossils: Their Significance to Evolutionary Theory," *Perspectives on Science and Christian Faith* 46 (1994): 159–68.

[16]H. J. Van Till, and P. E. Johnson, "God and Evolution: An Exchange," *First Things* (June/July 1993): 32–46, p. 38.

[17]G. C. Mills, "A Theory of Theistic Evolution as an Alternative to the Naturalistic Theory," 114.

Book Reviews

THE SECRET MELODY and Man Created the Universe by Trinh Xuan Thuan. Oxford, England: Oxford University Press, 1995. xvi + 313 pages, glossary, index. $25.00.

The dust jacket refers to Trinh Xuan Thuan, an astronomer at the University of Virginia, as "the French Carl Sagan." Like the late Carl Sagan, Professor Thuan has a splendid gift of finding vivid and memorable expressions to bring the mysteries of astronomy to life. For example, we might naively think that the most massive stars would last longest, with their larger hydrogen reserves. "Not at all! The richest people are often the most spendthrift," he warns us. Or consider the density of a white dwarf star: it is like compressing one hundred Eiffel towers into the tip of your ball point pen. Or notice the arresting headings, such as "Three Ways to Die" or "Can We Make an Omelette Before We Break the Eggs?"

But with this important and brilliant similarity, the comparison ends. Unlike Carl Sagan, who was a thorough-going mechanist, highly suspicious of and often antagonistic to theology, Thuan brings a reverence to his view of the universe, and at the close of his book, a sympathetic stance with respect to our religious impulses. "Science is no great help when it is a question of faith. Scientists have to weigh the risks and take the plunge. They have to make a wager, just like Pascal. For myself, I am prepared to bet on the existence of a supreme being ... Betting on chance implies nonsense and despair, as witness the cries of distress by Monod and Weinberg. Why not, then, bet rather on sense and hope?"

The curious subtitle to the book, "and man created the universe," may at first blush strike a note of human triumphalism and the elimination of God. Since quite the opposite is intended, the subtitle is in a sense an unfortunate choice. Thuan means that God has given the universe a subtle and deep rationality that humankind will never fully discover, but in the meantime we model and "create" a picture of the universe as we try to understand it. For this reason he includes, in broad-brush strokes, some of the historical background that has led to our view of the cosmos.

I was, frankly, charmed by the briskly comprehensible tone of the book. Its story moves in a swift and entertaining fashion, covering most of the excitement of modern astronomy. If the author has slipped occasionally, the mistakes are forgivable (though they should be corrected if the book moves to another edition). He falls victim to the oft-repeated mythology of "epicycles on epicycles" in the Ptolemaic system, and he says that cepheid variables in the Andromeda galaxy are four times more luminous than those in our own—not true! I believe it is incorrect to claim that physicists, uneasy that "religion was raising its ugly head" in the Big Bang cosmology, subconsciously "forgot" George Gamow's prediction of the background radiation. (The problem was that Gamow's closely-connected scheme for the creation of all the elements in the initial explosion would not work because of the lack of a stable mass 5.) He also repeats (twice) some nonsense about ten new galaxies appearing over the cosmological horizon every year because of the expansion of the universe. Nor can I accept the claim, made all too bold by the general terseness of the account, that in a single stroke Copernicus had dethroned humankind from its central place in the universe, "and reduced Man to insignificance."

Yet counterbalancing each question mark I placed in the margin are places where I've marked "nice!" or "good!" I'll reread the lucid section on the ratio of hydrogen to helium atoms before my next class lecture that mentions element formation. I like the idea of the cosmic clock that "delights archaeologists but terrorizes art forgers." And the explanation of how quantum uncertainty is directly responsible for our existence arrested my attention. I cannot think of any other popular astronomy book that quite fills this niche, so I happily recommend it.

Reviewed by Owen Gingerich, Professor of Astronomy and History of Science, Harvard-Smithsonian Center for Astrophysics, Cambridge, MA 02138.

THE INFLATIONARY UNIVERSE: The Quest for a New Theory of Cosmic Origins by Alan H. Guth. Reading, MA: Helix Books (Addison-Wesley Publishing Company, Inc.), 1997. 358 pages, index. Hardcover; $25.00.

As the subtitle implies, this book is about the search for a scientific explanation for the origin of the universe. Guth explains that until recently the question, "Where did all this come from?" was "thought to be outside the scope of science." The Inflationary Universe theory attempts to explain the cause of the Big Bang within the laws of physics. However, this idea has not gained nearly as much popular attention as the classic Big Bang theory in which the expansion of the universe is taken as an initial condition. That is probably because of the difficult and esoteric nature of the subject, which is a cross between particle physics and traditional cosmology. Guth, a key figure in the development of the Inflationary theory, attempts to make it more accessible to a wider audience. In the process, he tells the story of the theory's development.

The preface states, "No special scientific knowledge is expected on the part of the reader, although presumably the reader knows about atoms, protons, neutrons, and electrons." Guth presents clear and fairly detailed explanations of the necessary physics without much mathematics. However, the book may be slow going if the topics

of cosmology and particle physics are new to the reader. For those who want to learn even more, there are extensive notes. A measure of patience will be required while the background information is developed because the Inflationary Universe theory is not explained until over halfway through the book. The personal stories told along the way will help in that respect. Perhaps it is not emphasized enough that Inflation remains somewhat speculative because it relies on Grand Unified Theories (GUTs) which are beyond the reach of current experiments.

Guth's personal account of how the theory was developed is what will set this book apart from any other on the same topic. The diary that he mentions must be a detailed one because he can give details of events almost twenty years after they occurred. The few places where he states that he does not remember something stand out as exceptions. Guth is often singled out as the originator of Inflation, but he does a nice job of giving credit to many people, such as Andrei Linde and Paul Steinhardt, who also made contributions. One interesting theme of the book is how Guth's career advanced with the development of the theory. Overall, he comes across as a fairly modest figure who is even willing to tell stories where he comes across as a bit foolish. My favorite is about a misunderstanding that took place during a meeting with Andrei Sakharov.

After presenting the original theory, some modifications that it required, and some experimental results supporting it, the last three chapters of the book deal with more speculative ideas. These include the possibilities of self-reproducing universes and the creation of a universe in the laboratory. Finally, Guth revisits the idea which begins the book, that the universe might be a vacuum fluctuation. He concludes: "If the creation of the universe can be explained as a quantum process, we would be left with one deep mystery of existence: What is it that determined the laws of physics?"

In 1977, *The First Three Minutes* by Steven Weinberg did a great deal to popularize recent ideas in cosmology to the scientifically curious. Interestingly, Guth mentions that as a postdoc he once "crammed" for a talk using that book because he was not secure about his knowledge of cosmology. Obviously, that is no longer the case. The *Inflationary Universe* is an excellent update on the state of cosmology, especially how it has been changed by new ideas in particle physics. It may be a challenging book, but it is also a rewarding one.

Reviewed by Alan J. DeWeerd, Assistant Professor of Physics, Creighton University, Omaha, NE 68178

THE FABRIC OF REALITY by David Deutsch. New York: The Penguin Press, 1997. 366 pages, index and bibliography. Hardcover; $29.95.

One interpretation of the science of quantum mechanics is the theory of multiple universes. One interpretation of the science of biology is Darwinism, specifically as described and discussed by Richard Dawkins. Deutsch takes these two interpretations, and, intertwining them with discussions of epistemology and the theory of computation, concludes that not only are these interpretations "true," but that they are true in the sense that they describe the very "fabric of reality," and, hence, are leading us close to a "Theory of Everything" (TOE).

The book comes with words of high praise by Paul Davies, Frank Tipler, Douglas Adams, and others. Richard Dawkins and Frank Tipler are cited in the acknowledgments section.

The book's subtitle is "The Science of Parallel Universes—and Its Implications." Following an introductory chapter, in which the book's goals are set forth, Deutsch begins his arguments with a truly magnificent description of the famous quantum light experiment, concluding that only a "multiverse" explanation can possibly fit the observed data. As the book progresses, he argues well that this particular explanation could be the cornerstone of an ultimate TOE (more than the relatively simple TOE that physicists seek).

Whatever one thinks of the multiverse explanation, this book is worth reading and ought to be in all college libraries. It is well written, interesting, and entertaining. The author, a researcher at Oxford University, has the credentials to be heard.

Reviewed by John W. Burgeson, IBM Corporation (retired), 6715 Colina Lane, Austin, TX 78759.

INSTITUTING SCIENCE: The Cultural Production of Scientific Disciplines by Timothy Lenoir. Stanford, CA: Stanford University Press, 1997. 351 pages. Hardcover; $55.00.

Lenoir is professor of History of Science at Stanford University. In the introduction, we read that professional life in scientific fields happens in nested, overlapping, and sometimes conflicting institutions. A scientist usually belongs to more institutions than just scientific ones. Lenoir shows how interactions with artists and politicians influence careers and institutions, in this case scientific institutions, such as laboratories where skills are coordinated. Laboratories are mostly attached to universities, hospitals, or businesses. Each of these institutions has its own culture. Not knowing and conforming to that culture will cause frustration. Lenoir claims that people working in these institutions are often not aware of the invisible culture even when they conform to it.

Lenoir shows how in nineteenth century Germany the broader reshaping of the middle classes reshaped the scientific and medical culture. He discusses concerns, mainly those of medical laboratories, and also considers painting, physics, chemistry, medicine, and politics to show that existing universities or a single group of scientists do not create scientific disciplines and institutions. Reshaping involves a particular outlook on life developed through in-

teraction in a larger society. Only in this way are new ideas worked out. In Germany it was the developing middle class which became stronger after the revolutions of the eighteenth and nineteenth centuries. Artists, scientists, and politicians interacted to create, among other innovations, new science laboratories and new disciplines in a modern Germany. Lenoir shows how we also see the same development in the arts.

In the last chapter, Lenoir and Christophe Lécuyer talk about the new discipline of Nuclear Magnetic Resonance. They consider the beginnings of this work in the laboratory of Varian Associates, close to Stanford University, and describe the people and the reason why they set up their own company: to have more freedom to do the work they liked. A key person in the devolopment of Varian Associates was Russell Varian, who was not admitted into the doctoral program of Stanford University. Lenoir calls him an instrument maker. Because producing excellent scientific instruments requires listening to industrialists, here too reasons other than only scientific ones caused the beginning of a new discipline.

Lenoir refers to the works of philosophers Peirce and William James to explain that the notion of "truth" is historically situated. Their philosophy was pragmatic and realistic to get out of the impasse of objectivism. Lenoir refers to Husserl's idea of life-world as a precondition for objective science. It is a resource to link pragmatism with concerns about instrumentation and the material embodiment of dispositions that mediate between disparate domains of experience. Lenoir wants to get away from a history of science dominated by theory and gain an insight into the historically situated, time-dependent character of plans of action.

Often in the history of science authors limit themselves to the particular scientific discipline about which they write. Reality is, however, more complex. For that reason I like the scope of this book. The ideas expressed in this book are worth considering even if we are not interested in medical laboratories in nineteenth century Germany. The book shows that science is not just something standing apart from the rest of life. That should spur us on to show what Christianity means for science, just as Lenoir shows what revolutionary movements accomplished in painting and medical laboratories. I recommend the book to historians and philosophers of science.

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

MODERN CULTURE FROM A COMPARATIVE PERSPECTIVE by Wilfred Cantwell Smith. Albany: State University of New York Press, 1997. 174 pages, notes, references, index. Paperback; $14.95.

I do not remember when I last read so small a book so packed with large ideas. Because of Smith's breadth of understanding, this book about modern culture, by a student of comparative religion, will be of great value in the study of science and religion. How science and religion are to relate has been important to us because science as we know it sprang from a modern way of looking at the world. What is perhaps less widely recognized among students of science and religion is that our concept of religion, too, as an objective thing that can be apart from, even at odds with, science, is also a modern, Western perspective.

Smith is Professor Emeritus of the Comparative History of Religion at Harvard University. He has written many articles, and nearly a dozen of his books are widely available. *Modern Culture* is a collection of eight articles brought together by John Burbidge, Professor of Philosophy at Trent University. "Islamic Resurgence" is new; the rest were written in the 1970s and 1980s. Such collections often have their greatest appeal to specialists already familiar with the author. But Burbidge's insight is that Smith has much to say about modern culture, and that these ideas born of comparative study should be more well known. I cannot agree more. The articles fit together well, and, far from being dated, have much to offer current debates. In fact, they are so current, I wonder if perhaps they did not seem a bit ahead of their time when first written. Though Smith sometimes sounds postmodern, his perspective on modern culture is not always negative, and he is not radically skeptical of knowledge and reality. Indeed, he is a vigorous exponent of the view that there is far *more* to reality than we moderns have been able to grasp, not less.

Here are just a few of his fascinating insights. In "History in Relation to Both Science and Religion," he argues that while science is the most striking development of the modern age, our perspective on history is equally new and profound. The prime question for Western civilization "will be to choose between two radically divergent options: whether to subordinate its views of human affairs therefore, of human history—to its understanding of science; or *vice versa*, to subordinate its understanding of science to its sense of history and of the human" (p. 11). He is not arguing that there is anything wrong with science, yet is pleased to see signs, as am I, that we are now leaning toward the latter.

In Smith's hands, even a discussion of English renderings of book titles brings forth fascinating insights into the history of thought. His premise—worked out in discussions of how Durkheim, Aquinas, and Schleiermacher have all been, in a manner, domesticated—is that even so apparently simple a task as translating a title leaves much room for unwitting corruption of the intended idea.

In "*Philosophia* as one of the Religious Traditions of Humankind," he argues that religions are more divergent than we had thought, and that it is possible to be part of more than one religion at a time. These points pave the way for his conclusion that the tradition developed in Greece and powerfully with us to this day, is as much a religion as any (and science a radical sect). This perspective is helpful in approaching a range of intellectual problems. Thus he argues (p. 42) that the university is not, and cannot be, free of religion, and that the idea of

separation of church and state as some conceive it is simply absurd. If religious conviction nurtures honesty, is honesty to be ruled illegal in the public realm? Likewise we can look at the relationships of science and theology as efforts to relate faith in God to faith in Reason (p. 43).

I believe there is something very important in this, though I am not fully convinced of the premises. My main disagreement concerns his view that the concept of "religion" is so misleading. This is a complex matter, and I cannot do justice here to Smith's position much less his reasons. But I would suggest there are other possible positions. Recent work does appear to indicate that religions have little in common, but how much is due to scholarly assumptions? Perhaps scholars are having such trouble with religion not just because of the historically-particular origins of the concept (on which Smith has a good point), but because of the influence of philosophical naturalism in the study of religion. It is not that there is nothing religions have in common, but that when we deny the supernatural, the one central feature of religion, it begins to look like there is no center.

These examples can only hint at the extraordinary depth and range of insights here. Smith pushes a question, and pushes hard, in what seems, at first, strange ways. Yet all the while he remains most refreshingly sympathetic to the deeper aims of religion. If this book becomes well known among scholars of science and theology, it could add a new dimension to our discussions.

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HUXLEY: From Devil's Disciple to Evolution's High Priest by Adrian Desmond. Reading, MA: Addison-Wesley, 1997. 848 pages, introduction, bibliography, notes, and index. Hardcover; $37.50.

Thomas Henry Huxley (1825–1895) was one of the most important figures of Charles Darwin's day, yet most readers would view him mainly in terms of his clash over evolution with Bishop Wilberforce at the Oxford BAAS Meeting in 1860 or for his antireligious stance. Despite the book's subtitle, there was much more to the man and his accomplishments than his outspoken support of Darwin. Adrian Desmond's *The Politics of Evolution* and *Darwin* (with Jim Moore) have won him international awards.

Desmond had access to thousands of the Huxley family letters which allowed him to view his daily correspondence and frame an extraordinary picture of an uncommon man. For Desmond:

> Huxley was one of the founders of the skeptical, scientific twentieth century. We owe to him that enduring metaphor, the "war" of science against theology. He coined the word "agnostic" and contributed to the West's existential crisis. All this makes him seem so modern that we want to snatch him from his age. Today his agnostic stance seems obvious. But yesterday, it was an immensely daring, motivated, ideological position. That plodding zoological autocrat, Richard Owen, called him a pervert with "some, perhaps congenital, defect of mind" for denying Divine will in Nature. Who can realize the prissy, patronaged-based, undemocratic, sermon-dominated, Anglican-controlled, *different*, society Huxley faced, and faced squarely? (xvii)

Tom was the youngest child of six born to an impoverished evangelical school teacher. At 13 he was apprenticed in medicine to his sister Ellen's husband in Coventry. Two years later he moved to London to work under Thomas Chandler, a former House Surgeon at University Hospital at a time when the "talent before rank" movement was active. He enrolled at Sydenham College on borrowed money in 1841, winning prizes and scholarships in following a demanding pace of medical and philosophical reading. He next served at Charing Cross Hospital where he won the chemistry and physiology medals. In 1845 he took Part 1 of the London University Bachelor of Medicine exam, winning the gold metal for anatomy and physiology. Far in debt, he became a surgeon's mate on *H.M.S. Rattlesnake* destined for an "exploring expedition" to New Guinea. As the vessel moved to the Far East, he treated patients, collected specimens, wrote scientific papers, and, in Sydney, Australia, found 'Nettie' Woodstock, who would later become his wife. He returned to London in 1850 to find that his papers had been published in his absence. Soon after, he was elected a fellow of the Royal Society and was regarded as headed for great things; however, the path out of poverty to pursue science rather than medicine was uncertain.

Desmond plots Huxley's rise from debt-ridden surgeon's mate to the top of England's scientific heap with verve, allowing his subject to vent his innermost thoughts at his moments of triumph and failure. Able to make friends with people of diverse backgrounds, he easily joined the scientific establishment which, recognizing his scientific promise, teaching ideas, and organizational skills, helped him obtain research grants and teaching positions. He led in creating London teaching institutions which offered a laboratory where the nation's secondary school teachers learned practical laboratory skills. A leader of the "science for all movement," he became an advisor to Oxbridge and Crown despite a feisty style that often got him in hot water with the gentry and clerical establishment. He led the drive to move English science from the carriage houses of wealthy amateurs to institutions with *paid* scientists.

Huxley's guarded acceptance and spirited proclamation of Darwin's ideas are carefully documented. The story-behind-the-story of his relationships with Wilburforce and other clergy offer a new picture of his struggle with Christianity. An enormously interesting man, he seems almost a superman. His standing with his scientific peers was revealed in what Desmond calls the "greatest constellation of Victorian scientists ever to gather on one spot"—at his graveside; no invitations had been sent.

Huxley's prose is penned in the vernacular of the period but with a zesty 90's spin that is always interesting, but sometimes forced. This superb biography provides the reader with an illuminating picture of Victorian culture in tracing the path of one outsider to the top. The religious issues have not gone away. *Huxley* belongs in

libraries and on the shelf of anyone interested in the early English response to evolution.

Reviewed by J. W. Haas, Jr., Gordon College, Wenham, MA 01984.

A WINDOW TO THE DIVINE: A Study of Christian Creation Theology by Zachary Hayes. Quincy, IL: Franciscan Press, 1997. 100 and xiv pages, bibliography, index. Paperback.

This book is a revision of *What Are They Saying about Creation?* published in 1980 by Paulist Press and out of print since 1995. The revisions are minor. Hayes talks about the doctrine of creation as taught by the church. He claims that an extensive reading of both the Bible and the later tradition provides serious grounds for arguing that a specifically Christian theological understanding of creation must view the creation of the world and its relationship to Christ. He goes on to say that Christians cannot study creation without considering original sin.

The writer is not a scientist, but he wants to avoid incidents like the Galileo trial. For that reason he wants to listen to modern scientists. Hayes notes that the opening chapters of the Bible are not an eyewitness account of the beginning. Church Fathers and medieval scholastics found the true religious meaning at the level of spiritual interpretation. Various forms of fundamentalism are a reaction against modern theories of biblical criticism and the development of positive sciences. Hayes says that failure to distinguish the theological, philosophical, and scientific questions will inevitably lead to confusion concerning modern science and philosophy. Hayes points out that modern research in theology posits that Genesis 1–3 was written after the Sinai covenant. The intention was then to explain that God made the animals, the sun, and the moon, which the people around the Israelites worshiped. I enjoyed reading the book. I recommend it.

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

THE FOSSIL TRAIL by Ian Tattersall. New York: Oxford University Press, 1995. 262 pages, index. Hardcover; $25.00.

A rapid overview of the outlines of human evolution is contained in *The Fossil Trail*. The author is the Head of the Anthropology Department at the American Museum of Natural History. He has written the 1993 book, *The Human Odyssey*, and was an editor of the 1988 *Encyclopedia of Human Evolution and Prehistory*. In 1982, he also coauthored, with Niles Eldredge, *The Myths of Human Evolution*. His broad experience and wide exposure to various subdisciplines in anthropology clearly show through in this work.

The book is organized historically and begins with a discussion of the pre-Darwinian finds of human artifacts and the bones of extinct animals. Tattersall quickly traces the struggle between theology, the concepts of the fixity of species and the slow realization of the western world that the earth is older than 6,000 years. His book is full of little known accounts and dead-end explanations. For example, some initial explanations of stone tools were that they were petrified thunderbolts, fairy arrows, or condensations from clouds. Europe, it seems, had forgotten that men used to make stone tools. He informs the reader of many often overlooked people who anticipated the positions advocated by Darwin. A case in point is that of Robert Chambers, who published anonymously in 1844 *Vestiges of the Natural History of Creation*, which advocated an almost Darwinian position that life evolved through time in a fashion that had no relationship with catastrophes. It was Chambers' poor science that prevented evolution from being called Chamberism.

Tattersall continues with the accounts of the discoveries of Neanderthal, Homo erectus, Australopithecus and Habilis. Throughout these chapters, there is plenty of discussion of the behavior of the hominids. Tattersall takes a position that the behavioral repertoire of the ancient hominids was qualitatively different from that of modern man. This is clearly connected with his strong belief in the worldwide replacement of archaic hominids by anatomically modern man over the past 100,000 years. This view has a tendency to downplay the cognitive abilities of the ancients because if they were replaced, it is obvious that they weren't as good as the replacers. He holds that Homo erectus is merely a scavenger and that Neanderthal was not as bright as modern men. But he is fair in his discussion of the evidence. It is refreshing to see someone who is not afraid to discuss issues that contradict his own point of view. There is an excellent, if skeptical, discussion of the tool-making abilities of Australopithecus robustus (or Paranthropus robustus) found in Member 3 at Swartkrans, South Africa. This bed has only yielded fossils of Australopithecus bones but has produced the earliest evidence for the use of fire and the making of bone tools. The author apparently accepts the validity of the huts built by Homo erectus at Terra Amata, France 400,000 years ago. The only disappointment is the way he deals the fact that the earliest Upper Paleolithic tool assemblage, the Chatelperronian, was made by Neanderthals, not by modern humans. He assumes that the Neanderthals acquired this capability by copying modern man. However, all of this took place before there was evidence of modern man in Western Europe. The author ignores the fact that the earliest Aurignacian toolkit (the other early Upper Paleolithic toolkit) is found in strata dated ca. 40,000 years ago in Spain, a region dominated by Neanderthals until around 30,000 years ago. In fact the earliest fossil of anatomically modern man in Western Europe dates to around 33,000 years ago, long after the rise of Upper Paleolithic toolkits.

The only problem, which is a problem for any author in this rapidly changing field, is that some of Tattersall's beliefs about the cognitive abilities of the archaics have been disproved since his work was published. Wooden spears, made 400,000 years ago by archaics, clearly demonstrate that the archaics were big-game hunters, not scavengers. The discovery last year of art at Jinmium,

Australia, dated to 116,000-176,000 years ago, is clearly incompatible with Tattersall's low view of hominid cognitive capabilities. And the recently discovered burial rites of the more than 300,000 year old people at Sima de los Huesos, Spain, implies much more to the religious beliefs than Tattersall would accept. All this being said, the book is a very excellent addition to any library.

Reviewed by Glenn R. Morton, 16075 Longvista Dr., Dallas, Texas 75248

THE ECOLOGY OF HOPE: Communities Collaborate for Sustainability by Ted Bernard and Jora Young. East Haven, CT: New Society Publishers, 1997. 209 pages. Paperback; $16.95.

With so much available on restoring human relationships with the natural world, a legitimate question is why one would choose *this* book. Initially, the title seems overblown; the subtitle is more in keeping with the content. Moreover, in the company of the current wave of related works, this prose seems pedestrian, the grammar occasionally sloppy, and the content bordering on the simplistic. The answer lies in the hope for a sustainable future expressed through the selected local histories, and its refreshingly accessible conversational style.

This is a collection of "new stories" of local conservation efforts, a contemporary innovation in approaching Western estrangement from the natural world. These are stories of correction and restoration, related in three parts: a retelling of American conservation history for context, the local stories themselves, and an exposition of the transcending moral. The text is supported in endnotes and carried forward by a brief epilogue inviting readers to be open to conservation opportunities and to be pulled into the light instead of turning away, preoccupied or cynical.

The authors' thesis is that we must attain sustainability in agriculture, forestry, and fisheries before we can hope to apply that philosophy on any grander environmental scale. A complementary theme is that a network of people is requisite to resolving environmental problems. Local stories recount such sustainability efforts and provide a foundation for such a network. Each story from around the continental United States is preceded by a map in silhouette locating the subject community. Why stories? Because, according to Thomas Berry, we are currently between stories, and the old one is no longer effective in our attempts to emerge from a Dark Age of environmental exploitation. Why here and now? Because existing institutions for making choices are not solving the problems. Local sustainability is characterized as a third wave of American conservation and one based on an ecological worldview, encompassing deep ecology and bioregionalism as well as conservation's own historical predecessors. There are additional contributions through resurgent interest in rebuilding human community. An environmental tapestry results, woven from these conceptual threads, but with a design not yet clear.

The content and tone are indicated in the observations, "you won't find a place where sustainability is perfectly practiced" and "sustainability is like pure love and equality: grand goals that should always lead human endeavor but a destination at which we will never arrive" (p. 15). The stories themselves provide many lessons and caveats: Foresight and philanthropy must be united with political savvy in keeping with local realities, and the success stories may not be without a tarnish of greed and of fouling one's own nest (Maine's Monhegan Island). A pre-existing attitude of volunteerism can be a meaningful boon (Chattanooga, Tennessee). Hope is to be found in the involvement of a broad cross-section of people even in face of poverty and lost resource-based industries. And, given the inevitable tensions, win-win situations are preferred and to be sought out in place of the more frequently experienced win-lose (Virginia's eastern shore). Both self-discipline and respect for generations of local knowledge are in order—as is a spirit of forgiveness for past wrongs (Menominee Reservation in Wisconsin). Working together in a spirit of cooperation among those seldom deemed allies may be essential. Furthermore, the focus must turn from personal positions and needs to the needs of regional resources (the Arizona, New Mexico, and Mexico borderlands).

Ultimately, the interweaving theme—the moral—of these stories is one of hope for a brighter environmental future fostered on a local scale and expanding into the national and even the global, starting with environmental components we claim as resources. Eden was not found among the subject communities, but they reveal that *some* vision is essential if environments and people are not to perish. A land ethic and a human one must be combined. That moral, with all its lessons, provides the reason for perusing this book. The message is more important than its mode of conveyance.

Reviewed by Dorothy J. Howell, student in Antioch New England's Environmental Studies doctoral program, Keene, NH 03431.

ECOLOGISTS AND ENVIRONMENTAL POLITICS: A History of Contemporary Ecology by Stephen Bocking. New Haven, CT: Yale University Press, 1997. 271 pages, index. Hardcover; $35.00.

Ecologists, like other scientists, have for decades debated their role in society and the sociopolitical process. While some argue that ecologists should participate in environmental politics, others think that they should focus exclusively on scientific issues. In this book, Bocking, an environmental historian at Trent University in Canada, explores the debate by recounting the history of ecology in Great Britain, the United States, and Canada since the 1940s.

Bocking tells this history through four case studies: the origins and early research of the Nature Conservancy in Great Britain; the development of ecology at the Oak Ridge National Laboratory in Tennessee; the work of the Hubbard Brook Ecosystem Study in New Hampshire; and

research in fisheries ecology conducted by the University of Toronto and the Ontario provincial government. Each of these settings involved extensive, and sometimes confrontational, interactions among scientists in research settings, politicians, funding agencies in both the public and private sector, and a host of other players.

In each institution, ecologists markedly influenced the development of their discipline by the types of questions they chose to explore and the methodologies and reporting procedures they employed. By comparing these case studies, Bocking demonstrates how the places of contemporary science—laboratories, landscapes, and funding agencies—and its purposes, as expressed through the political roles of expertise and specific managerial and regulatory responsibilities, have shaped contemporary ecology and its application to pressing environmental problems.

The book is important for understanding the current landscape of ecological research, but, more importantly, for gaining appreciation of the complex interactions among science, technology, and society. The sometimes alleged neutrality of science is exposed as a facade in the confused jumble of funding, competing proposals, publicity, and research that comprises the contemporary scientific enterprise. The application of case studies to make the major points within the book is a good example of the use of more qualitative approaches which focus on situation and context to enrich understanding of human processes and institutions. Christians can fruitfully read the book not only to explore the above issues but also to consider how Christian scientists should relate to the larger sociopolitical world within which research laboratories are nested. It could serve as a useful set of test cases for the application of some of the ideas advanced in Walter Hearn's latest book, *Being a Christian in Science* (InterVarsity Press).

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RELIGION AND THE ORDER OF NATURE by Seyyed Hossein Nasr. New York: Oxford University Press, 1996. 310 pages, index. Paperback; $65.00.

The aim of this book is to address the "crisis of the natural environment ... [through] ... the rebirth of the religious knowledge of nature" (p. 7). Nasr identifies similarities between the main religions and, in eight chapters, uses this common ground to develop a religious response to the current environmental malaise. The author, a professor of Islamic studies at George Washington University, developed the book from the Edward Cadbury Lectures he presented at the University of Birmingham in 1994.

Simply put, Nasr's thesis is that the world can only be saved from environmental destruction if people rediscover the relationship between their religious heritage and nature. Or as Nasr writes:

> The art of being able to cross religious frontiers in a religious and not simply anthropological, linguistic, or historical manner consists precisely of being able to appreciate the meaning of sacred doctrines, rites, forms, and symbols in the new landscape ... This art, which is also a science of the highest order, necessitates gazing upon forms in the sense of *surat* according to Rumi, and not to be confused with the form in its Platonic or archetypal sense, always in function of the essence or meaning *(ma'na)* and seeing the world of *ma'na* reflected through the variegated forms comprising different worlds of the sacred (p. 19).

Nasr's sentence style is maintained throughout, making the book difficult to read. More disturbing are some generalizations. In an age of political correctness, there should be no surprise to learn that primal religions are more in communion with nature than with Christianity (p. 220), but, as someone who has spent over 20 years in New Zealand, I have yet to meet one of the "Several hundred million followers of primal religions [that] ... still survive in the Americas, Africa, the Polynesian islands, Australia, India, New Zealand ..." (p. 31). There are other times when Nasr seems to force his thesis, such as his view that Copernicus "helped to destroy the idea of nature as a living reality and reduced the cosmos to simply structured matter" (p. 134). What Copernicus actually saw was such continuity between God and the cosmos that he said he was "thinking God's thoughts after him." Similar comments apply to the selection of "the most often heard [ecological] voices in Protestant circles" (p. 195): Sallie McFague, Matthew Fox, and Philip Sherrard—with no mention of Calvin deWitt (*Caring for Creation: Responsible Stewardship of God's Handiwork*) or Loren Wilkinson (*Earthkeeping in the Nineties: Stewardship of Creation*).

The final chapter revisits the rediscovery of "the Sacred and consequently to behold again nature's sacred quality" (p. 271). This laudable aim occurs in a book that is not written for a general audience and has a strong Islamic bias that makes this reviewer wonder how Nasr intended to achieve the stated aim. Most readers, and ASA members in particular, will probably find their efforts better directed to more popular authors whose books are considerably more readable and affordable.

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

REDEEMING THE TIME: A Political Theology of the Environment by Stephen Bede Scharper. New York: Continuum, 1997. 240 pages, index. Hardcover; $29.95.

Much of the debate in the late twentieth century concerning human roles and responsibilities toward the environment has been markedly free of reference to religious values. Yet clearly any human decision regarding the proper and improper uses of the environment and natural resources is a value-laden enterprise. The author, current President of the Religious Education Association and a

faculty member of the University of Notre Dame, provides a succinct and helpful look at religious approaches to the environment. He has developed his analysis over the course of many years of teaching an undergraduate course in religion and the environment.

The book opens by considering the question, "What is the proper role of humans in light of the ecological crisis?" The core apologetic argument is advanced that only a religious point of view—seeing human agency as central to both the devastation and the reclamation of planetary life—is viable. Such a religious view must include social, economic, and cultural, as well as theological, transformation to be effective in confronting threats to the environment. Three major branches of Christian ecological discourse are considered, with representatives from each branch being briefly described and considered. The "apologetic approach" has concentrated its energies on responding to Lynn White's arguments and variations on his thesis. Key respondents within this approach are Robin Attfield, Thomas Sieger Derr, and H. Paul Santmire. The "constructive approach" accepts some Christian culpability for the core of White's critique and seeks to build upon the Judeo-Christian tradition for an environmental theology. Representatives of this approach are Douglas John Hall, Jürgen Moltmann, and Walter Brueggemann. The "listening approach" is less dependent upon either White's analysis or Christian tradition, seeking instead to hear nature and creation itself, mediated through a mélange of non-Christian religious thought and natural science. Key figures described in this approach are John Carmody, Albert Fritsch, and Thomas Berry.

Subsequent chapters consider approaches such as the new cosmology, ecofeminism, process thought, Gaia theory, and liberation theology. While each of these approaches recognizes the role of the human in the present environmental crisis, Scharper finds each approach incomplete or inadequate. His general method is to briefly describe each approach through the work of one or two of its key proponents. Then he discusses the role of humans in this particular approach, identifying human responsibilities and roles. Finally, he loops back to the various theological/religious approaches he discussed in the first chapter, showing how certain writers have interacted with these approaches in their religious/theological work.

The final chapter advances a preliminary political theology of the environment. It builds upon the rich metaphors found in the literature of the various writers surveyed. As Scharper explains, "All of these metaphors are placed as buoys, as it were, helping Christian theologians to navigate between the Scylla of a theological anthropology that perceives the human as lord, master, and telos of creation and the Charybdis of viewing the human as an inconsequential inhabitant in the overall functioning of the planet, as Gaia and deep ecology suggest" (p. 186).

Any ASA member interested in ecology and Christian responsibility will find the discussion and analysis useful. Disappointingly, more conservative and evangelical Christian work in ecology such as that produced under the auspices of the Au Sable Institute, are not even referenced in this book. The book provides ample challenges for the work ahead and is an excellent entree into some of the key philosophical and theological issues which must be considered.

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THE ECOLOGICAL COMMUNITY by Roger S. Gottlieb, Ed. New York: Routledge, 1997. 384 pages. Paperback; $21.95.

Critics of ecology and environmental studies programs frequently err in treating the movement as a monolith lacking both rigor and depth of understanding. Gottlieb, Paris Fletcher Distinguished Professor of the Humanities at Worcester Polytechnic Institute, has assembled an impressive cast of philosophers and political scientists that reveals the diversity and depth of current philosophical approaches to the environment. Eighteen contributions are organized around three major themes: environmental challenges for political theory and philosophy; environmental theory and moral questions; and current conflicts in environmental theory and practice. Seven of these essays formerly appeared as a special 1995 issue of *Social Theory and Practice.*

The major point of the book is that political theory, ethics, and philosophy all have to be reworked in light of current ecological crises. Pressure from two different directions for this reinvention is alleged: the current environmental crisis has arisen in part because of the impact of faulty political, ethical, and philosophical theories that failed to account sufficiently for human impacts on the environment; and the dynamic, changing Earth itself forces us to rethink our own place in the world and our personal and corporate responsibilities. While reinvention is advocated, the exact question of its fundamental shape and direction is not as clearly expressed in the essays.

One of the most fascinating aspects of the book is the degree of disagreement among the authors about the validity and explanatory power of current theories in politics, ethics, and philosophy as they relate to environmental concerns. One author, for example, claims that liberal moral and political theory is highly supportive of environmental concerns. A second author finds its focus on individualism to be a major intellectual contributor to our current environmental dilemmas. These exchanges, handled indirectly via separate essays, provide many points of departure for personal thought and class discussions. Some essays are more heavy duty than others, but all are accessible by undergraduates. The concluding essay by Carl Mitcham, a noted philosopher of technology, on the sustainability question, is perhaps the clearest essay on this topic as it carefully dissects the varied ways in which sustainability has been defined, discussed, and advanced.

Christian scholars will want to supplement this book with some of the fine Christian contributions that have appeared in recent years. Viewed together as a corpus, students can be wonderfully challenged to rethink a variety of issues related to political theories, personal and social ethics, and philosophical orientations. Students can critique current Christian conceptions in light of the excellent essays this book provides at an affordable price.

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RELIGION AND TECHNOLOGY: A Study in the Philosophy of Culture by Jay Newman. Westport, CT: Praeger, 1997. 208 pages, index. Hardcover; $55.00.

I tell my students that you can't have a meaningful discussion without defining terms. Newman would probably agree, but this is a serious book. One part of my definition of serious is that this book isn't superficial. Newman realizes that religion, technology, and culture are not easy to define, and, therefore, he warns readers that he hasn't defined terms, as these definitions in themselves would each be a book length study. However, most readers would have little quarrel with what they perceived to be his definitions. He is, of course, aware that there are many religions, but sticks almost entirely to Judaism and Christianity. A quote might help illustrate his thinking on defining terms:

> One can easily become discouraged when one reflects on the ambiguity of a key term, especially when one has been striving to clarify its meaning; and the more that one dwells on linguistic and conceptual confusions related to the term, the more one is likely to feel that the subject matter of one's investigation is gradually slipping out of one's grasp. I suspect that this fear of losing control of one's subject matter and getting lost among all the competing perspectives has contributed greatly to turning many a subtle philosophical mind into a dogmatic ideologist. Besides, the "crowd" often prefers boldness to subtlety and rewards it accordingly (p. 60).

Another part of serious is that this is a scholarly book. There are about 400 notes (at the ends of the chapters) and almost twelve pages of bibliography. The only writer I did not find who might have been included was Jeremy Rifkin. There are no charts or illustrations, and none are needed. There are scriptural references, and comments on the thoughts of others on relevant Scripture, when appropriate. Serious also means that Newman knows, and uses, western cultural history. This is not just a book about the 1990s. Newman does have opinions, but they don't stand out. As far as I can tell, he treats the opinions of others fairly, and is cautious in presenting his own.

There are five chapters. The first is "Religion and Antitechnology." In this chapter, Newman considers the writing of several authors who have thought that technology is antireligious, or that religion should be antitechnological, notably Langdon Gilkey and Jacques Ellul. Newman clearly doesn't believe that a conflict is necessary. He closes the chapter by reminding readers that a religious organization (namely the Inquisition) used technology to advance its ends.

The second chapter is "Technology and *Techne*," in which he considers some of the definitions of technology, and finds that many thinkers haven't been broad enough in their definitions. (*Techne* is from Aristotle and Plato, and means something like craft, making things, and the like.) The third chapter is "Technology and Progress." One of his main concerns here is the question of whether technology decreases or increases freedom. Of course, the answer is that the use of technology has done both.

Chapter four is "Technology as a Religious Endeavor." The very thought is fascinating. Newman points out that much of religion is made by humans. Therefore, in a sense, religion is technology. There is, or should be, artistry in the production of a sermon, for instance. Besides, one of the most important technological developments, printing, has been crucial for the spread of religion. Other technologies have also contributed, of course. Newman includes the story of the golden calf, which shows that the worship of a technological product, apart from God, is wrong. He quotes Margaret Mead, who said that Christianity applauds those who volunteer their time to work in a soup kitchen, but not those whose careers are devoting to breeding better crops or developing better ways of delivering fertilizer. Unfortunately, she is right.

Chapter five is "Religion, Technology and Culture." I find that I can't summarize this simply, perhaps because Newman has not come to firm conclusions. I summarize the entire book by saying that the interaction between religion and culture has been, is, and almost certainly will be complex.

One point that Newman alludes to, but does not magnify, is the suspicion that opposition to technology is often just because it is new, and we aren't used to it. However, this opposition often puts on the mask of protecting religious interests, when they may not really be at stake.

Newman is a professor of philosophy at the University of Guelph, and an author of eight other books. This book is written so that readers should have no trouble understanding it. But is it worth $55? Probably, but you might want to hold out for the paperback, if there is one.

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ANGLO-AMERICAN POSTMODERNITY: Philosophical Perspectives on Science, Religion, and Ethics by Nancey Murphy. New York: Westview Press, 1997. 211 pages, index. Paperback; $18.95.

In the essays that make up this book, Nancey Murphy advocates a shift towards a more holistic approach to the study of religion, science, and ethics, which she describes

as postmodern. However, in contrast to what might be called the "hard" postmodernism of Continental (mostly French) thinkers, Murphy presents a "soft" postmodernism, which she terms "Anglo-American." This softer postmodernism is characterized by a movement away from positivist and modernist conceptions of science and religion, and, at the same time, avoids the excesses and pitfalls of the harder deconstructionist position generally associated with postmodernism.

In her introductory essay, Murphy characterizes modernist debates as taking place along three Cartesian axes. Modern epistemology is dominated by concerns about the foundations of knowledge, with a range of responses from absolute foundationalism to absolute skepticism. In the philosophy of language, referentialism is the dominant modern theme, with scholarly opinion ranging between representationalism and expressivism. Finally, modern approaches to metaphysics are characterized by debates over reductionism, with atomists at one end of the scale and idealists at the other. The point of the postmodern perspective is to move beyond the dualistic limits of these debates, and strive for a holism that is anti-foundationalist, anti-referentialist, and anti-reductionist. The remaining essays, which are divided into three sections, explore these ideas in more detail.

The essays in the first section examine issues in the philosophy of science, with an emphasis on critical realism, relativism, and progress in science. Building on Kuhn's notion of the incommensurability of worldviews, Murphy argues that the proponents of the realist debate spend much of their time talking past each other, and that the confirmation or denial of scientific realism "really" makes no sense in a postmodern world. Rather, what is important is how scientific claims are justified. In her examination of the basis for competing claims, she argues that standards of rationality, rather than being absolute, are based in tradition. This limited relativism allows for the existence of different paradigms, research traditions, and so on. On the final issue, Murphy argues that, as a balance to the medical or biological model, research in the psychosocial aspects of mental illness serves to advance, rather than inhibit, progress in terms of treatment efficacy.

The second section is devoted to an examination of issues in theology and the philosophy of religion. In the first essay, Murphy argues that modernism forced theologians into advocating either a liberalist or fundamentalist position. The former is viewed as experiential, expressivist, immanentist, and incommensurabilist, while the latter is considered to be scriptural, propositional, interventionist, and commensurabilist. Murphy's conclusion is that it has almost been impossible to do theology within this modern framework. Proposing a new agenda for conservative theology, the author advocates incorporating Alasdair MacIntyre's account of truth and the role of Scripture. In the final essay in this section, the author argues that the interpretation of texts should be based on a new philosophy of language that recognizes the development of conventions and practices within communities of users.

The final section contains essays that focus on the relationship among religion, science, and ethics. Murphy first draws attention to parallels between religious thought and scientific reasoning. Exploring the relationship between theory and evidence, he examines how some kinds of religious experience may count as objective, empirical support for religious theory. The next essay argues for a new model of the hierarchy of the sciences in which theology, ethics, and the traditional sciences exist as part of an ordered and intrinsically interconnected system of inquiry. The final essay is directed against reductionism, with particular emphasis on the nonreducibility of ethics to biology. Here, Murphy calls upon the notion of supervenience, which recognizes the importance of context and circumstances that correspond to different levels of analysis. In other words, at any level of analysis, there may be some factor that is essential to our understanding of a particular phenomenon that cannot be reduced to lower levels of analysis. For example, a protein behaves differently in an organism than it does in a test tube. There is something about being in the organism that supervenes the chemical composition of the protein and thus defies the reductionist account of its activity.

This is a challenging and thought-provoking book that requires and deserves careful attention. It will be of particular interest to the readers of this journal because it tackles central issues of religion, science, and ethics. Readers who take the time to wrestle with the issues presented here will be well rewarded for their efforts.

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

IN DEFENSE OF MIRACLES: A Comprehensive Case For God's Action in History by R. Douglas Geivett and Gary R. Habermas, Eds. Downers Grove, IL: InterVarsity Press, 1997. 330 pages. Paperback.

Geivett, associate professor of philosophy at Talbot School of Theology, Biola University, and Habermas, Distinguished Professor of Apologetics and Philosophy at Liberty University, have assembled a distinguished team of scholars to address the following question: Is the action of God, in history, through miracles possible and have they occurred? The book begins by giving the opposition first crack at debunking such efforts by first reprinting David Hume's 1776 essay "Of Miracles," with arguments that are still relevant today, and then giving Hume's modern defender, Antony Flew, professor emeritus at Keele University in England, the opportunity to solidify the case against miracles. The remainder of the book is then devoted to building a thorough case, not only for showing that miracles are possible, but that they are also verifiable and, in fact, have occurred.

The book is divided into four chapters. Geivett and Habermas give a historical backdrop followed in chapter 1 by Hume's and Flew's arguments against the possibility of miracles. Chapter 2 gives rebuttals to these counterarguments by setting up the possibility of miracles, giving

a foundation for later chapters. Chapter 3 presents the theistic context under which miracles are possible and occur. Finally, chapter 4 focuses on the most important miracle in Christian history: the resurrection of Jesus.

The case built for miracles is done carefully and systematically. The counter-arguments of Hume and Flew are each addressed seriously and carefully. The strongest arguments presented against miracles are that no definition can make the determination of a miracle possible and, even if such a definition was possible, no miracle is historically verifiable due to its uniqueness and novelty. In the case for miracles, these arguments are taken up first. Such notable Christian philosophers as Richard L. Purtill, Norman L. Geisler, and Francis J. Beckwith take up this charge and give a working definition of miracle as well as show how historical studies can authenticate such an event.

The question of a consistent worldview allowing for both God's existence and his action is taken up by such philosophers as J. P. Moreland, W. David Beck, and Stephen T. Davis. Here, all the arguments for God's existence are used to give a well-rounded description of his nature and demonstrate how that nature is consistent with actions that can and do occur in history. Furthermore, addressing other religions' claims to miracles is done in a consistent way with claims from Christianity. This allows for openness to such a possibility without compromising Christian theology.

The case for the resurrection of Jesus is the central case study of the book. John S. Feinberg, William Lane Craig, and Gary R. Habermas make a careful analysis of the events surrounding the occurrence and make the case that the timing, style of reporting, and variety of sources are strong supports for its validity.

This book is well organized. While Hume and Flew are given the main task of defending the case against miracles, they are not set up as straw men to be knocked down. A wide range of other arguments from others in the opposition are addressed throughout. This book attempts to leave no stone unturned and presents cogent and incisive arguments in an organized way while not compromising Scripture at any time.

The arguments for the resurrection of Jesus are particularly well done and use the full power of the material furnished in the earlier chapters. A notably demanding section is John S. Feinberg's examination of the question of how Christ could be both God and fully human. Also, J. P. Moreland's section on science and agency theory should be of special interest to scientists.

This book is highly recommended for anyone wanting an apologetic for God acting in history. ASA members should particularly find it a welcome addition to their libraries.

Reviewed by James M. Turner, Visiting Professor of Mathematics, College of the Holy Cross, One College Street, Worcester, MA 01610.

A NATURAL HISTORY OF PARENTING: From the Emperor Penguins to Reluctant Ewes, A Naturalist Looks at How Parenting Differs in the Animal World and Ours by Susan Allport. New York: Harmony Books, 1997. 238 pages. $23.00.

Most parents commiserate as well as celebrate the life of child-rearing. Parenting is painful; parenting is glorious. And as anything so grand and miserable, its waters run deep. Susan Allport explores this depth, from an evolutionary perspective, as she shares the struggles, curiosities, eccentricities, and successes of parenting through such creatures as the dwarf antelopes of Ethiopia, the bluebirds of South Carolina, African elephants, Texas bats, and that incredibly strange species known as *Homo sapiens*. This is not a theological book, yet at times the reader feels like Job before the whirlwind: "Where were you when I laid the foundation of the earth?" Consider the Behemoth and Leviathan and try not to shudder in amazement! As Job discovered, insight (theological or otherwise) is inseparable from a larger perspective even if initially overwhelming.

First of all, Allport is a wonderful writer. She guides the reader through complex biological, zoological, and anthropological territory with the compelling drama of a good storyteller and the attentive wisdom of a masterful teacher. She approaches the subject of parenting as a naturalist, a science writer, a part-time shepherd, and finally as a parent. Why do mammals typically incubate and nurture their offspring with their bodies while cold-blooded animals let the earth and sun do the hard work? How does each parenting strategy work in the evolutionary scheme? Why do ewes lick their newborns and why did one of Allport's ewes resist, even at the risk of her own lamb's demise? What difference does it make in a species whether one is a nester or a wanderer? What encourages long-term commitment in mating and parenting, and what encourages philandering and abandonment? Why do so many people comment on seeing the father's traits in newborns? These are samples of the kinds of questions Allport pursues and actually answers.

Questions even more fundamental are addressed as well, such as: What makes a male a male and a female a female and what difference does it make for parenting? Such gender boundaries bend when considering, for example, that the male sea-horse is the one who actually becomes pregnant. And in many species of fish, it is the father who nourishes, protects, and cares for the young. After reading of the tremendous variety and flexibility in parenting strategies across species, the reader will reconsider before ever again making an argument on the basis of "nature." Nature, including the phenomenon of parenting, is incredibly complex and resists human reductionistic categories. Yet, even while variety reigns, there are patterns at work as well, patterns that are both destructive and creative, and that overall seem to reflect an instinctual urge towards life as such.

With care and caution, Allport also journeys into the realm of human parenting—from the Gussi of southwestern Kenya to traditional Inuit, from Pakistan to America—again uncovering great variety as well as common

themes in parenting. In humans, attachment, sensitivity, and endurance are key. With our young doing most of their development outside the body, and at such a slow rate compared to most species, long-term devotion is crucial if the younger generation is to survive, thrive, and learn the ways of the elder generation in a dangerous and predatory world. On the one hand, Allport describes how, evolutionarily speaking, love itself has emerged, and its key role in parenting. On the other hand, she reminds us of the often horrifying ways humans, like other animals, are themselves dangerous toward even their own. From obscene baby-formula schemes to abandonment to overt infanticide, Allport examines the evolutionary tension that exists between generations—the tension between insuring one's own short-term survival and the long-term survival of one's genes. For example, the male emperor penguin will incubate a mate's egg until eighty percent of his fat reserves are burned. At that point (which is the threshold of his own ability to survive), he abandons the egg. As Allport points out, in the penguin's world it does no good to continue, for without the parent the egg would not survive either.

Like Pascal, or, before him, the author of Job, this book gives us a glimpse into the grandeur and the misery of existence—in this case through the beauty and terror of parenting. And as Tillich or Kierkegaard might suggest, the situation of existence (here, parenting) raises questions which are ultimately theological—questions of meaning, purpose, hope, transcendence, or "ultimate concern."

If you have no tolerance for evolutionary explanations for behavior, you will not like this book. But if you find such an angle on existence intriguing, persuasive, or helpful—a kind of theological "necessary but insufficient" approach to other disciplines—and especially if you are a parent or concerned with parenting—enjoy. It is striking that even within the evolutionary framework, love and devotion are foundational to the species.

Reviewed by J. Bradley Wigger, Louisville Presbyterian Theological Seminary, Louisville, KY 40205-1798.

QUEST FOR PERFECTION: The Drive to Breed Better Human Beings by Gina Maranto. New York: Scribner (Simon & Shuster), 1996. 335 pages, bibliography and index. Hardcover; $25.00.

Gina Maranto is a science journalist whose writings have appeared in a variety of publications, including the *Atlantic Monthly* and *Scientific American*. *Quest for Perfection* is her first book.

The well-chosen title of Maranto's book appropriately summarizes the theme which underlies the historically and topically diverse sections contained within it. *Quest for Perfection* refers to the tendency of human beings—at all times and in all places, it seems—to understand, control, and "improve" upon what nature has equipped us for as far as conception and birth are concerned. In fashioning an argument which proclaims that humanity's desire to "improve" upon the species is an "impulse" with ancient roots that continues to find modern expression, Maranto juxtaposes contemporary headlines announcing the latest advances in reproductive technology with historical references as varied as the exposure practices of the Egyptians, Greeks, and Romans, to the *rassenhygiene* fanaticism of Nazi Germany. She also draws upon an array of anthropological evidence concerning the practice of infanticide to add additional weight to the argument that our penchant for controlling and modifying birth outcomes is both widespread and deeply rooted. The central message of the book is that nothing much has changed throughout human history, except the technological means at our disposal, which permit an increasing degree of control over the reproductive process.

The reproductive technologies of today echo the eugenic schemes of this and the last century, which in turn echo the scientific and theological musings of the Middle Ages regarding conception and birth, which echo the utopian visions of Greece and Rome. *Quest for Perfection* provides a compelling argument that the quest to control our genetic destiny has been a constant in history; from the ancient and comparatively crude practices associated with infanticide, to the modern, sanitized, and sophisticated techniques associated with assisted reproduction, embryonic manipulation, and the Human Genome Project. It is the power and sophistication of today's technologies that have raised and expanded the levels of debate concerning the ethical and political implications of such "tinkering," but the desire to tinker with human destiny is not new.

Throughout history, humans have devised a variety of methods and a variety of rationalizations to facilitate the elimination of the undesirable and unwanted amongst them; just as they have devised methods and rationalizations for creating the desirable and the wanted. The "quest for perfection" has been largely fueled by our penchant for seeking "biomedical fixes for socioeconomic problems." Again and again we are reminded of the role played by the larger social context—the influences of politics, religion, science, and technology—in the "service" of this quest. Therein, of course, lies the rub. Science, religion, and philosophy provide us with visions of "perfection" and we employ the means at our disposal to strive toward that goal, but we appear to have absorbed little of the lessons of history in the process. The "quest for perfection" would doubtless be considered a noble enterprise if we could be certain of the existence (and attainability) of such a reality in any *objective* sense. We do not, and so are left, it seems, with continually defining that "brave new world" for ourselves. As history clearly demonstrates, our track record in this respect has all too frequently been less than noble.

Quest for Perfection is not a book of answers, nor does it aspire to be one. It explores and challenges a wide variety of issues—historical, technological, and ethical—surrounding the "eugenic impulse" and does so with a narrative skill that makes for intellectually satisfying and compelling reading. Maranto has crafted a thoughtful and thought-provoking book which represents science journalism at its best. For a topic about which so much, and by so many, has been written, one would be hard-pressed to recommend a more passionate or compassionate treatment than this.

Reviewed by Janice Drodge, Assistant Professor of Anthropology, University College of Cape Breton, Sydney, NS, Canada B1P 6L2.

MODELS FOR CHRISTIAN HIGHER EDUCATION: Strategies for Success in the Twenty-First Century by Richard T. Hughes and William B. Adrian, Eds. Grand Rapids: Eerdmans Publishing Co., 1997. 461 and x pages. Paperback; $30.00.

In the introduction Hughes asks: "How is it possible for Christian institutions of higher learning to develop in academic institutions of the first order and, at the same time, to nurture in creative ways the faith commitments that called these institutions into existence in the first place?" Hughes notes that many colleges and universities in the United States started as Christian institutions but abandoned their Christian orientations in the interest of a purely Enlightenment-based search for truth. On the other hand, some colleges cling so tightly to an a priori Christian worldview that it places limits on the search for truth. This clinging to an a priori Christian worldview may be done in two ways. Some insist on a so-called "literal" reading of the Bible. Others say God gave the revelation in nature first and base their philosophy of learning on a combination of their findings in studying nature and the Bible. They do take the Bible seriously but believe that the Bible gives us the story of salvation, written in a language understandable for people living in the time when the prophets lived. The editors asked, "What are the results of these different approaches?" They answer this question by asking how Christian institutions of higher learning deal with it. Hughes identified seven faith traditions in the introduction. A knowledgeable person discusses the history and present state of each tradition. Then follows a discussion of two institutions in that tradition.

The book discusses, in the Roman Catholic tradition, the University of Portland and St. John's University. In the Lutheran tradition, they chose California Lutheran University College and Saint Olaf College. For the Reformed tradition, they selected Whitworth College and Calvin College. In the Mennonite tradition, the choice was Fresno Pacific College and Goshen College. The next three traditions are a bit more difficult to define, since the borderlines between them are a bit vague. For the tradition they call the Evangelical/Interdenominational, they chose Seattle Pacific University and Wheaton College. In the Wesleyan/Holiness tradition, they selected Point Loma Nazarene College and Messiah College. The seventh tradition is Baptist/Restorationist and the choice was Pepperdine University and Samford University. Some of these institutions started in one tradition, but are now in another, especially the interdenominational ones.

The introduction to each tradition is interesting because it gives a short history of that particular tradition in the United States and its approach, often a changing one, toward Christian higher education. Different traditions give different answers to questions like: "How do we integrate faith and science in our life and in our studies? Can we work toward such integration?" The book makes us aware of why some colleges cease being Christian.

Since twenty-seven authors wrote chapters, some chapters are easier to read than others. I enjoyed reading the book, and recommend it to anyone interested in the future of Christian education and scholarship.

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

ALL GOD'S CHILDREN: A Biblical Critique of Racism by Stephen L. McKenzie. Louisville, KY: Westminster John Knox Press, 1997. 132 pages. Paperback.

McKenzie is Associate Professor of Old Testament at Rhodes College in Memphis, Tennessee. It is the purpose of this book to emphasize not only that the Bible cannot properly be used to defend racist beliefs and practices, but that its true message leads away from the divisions associated with racism to a God-ordained diversity-in-unity. The author treats a number of situations based on the Old Testament in nine chapters, and on the New Testament in the final four chapters. It is probably the author's own area of specialization that leads him to devote as much space as he does to the Old Testament, where hermeneutical analysis of the text relevant to his subject is often required. By contrast, the New Testament passages appear to be very clear and need little additional elucidation.

Old Testament topics covered include: (1) the creation story in Genesis 2 and 3, which embraces the idea of equality and fraternity between all people, regardless of race; (2) the "curse" on Ham from Genesis 9, which had been inappropriately invoked by southern Christians before the Civil War to legitimize black slavery; (3) the tower of Babel in Genesis 11, the separations following which were caused by sin, not racism; (4) several events in the life of Abraham in Genesis 12–26, in which Abraham got into trouble because he unnecessarily feared "the other"; (5) the teaching of the "election" of a specific people, which goes along with the revelation of God's final goal in universal blessing; (6) the holy war in Deuteronomy, in which God's command to the Israelites to conquer and annihilate the Canaanites is seen to be religious rather than ethnic in motivation, and the description of these events by the author(s) of Deuteronomy is given to promote religious "purity" at a time when there were still many Canaanites living in the land; (7) the Israel that Moses led out of

Egypt, which was not an ethnic unity—even Moses' own wife was not an Israelite by ethnic background; (8) Joshua's account, which shows that the complete destruction of the Canaanites was impossible, and ultimately undesirable; (9) Rahab, who was a one-time Canaanite prostitute, but played a key role in Israel's conquest of the land, and also played a role in the ancestry of Christ himself; (10) the citizens of Gibeon, who were still predominantly ethnic Canaanites; (11) many individuals in the Bible stories about David who are members of non-Israelite ethnic groups; (12) three of the five women mentioned in Matthew's genealogy of Christ who were non-Israelites: Tamar and Rahab were Canaanites, and Ruth was a Moabite; (13) issues involving marriage between Jews and non-Jews as set forth in Ezra and Nehemiah, with possible responses and clarification in Chronicles and Malachi; (14) important books of the Bible which were written by non-Israelites: Job, much of Proverbs, and Ecclesiastes; (15) Jonah which is a book against prejudice and advocating the love of God for all people; (16) Isaiah 11, for example, which stresses the goal of harmony among different people, whereas Christian theology has often emphasized "vertical" relationships with God rather than "horizontal" ones between people.

New Testament topics covered include: (1) Luke's emphasis that Jesus' ministry was to all people, including those socially considered outcasts; (2) the Parable of the Good Samaritan, which explicitly counters the kind of prejudice found in racism; (3) the first Gentile convert to Christ, who according to Acts, was a black man; (4) physical features, such as skin color, wholeness of body, or health, do not influence one's acceptability before God; (5) the mission to the Gentiles beginning with the conversion of Saul; (6) the welcome of God for all people, including their diversity; (7) the strong case made against segregation among Christian churches in the desire to follow the command of Christ that all should be one in him, that indeed it is specifically through this union that the witness of Christians will reach out to others; (8) the story of the encounter between Jesus and the Samaritan woman in John 4 as a striking example of how Jesus ignored ethnic and religious prejudice; (9) "The theology of the Gospel of John and the letter of I John offer a significant challenge to the segregation of churches along racial lines as is commonly practiced in this country"; (10) the continuing clear call from St. Paul, especially in Romans 9–11, Galatians, and I Corinthians 12:12–30.

The message of this section is: There is no doctrine of segregation in the New Testament. Its credo is not "separate but equal"; it is "different but united." It could be well used in a context where Christians recognize the call to exhibit their unity and are willing to begin the difficult task of overcoming traditional ethnic or racial separations.

This book treats an important topic for the life of the Christian church today. It could well be used as a background text for study and/or action groups. It would be even more effective if it could be used with a multi-ethnic, multi-racial Christian group.

Reviewed by Richard H. Bube, Professor Emeritus of Materials Science and Electrical Engineering, Stanford University, Stanford, CA 94305.

PAGAN RESURRECTION MYTHS AND THE RESURRECTION OF JESUS by Leon McKenzie. Charlottesville, VA: Bookwrights Press, 1997. 160 pages. Hardcover; $21.95.

Previous to his retirement, McKenzie taught at Indiana University. The author of ten books, McKenzie has also published over one hundred journal articles. In this book, he advances the argument that the religious imagination has been lessened by fallacies of intellectual history which has resulted in unjustified hostility against religion.

McKenzie believes that liberal Christians have trivialized orthodox belief by falling prey to relativism. Rather than pagan resurrection myths providing evidence against Jesus' resurrection, McKenzie believes they validate it by providing a resurrection archetype based on the universal resurrection theme found in the human collective unconscious.

In chapter one, McKenzie argues that those Christians who reject the resurrection of Jesus do so as a result of a pseudo-conclusion based on the hidden assumptions of their research models. The nature of biblical research is examined and the discontinuities between pagan resurrection myths and the resurrection of Jesus are explored. Three recent books denying the resurrection are refuted and labeled as "baldly erroneous," "shop-worn," "out of touch," and "overwrought fancy."

In chapter two, Frazer's *The Golden Bough* is critiqued: McKenzie shows that the resurrections of Frazer's gods (Tammuz, Adonis, Astarte, Attis, Marsyas, Hyacinth, Osiris, Dionysus, Demeter, and Persephone) bear some resemblance to Jesus' resurrection. But the differences are substantial. The main one is that Jesus' resurrection is rooted in history, while resurrections of pagan deities are fables. The third chapter looks at the idea of the universal archetype (psychology students will recognize McKenzie's dependence upon Jung for this concept) and illustrates it by seven resurrection motifs. These universal human motifs show a good "fit" with Jesus' resurrection.

Chapter four presents the idea that many people fail to accept the resurrection because of a deficient "interpretive imagination" resulting from the Enlightenment products of a narrow rationalism, scientism, philosophical naturalism, materialism, atheism, and nihilism. Chapter five gives the views of prominent biblical scholars and the modes of Jesus' presence today via the church, the Bible, and the Eucharist.

This is a helpful book, written in an easy-to-read style, and apologetic in that it seeks to defend the orthodox view of Jesus' resurrection. It is very critical of resurrection critics, seeking to show that their whole approach to the question is biased. Whether McKenzie will get a fair hearing from the ranks of atheists and agnostics is questionable, but his presentation will certainly be well-received among those already convinced that Jesus did indeed rise from the dead.

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

THE OUTRAGEOUS IDEA OF CHRISTIAN SCHOLARSHIP by George M. Marsden. New York/Oxford: Oxford University Press, 1997. 142 pages. Paperback; $22.00.

In many academic circles it is unacceptable to have religious perspectives used in scholarship and debate. But Marsden has argued previously (in *The Soul of the American University*) that religious perspectives are legitimate. In this book, he offers positive guidelines about what he means. The argument should appeal to the broad community of scholars who do not think in this way and do not want to, and to Christians who would like to know what Christian scholarship might mean. Because there has been a long period in which religion, he suggests, has been trivialized in the academy, religious thought and argument need to be justified.

Marsden writes cogently from a deep understanding of the history of developments in the modern academy (reviewed here, but tested at length in his previous book). This book can be recommended to both non-Christian and Christian colleagues. Many readers of this journal (which is mentioned in the book's appendix as an example of a significant journal in support of a Christian academic organization) will find it helpful in crystallizing and expressing their own commitment to Christian scholarship.

Reviewed by David T. Barnard, Vice-President (Administration), University of Regina, Regina, Saskatchewan, Canada S4S OA2.

TRANSFORMED THINKING: Loving God with All Your Mind by Edward M. Curtis with John Brugaletta. Franklin, TN: JKO Publishing Inc., 1996. 200 pages, index. Paperback; $12.95.

Transformed Thinking is an excellent contribution to the current debate on the evangelical mind. In nine chapters the book explores integrating general and special revelation, understanding the "spirit of our age," and developing a Christian mind. The text is lucid and contains several discussion questions at the end of each chapter that make the book useful as a textbook. In fact, Curtis developed this book as a text for Biola University's adult degree program.

The first two chapters are foundational for the book's theme, developing a Christian mind. The authors begin by showing that knowledge is acquired "in four basic ways: through empiricism, reason, intuition and faith" (p. 13), using familiar examples to illustrate both the principles and limitations of each learning method. Then they move to how worldviews affect learning, by creating unconscious and conscious bias. By using illustrations from theology and the social sciences, they build a strong case showing how the "spirit-of-our-age" has infiltrated many areas of thought, including some evangelical theology.

In chapter 3 on Modernity and chapter 4 on Postmodernism, Curtis and Brugaletta expand on the "spirit-of-our-age" and the challenge to Christian thinking. They successfully separate the nuggets of these issues from the dross and achieve a succinct, and very readable, summary of Modernity and Postmodernism. Also, these chapters stress both the benefits and pitfalls of Modernity and Postmodernism, with suggestions on how Christians can use the positive elements to their advantage.

Chapter five marks something of a transition from the first four chapters, showing how to develop a Christian mind first in special revelation (chaps. 5–7) and then in general revelation (chaps. 8–9). The chapters on special revelation use many examples from Old Testament theology, which is the author's specialty, though most ASA members will probably find the discussion on general revelation more useful. This last half of the book (chaps. 5–9) gives the reader impetus to strive for humility while seeking truth and understanding by "thinking God's thoughts after him." For example:

> While the example of Job clearly illustrates the way experience can bring people to a clearer understanding of reality, including truth about the way God works in the world, it is also important to recognize that experience, especially individual experience, is subject to several problems that often make it a problematic indicator of "truth." First of all, there is no guarantee that our experience is typical and thus indicates what others could normally experience in a similar situation. Secondly, our experiences are always subject to interpretation, and often there is great uncertainty as to the meaning and significance of our experience—as exemplified by the debate between Job and his friends (p. 147).

This is an excellent book that is "intended for people who are serious about both their thinking and their faith" (preface)—in other words, all ASA members! The progression from epistemology to worldview to special and general revelation illustrates how the authors have striven to "love God with all your mind," which is the book's subtitle. Developing a Christian mind is a difficult task. Few books get further than identifying the problem, and then fail to help others think Christianly. These authors have compiled an excellent resource that is invaluable for leading classes on the Christian mind.

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

JESUS AND THE GOSPELS by Craig L. Blomberg. Nashville, TN: Broadman and Holman Publishers, 1997. 440 pages. Hardcover; $24.99.

Blomberg, a New Testament professor at Denver Seminary, is the author of the Matthew commentary in The New American Commentary series as well as five other books. He divides the 19 chapters of Jesus and the Gospels into five major divisions. In these, Blomberg surveys the Gospel accounts of the life of Christ in historical and cultural contexts, taking issue with some views the last two centuries have spawned. In the process, he analyzes the Gospels from the perspective of their literary forms. Included are author, subject, and Scripture indices, review questions, and diagrams. The book has no pictures.

Blomberg indicates that the material in this book has developed over many years via different experiences as

a student and teacher. He has taught for 12 years on this topic, but it was after teaching a course at the University of Denver on the life and teaching of Jesus that Blomberg became convinced to produce a book. His goal for this book is "a one-stop shopping textbook for courses on the Gospels." Although it is written in a style easily accessible to laypersons, pastors, and scholars, it is intended primarily for theological students.

The five major topics present a history of the intertestamental period, an analysis of scholarly critical methods used in studying the Gospels, an introduction to each Gospel, a survey of the life of Christ, and a synthesis of the major issues involved in the study of Jesus. For anyone interested in a scholarly, conservative presentation of Jesus and the Gospels, this book is a good place to start. Additional study can easily be pursued by obtaining the many books listed in the chapter bibliographies.

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

Letters

Missed the Point

I have just received the March issue of your journal, in which my book, *The Infinite Voyage: A Metaphysical Odyssey*, is reviewed (p. 60). I wish to thank you for the review, but I must be frank in saying that I am quite disappointed with it. It is clear that the reviewer has wholly missed the import of the book and its inspirational message. What he cannot fit onto his procrustean bed of Christianity is, in his opinion, not to be recommended for "further study." He has selected a very few phrases in the book to make his point that I "appear to reject Christ as the Messiah." If this narrow criterion of truth is the lens through which he views ultimate reality, then I pity him, for he is not truly an educated man. He distorts my meaning of the phrase "idealization of the self" (concluding paragraph) by repeating it as "realization of the self." I have, moreover, nothing in common with his depiction of my message as "new age thinking."

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Is Theology Science? Re Peterson

Peterson's attempt to make theology a science (*PSCF*, 50 [March 1998]: 22–31) involves linguistic confusion and problematic consequences. Theology is *Wissenschaft* or *scientia*, for these terms apply broadly to rational endeavor, as "science," in contemporary usage, does not. The *regina scientiarum* of the medievals is now recognized by the orthodox as the application of philosophical techniques to the data of Scripture, but what it may become among liberal theologians is unpredictable.

Peterson explicitly exempts metaphysics from science (pp. 21 f). However, a research program is as possible here as in theology. Someone has claimed that there are four consistent metaphysical positions: materialism, realism, absolute idealism, and pragmatism. Assuming this assessment is correct, although it may not be true of all variants of the basic views, the disproof of the doctrine via *reductio ad absurdum* is not possible. Yet one can lay out the consequences of each of these positions. The required research program will examine the adequacy of each outlook to support (or explain away) rationality, morality, freedom, origins, etc. Here we have to call in auxiliary hypotheses. So this is as clearly a Lakatos' "research programme" as what Peterson suggests for theology. Indeed, I believe that any problem, down to what one may have for breakfast, can be made into a "scientific" matter within Peterson's criteria.

I recognize that he tries to give an empirical content to theological predictions (pp. 27 ff). But how can he distinguish between the unpredictable work of the Spirit (John 3:8) and psychological factors? It appears to me that sects that teach that certain activities are necessary to attain bliss or greater bliss, or to avoid perdition, more effectively motivate their membership's activity than do evangelicals who declare the biblical doctrine of grace. Shall we then declare faith erroneous and supersede it with legalism on empirical grounds? I note that the infamous *argumentum ad baculum* is far more persuasive than careful rational analysis.

If one reduces theological studies to psychology, sociology, and anthropology, it will be scientific, softly. But this is neither orthodox dogmatics nor biblical theology.

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God as a Blown-up Me: re Busen

Busen, in his responses to Drozdek and to me, though my name is wrong (*PSCF*, 50 [March 1998]: 75–7, 74f), uncritically cites authors to establish his thesis that the deity is time-bound. But is it true, as Davies claims, that God has to become temporal to communicate to us (p. 74)? I don't think he would have said this if he had read and understood Dorothy L. Sayers, *The Mind of the Maker*. If Davies is correct, all authors who want the characters in their plays or novels to know something have to become characters within their writings. This is ridiculous, for all that is required is that the clues necessary for the characters to infer or discover the information are included within

the internal circumstances of the work. Analogously, God does not have to be within his creation to communicate to the creatures he made sentient. How he places his revelation within their reach is strictly up to him. He has included an ass, apostles, and angels among his messengers. But there is a vital difference between God and human authors: no author can wholly become a part of a literary work, but the incarnate God entered his creation.

I was amazed to find Tillich and Barth cited unquestioningly as authorities in an evangelical context. Both are encumbered with a lot of higher critical and philosophical baggage. Tillich, especially, has no commitment to Scripture or creed. He declares "'God has become man' is ... a nonsensical statement" (*Systematic Theology*, II, 94). When he says that God must incorporate non-being as a dialectical process (III, 284), he has swallowed too much irrational Hegelian dialectic for me. Their claims are fully answered below.

Davies' insistence that personality demands change is totally confused. I recall being asked if the crucifixion had not changed God. The answer is clearly "No," but one must be aware that this is a complex question, as in the chestnut, "Have you quit beating your mother-in-law yet?" Were the question, "Is a Redeemer-God recognizably different from one who is not a redeemer?", the answer would be "Yes" with a qualification. In *Perelandra*, C. S. Lewis presents a creation story without a fall. So the ongoing revelation of God to Tor, Tinidril, and their descendants would be radically different from his revelation to the children of Adam. Yet there is but one God in the universe, a single deity however many populated worlds he may see fit to produce.

The question about the changing deity assumed that God is tied to a before and after as we are, and so had to change at the time of the crucifixion. But he is immutable and eternal, necessary conditions to being the Creator rather than a purely immanent pantheistic all. This, unfortunately, Pike does not see (p. 77). So he turns Genesis 1:26 f on its head and produces a deity in his own human image. Busen does not see that ascribing some sort of time to God to "solve" Davies' and Pike's problem merely produces a problem equally heterodox and irrelevant. The eternity appropriate for human beings, namely unending time with change (see Ephesians 2:7), does not have to be ascribed to God, whose eternity is without time, T_1, T_2, ... , T_n included.

What is the alternative? A deity in time of any sort changes, for there is necessarily a before and an after. There is consequently a future which is not yet open to it, making it both finite and liable to surprise. It is but me writ large, an idol though not graven. How can I worship it, when it is such a sorry substitute for the God of Abraham, Isaac, and Jacob, the Almighty, the I AM THAT I AM.

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The Messinian Crisis vs Noah's Flood

The geological question of the Mediterranean flood was discussed in "The Mediterranean Flood" by G. R. Morton (*PSCF* 49 [Dec. 1997]: 238–51). In this piece, the suggestion was made that the Mediterranean flood was also the Noachian flood, and that coupling the two together solves a lot of problems.

The more-or-less sudden infilling of the Mediterranean Basin took place in Messinian time (the Messinian crisis; late Miocene), in round numbers about six or seven million years ago. Morton equated this event with the "appearance on earth of the first hominids." He used this deliberately ambiguous term ("hominids"), thus avoiding the use of "modern human beings." Early hominids are physiologically distinct from modern human beings, and this fact bears heavily on his thesis.

Therefore, the hypothesis of Morton includes, among other things, the idea that Noah and his predecessors, all the way back to Adam, were *not* modern human beings.

The date for Noah, as implied by Morton, is about 5.5 million years ago. *Homo sapiens sapiens* (modern humans) first appeared roughly 100,000 years ago. Construction of the ark, presumably built of planks, required the skillful use of tools, at a level not indicated at sites where the remains of early hominids have been found. Furthermore, the genealogy in Genesis, read as a straight-forward account, appears to place Adam at less than 10,000 years ago.

Therefore Morton's article sets an event roughly six million years ago equal in time to another event, less (perhaps much less) than about 100,000 years ago. It appears to be untenable to equate the Noachian deluge—whatever its extent—with the Messinian crisis.

Part of Morton's article depends heavily on expressions such as "could have been" and "possibility" (e.g., p. 246, second column, last paragraph). This is the phraseology that is very popular with people who do not really have any pertinent data; "could" is the tip-off that we are not dealing with facts. Other hypothetical statements are presented without caveat (e.g., p. 248, top of second column: "... the Mediterranean shore, which Noah formerly knew as the mountains of Ararat ..."; and again near the bottom of that column). What do we know about what Noah "formerly" knew, or even what Noah knew at a later time, in terms of geographic features and names? And what do we know about the possible peregrinations of the name "Ararat"?

Morton included a closing comment that his hypothesis "fits all the disparate facts outlined in Genesis and in the geological record of the Mediterranean." This is indeed quite far from the case.

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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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The 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* 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

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, USA or Canadian Scientific & Christian Affiliation, P.O. Box 386, Fergus, ON N1M 3E2, CANADA or by contacting the CSCA website at: http://avatar.uwaterloo.ca/~mann/cscahome.htlm

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