PERSPECTIVES on Science and Christian Faith

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In this issue

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

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Perspectives on Science and Christian Faith

MANUSCRIPT GUIDELINES

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The Joy of Science

The usual fare of *PSCF* falls along the lines of "science studies" rather the study of nature. Here we are interested in the methods of science, the resolution of conflicting ideas, the ways that scientists interact with each other, and the ways that science has influenced and, in turn, been influenced by the broader culture—especially Christianity. The result of these studies has been to offset earlier notions of science as an entirely objective, rational, and impersonal process. The postmodern mood is seen by some as putting science in its proper place along with other elements of culture rather than at the top of the heap.

In all this heady chatter *about* science, there is a tendency to distract today's scientists and the coming generation from that which attracted us to the field in the first place—the sheer joy of the study of nature. Do you remember the smile that lit your face as you grew a crystal or examined the inhabitants of a tidal pool? The thrill of discovery—biochemical pathways for repairing damaged DNA (thereby preventing mutations and cancer), rational design of inhibitory enzymes (a cornerstone of drug discovery), new ways to synthesize polymers in environmentally-safe carbon dioxide, a radio-isotope by-product that selectively reduces cancer-induced bone pain, a new one-electron route to photosynthesis under anaerobic conditions—provides motivation for this quest.

The splendor of nature writ large and small must not be lost in our quest for ultimate meaning and purpose for our lives and the world. Both are essential!

Jack Haas, Editor
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In This Issue

We begin with young scientist Steven Hall's thoughts as he moves to a "foreign" academic campus in the aftermath of completing a doctorate. Deborah and Loren Haarsma then add their thoughts on the implications of big-bang theory from the discovery that some neutrons have non-zero mass. Oliver Barcley concludes the News and Views section with suggestions for clarifying the evolution discussion.

By the time that this issue reaches you, the CiS/ASA Conference in Cambridge, England will be history. One theme of that meeting is found in Pattle Pun's "Toward an Ethics of the Human Genome Project." Pun examines a theological model of a *perfect human being* and suggests ethical issues of genetic confidentially and nondiscrimination that come from the new understanding of our genetic make-up.

J. Raymond Zimmer then examines the challenge of the new field of "evolutionary psychology" to the traditional social sciences. He argues that evolutionary psychological theories may be complementary, rather than antagonistic to Christian views. Roger Bufford and Jonathan Garrison follow with a critical evaluation of Evolutionary Psychology, suggesting that while the new discipline has "unique areas of compatibility with Christian beliefs [there are] particular areas of existing and potential conflict"—examine with caution.

As the Mars Global Surveyor continues to collect data, pundits from late night talk shows to the science news magazines speculate about evidence purporting to support extraterrestrial life. More definitive answers may be gained from the Mars Climate Orbiter and Mars Polar Lander slated to be launched in late 1998. Joseph Spradley examines earlier speculations about extraterrestrial spiritual beings and the implications for Christian theology.

In our first communication, Robert T. Pennock continues his discussion of the current appeal for a "Theistic Science" in examining Phillip Johnson's notions of this approach. Geologist William Tanner then takes a critical look at the popular notion that the body of water crossed by the children of Israel in escaping from Egypt was the Red Sea. He offers evidence on linguistic and geographic lines that the crossing took place over Great Bitter Lake.

We close this issue with a strong selection of book reviews and two letters. The December issue will celebrate the fiftieth anniversary of the *Journal of the American Scientific Affiliation.*

Young Scientist Corner

In Transition

by Steven G. Hall, McGill University, Quebec, Canada

Greetings, fellow young ASA-ers!

During my first few weeks in Québec, I have had a chance to recover a bit from completing my doctorate. I have seen some beautiful and challenging parts of a unique culture "next door," met a variety of interesting and enjoyable people, and really started to consider my callings and hopes for the future.

I have been blessed to find a quiet campus with much natural beauty (and wonderful weather, for the most part!). The people here have been supportive and friendly, and my French is slowly improving. I have made one public presentation about my modeling and experimental work with composting, and have submitted two papers for review. I have visited farms, academics, downtown, local Anglophone and Francophone homes, and churches where I have met interesting students, politicians, and local Quebecois folk. I have enjoyed hiking in the mountains and listening to *belle musique*. And I have been fortunate to be staying with Roger Samson, a local organic activist who puts his money where his mouth is—we eat tasty, healthy, fresh-this-minute greens, spices, mint tisanes, and lately succulent strawberries. All this for free. In short, I feel healthy, and I am meeting interesting new people.

While I continue with academic work and begin to feel more at home, one of my most important callings now is clarifying my direction: envisioning clearly what it is that I hope to do here, and learning to express a vision for the future that is true, compelling, and sincere.

I am working on several "thought papers" or "position papers." In a sense, I feel I have the luxury of considering the future direction of my life, and I hope to use this opportunity wisely. In short, I am beginning to recognize the level of significance that local and, more consistently, global environmental concerns truly have.

I also see the ideal role of people, not as users or abusers of the earth and other species, but as stewards, as creatures with a special ability to act as rehabilitative and reconciliatory agents or as destructive agents in the ecosystem. Historically we have played both these roles for thousands of years. The areas around the Mediterranean, for example, were largely deforested and, in many areas, deserts and bedrock have been the result. However, in areas

where wise stewardship of native and agro-ecosystems have been practiced, deserts and rocky hills have been converted to forests, productive, stable farmlands, and habitats for both humans and native species. Our modern western society has taken the notions of domination, short-term use, and extractive technologies to new extremes, in many cases to the detriment of local and regional ecological systems, and ultimately to our detriment, since we depend upon these systems for food, resources, and even for the air we breathe. Yet the phrase which continues to strike me about much of this waste and abuse is that it is "sad and unnecessary."

With about six billion people on the planet, and continued increases in both population and resource use on every continent, the responsibility to care wisely for the resources of creation is more critical than ever. We need to wisely use our resources with ingenuity, available technology, and a compassionate heart. When our time horizon is measured in weeks or months instead of decades or centuries, we are unlikely to leave our children the kind of legacy we might hope to receive. This linkage between the personal and technical aspects of environmental concerns is near the heart of our current dilemma. Furthermore, the consideration of long-term dynamics and possible plausible transitions to not only a sustainable agriculture, but a sustainable future for all, is critical to our survival and the renewed health of the biosphere upon which we depend.

Biting off a small bite of this huge project is my present challenge. Technically, this will include energy and resource engineering and ecosystem modeling of long-term system dynamics. I am also recognizing the significant interpersonal, political, and spiritual aspects of the environmental crisis, and am trying to assess my own strengths, interests, and callings in order to respond wisely to this clear message of both concern and hope. I believe communication via writing, speaking, and even music is a strength I possess. In addition, I realize that my scientific and engineering background allows me to converse with others on some of the intertwined technical issues involved. I hope you will feel free to advise me as to what you feel my strengths and weaknesses are, what you see as critical issues, and to offer feedback and prayer as you feel called, on these or other issues. I wish you much joy and clarity of vision.

God bless you.

Love,
Steve

I am also recognizing the significant interpersonal, political, and spiritual aspects of the environmental crisis, and am trying to assess my own strengths, interests, and callings in order to respond wisely to this clear message of both concern and hope.

News & Views

Neutrino Mass, Inflationary Cosmology, and the Fine-tuning Argument

by Loren D. Haarsma,
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Recent results from the SuperKamiokande Collaboration provide the strongest evidence to date that some neutrinos have non-zero mass.[1] Contrary to the implications of some popular press reports, most physicists have been expecting such results for several years. Non-zero neutrino mass can be accommodated by fairly straightforward extensions of the "standard model" of particle physics. Earlier measurements of neutrinos produced in the sun, in the atmosphere, and by accelerators[2] suggested that neutrinos might oscillate from one "flavor" (electron-, muon-, and tau-) to another—an expected consequence of non-zero mass. Neutrino mass gives additional data in constructing the Grand Unified Theory (GUT) of physics. It also provides additional data for cosmologists.

The neutrino mass measurement should cause a revised estimate of *Omega*, the mass density of the universe. *Omega* is defined such that if it is greater than 1, the mass in the universe is large enough to cause its eventual collapse, and if *Omega* is less than 1, the mass of the universe cannot prevent it from expanding forever. Observations of the galaxy clusters dynamics currently place *Omega* at about 0.3. If neutrinos (or other Weakly Interacting Massive Particles [WIMPS]) have even a small amount of mass, their high density throughout the universe would add significantly to this value. Since the actual values of the neutrino masses are not known (only that at least two are non-zero), their contribution to *Omega* is not yet known.

The cosmological constant *lambda* is also an important parameter. It is also referred to as "vacuum energy," "quintessence," and (recently in the press) "anti-gravity." It is an energy density associated with empty space and has a constant value throughout the universe. *Lambda* and *Omega* in various combinations determine the current acceleration or deceleration of the universal expansion, the curvature of the universe, and its ultimate fate (whether it will contract or expand forever). There are several types of observations being made to determine *lambda* and *Omega*. Recent distance measurements to supernovae have found that the universal expansion may actually be accelerating, which is only possible if *lambda* is non-zero. Observations of the curvature of the universe limit the sum of *Omega* + *lambda* to less than about 1.5. Standard inflation theory predicts that the curvature of the universe will be precisely flat, or *Omega* + *lambda* = 1. There are also variations of inflation theory that allow a curved universe.[3]

Cosmology and particle physics are closely related. The values of the fundamental constants of physics (particle masses, coupling constants of the various forces, etc.) are integral to both fields. It has been known for some time that only very narrow ranges within the fundamental constants allow for human life. This fact is sometimes used apologetically, as evidence that the laws of nature were designed for life. However, several scientific theories have been proposed to account for this apparent fine-tuning without reference to a Designer. Three theories which have attracted the most attention are the "many-worlds" interpretation of quantum measurement theory, "many-universes" quantum cosmology (in which quantum fluctuations in a hypothetical high-dimensional space-time can produce Big Bang-like events), and inflation theory. The first two, while intriguing, are not widely accepted by physicists. It is unclear whether they resolve the problems they claim to resolve, nor do they seem to make any observable predictions different from "standard" interpretations of quantum mechanics and standard cosmological theories.

Inflation theory, although still speculative, is given a fair bit more credence because it solves a few problems in noninflationary cosmology.[4] Three problems in particular are: (1) Magnetic monopoles are scarce, yet predicted in abundance in noninflationary cosmology. The exponential expansion of inflation would push monopoles and other relics beyond the edge of the observable universe. (2) Observations (see above) indicate that the universe is nearly flat, but noninflationary cosmology has no mechanism to set *Omega* + *lambda* between 0.3 and 1.5. The exponential expansion would cause any initial curvature to be smoothed out so that *Omega* + *lambda* is precisely 1.[5] (3) The cosmic microwave background is very nearly in thermal equilibrium everywhere we observe—including parts of the sky which should be causally disconnected from each other. In noninflationary big-bang cosmology, we know of no particular reason why different parts

of the universe which never had a chance to interact with each other should be at the same temperature. In inflation, the different parts of the universe were in causal contact before the exponential expansion and the observed thermal equilibrium is expected.

Another prediction of inflation theory is that the universe is much larger than the observable universe, containing other regions in which the fundamental constants of physics may be different. These different regions are thought to arise in the following manner: Immediately after the Big Bang, gravity, electromagnetism, and the strong and weak nuclear forces operate as a single, unified force described by what is often called the "theory of everything" (TOE). As the universe cools, gravity uncouples from the other three forces, which are now described by the GUT. As the universe cools further, the mathematical symmetries which GUTs have at higher energies break down. The strong nuclear force uncouples from the weak nuclear force and electromagnetism. The exact details of this "symmetry breaking" are not understood because we do not yet know the details of the GUT, but it is known that those symmetry-breaking details set the values of many particle masses, coupling strengths of the forces, etc.

The inflationary epoch is thought to happen after the TOE separates into gravity and GUT, at the time of the spontaneous symmetry breaking of the GUT into strong force + electro-weak force. If inflation theory is correct, space expands (and matter cools) exponentially during the inflationary epoch. The spontaneous symmetry breaking happens at slightly different times in different regions of space. Each region becomes its own "island universe," each much larger than our observable universe. Since the symmetry-breaking happened differently in each region of the universe, each could have somewhat different strong-force, weak-force, and electromagnetic coupling constants, particle masses, etc.

It is unknown how different the fundamental constants could be. All parts of the universe would have the same TOE and the same GUT. Since we do not yet know what the correct GUT is, we do not know how much variability there could be in the fundamental constants set by symmetry breaking. Even supposing that inflation would produce many different regions of the universe with a great variety of fundamental constants—some of them "naturally" falling into ranges suitable for life—it still begs two important questions. First, how "finely-tuned" is the GUT and the TOE? It is impossible to speculate on the answer to that question until more details are known about the GUT. Second, why should the universe, with its particular TOE, exist at all? Inflation, or for that matter any scientific theory, cannot answer why something should exist rather than nothing.

Whether inflation theory is true or not, we can praise the Creator for an amazing creation. As for using the apparent "fine tuning" of the laws of nature as an apologetic argument, it would seem that wise use is cautious use. ✣

Notes

[1]http://www.phys.hawaii.edu:80/~jgl/nuosc_story.html
[2]http://www.neutrino.lanl.gov
[3]For a recent overview of alternatives to standard inflation, see "Inflation is Dead; Long Live Inflation" by George Musser, *Scientific American* 279 (July 1998): 19–20.
[4]For a recent popular overview by the originator of inflation, see *The Inflationary Universe: The Quest for a New Theory of Cosmic Origins* by Alan Guth and Alan Lightman (Reading, MA: Addison Wesley, 1997).
[5]George Musser, "Inflation is Dead; Long Live Inflation."

A Strategy for the Evolution Debate: A View from the Other Side of the Atlantic

by Oliver Barclay, 8A Southland Road, Leicester, England LE2 3RJ

The frequent confusion of the scientific evidence for and against evolution with the philosophy of naturalism clouds the discussion at present. For example, Phillip Johnson starts his first book, *Darwin on Trial*, with this confusion. He uses the word Darwinism to mean a philosophy and leaves the word evolution ambiguous. He claims that "in contemporary scientific usage," evolution is a philosophy that "excludes not just creation-science but creationism in the broad sense." Then, however, he proceeds to attack, not naturalism, but some aspects of the scientific problems of biological evolution. How current *scientific* usage can be so philosophical he does not say. What he means emerges as a incorrect label. He calls the writings of those who take this view "mainstream science," rather than calling them "some prominent scientists," as he should. Whatever may be the situation in the United States, the British scene does not really look like that. Attacking mainstream science makes him seem anti-science and he is read in that way by a number of scientists.

That, however, is not the main point. Most of his book attacks scientific views and does nothing to attack naturalism, except to say that we have scientific difficulties today in explaining some facts and perhaps we should admit that we may never have any explanation unless we accept "direct divine ac-

tion" as the material cause. Johnson fails to address the issue of the jump from science to a philosophy and this is a too common policy. He fails to distinguish scientific theories from the philosophical interpretations that may be put on them, though he agrees that there can be no Christian objection to biological evolution if seen in a Christian light. His strategy is confused and, unfortunately, is followed by a good many other creationists.

There is a close analogy with the "scientific materialism" that some people tried to deduce from Newton's mathematical discoveries. What came to be called a mechanistic philosophy never followed from Newton and Newton himself did not hold it, though it is sometimes called the Newtonian worldview. The success of his mechanics was, however, so spectacular that it tempted people to jump to the view that everything was just a matter of mechanical cause and effect, which is what is being called naturalism today. It would have been futile to attack this philosophy by attacking Newton's mechanics. Even when it emerged that, at very high speeds, relativity was a better way to describe events, it did not lead to a loss of confidence in naturalism. The same mechanical philosophy is still widely held and is supposed to rest broadly on the success of science and technology. Relativity, however, provided (unjustifiably) another alternative philosophy: that of relativism. No one as far as I know has tried to attack relativism by attacking relativity theory. The philosophical jump is unjustified and the collapse of relativity would do nothing to weaken relativism.

More recently quantum mechanics and chaos theory have been used to support a philosophy of chance. Again, it seems futile to deny the reality of chaotic events or to attack quantum mechanics in order to attack this philosophy.

In biology, evolution has provided an excuse for another form of naturalism, which in the UK is usually called evolutionism. The response of many creationist organizations has been to attack biological evolution, even appearing to agree that the scientific theory justifies such a jump, as in the case of Johnson (on any but a small scale). This arises, at least in part, because, long before Darwin, a considerable tradition of Christian apologetics had accepted a deistic, rather than a properly theistic view, of "Nature" as a machine and set out to argue with it. These writers have accepted the basically mechanical picture of nature and look for things that cannot be explained within the present theories. This lands the discussion in the area of obscure corners of science and the exchanging of one authority against another, each boasting that excellent scientists agree with them. It does nothing to combat naturalism in principle or to show that mystical entities, such as are beloved of the New Age and astrological communities, could not fill the gaps equally well.

Now we have a revival of many of the older arguments, which see nature as basically a machine that "does things of itself," as C. S. Lewis put it. God set it up at the beginning and interferes with it only occasionally. Therefore, we should look for these gaps in the scientific picture. This was the generally accepted approach of evangelicals in the first half of this century. They worked with the deist picture of reality in order to find gaps in it.

Evangelicals nowadays (due considerably to the work of Donald MacKay and others) recognize that, in the Bible, God is continuously upholding the universe, including all the processes of nature, so that he is involved in what we do understand as much as in what we do not. Although everyone agrees in theory, few of the present creationists take it seriously. They do not ask us to marvel at the explicable—in the way that the Bible does—as much as the inexplicable. Their arguments nearly always concentrate on the inexplicable. The result is an implicit deism, or at least semi-deism, in much of evangelical apologetics. In these terms, one of the most important things to do is to find *scientific* things that cannot be explained by science. Paley and his colleagues would have agreed.

The design arguments, however, have two different aspects. There are positive evidences for design in the pattern of Romans 1 and Psalm 104, etc. These point to features which, however they came into being, look like design and Christians ask others to see the world in these terms. Thus the unusual properties of water that alone make much life in water possible, the flight and eyesight of the eagle, bird migration, and echo-location in bats are a proper source of wonder and awe at the almost incredible ingenuity of the creation. At the same time, it is the *negative* arguments that tend to take pride of place and while they have no precedent in the Bible, that does not mean that they are improper. They are, however, precarious and have several problems. First, they concentrate on obscure corners of science that are understood only by experts and experts can disagree. Secondly, arguments in the form: "You cannot find a scientific explanation for that!" are to a scientist merely an invitation to look for one. Darwin is no more likely to be the end of the road for evolution than Mendel was for genetics. Who could have guessed at the development in genetics in this century? Thirdly, they seem to imply that God could not have created a *process* to create certain things and

that it is left to the late twentieth century to discover that fact. Therefore, God must have acted "directly" in some selected areas. Finally, it leaves our faith at the mercy of science. That cannot be correct.

I suggest that we need to return to a much more robust theism, recognize that there are likely to be new discoveries that may take evolutionary theory forward, or even revolutionize it, but stress that whatever *processes* might be discovered, they are *God's* doing. We must be astonished at the processes that we *do* understand and at the wisdom, beauty, and intricate coordination of the universe.

In such a view, it really does not matter *in principle* how God created, unless you take a view that Genesis 1 excludes it. If you really believe that God is in charge of our lives and of history, then it is not too much to believe that God is in total control of all the processes of nature (Matt. 5:45, Eph. 1:11). All that happens is then his doing. In history and in one's personal life, it is nearly always possible for the unbeliever to dismiss events as coincidences. In nature, it is similarly possible for unbelievers to say that all is a mechanical process, even if we do not know enough yet to show that. It is the philosophy, not the facts, that need to be addressed first.

In a recent article (*PSCF* 49, no. 1 [1997]: 2–14), J. P. Moreland, one of the philosophers who works with Johnson, defends the gaps approach by arguing that since human freedom requires that all is not mechanical cause and effect, and since we have genuine freedom to alter events, as all must agree, then gaps are there and God uses them when he pleases. This is a frank acceptance of the mechanical character of nature. It also sees God's activity in nature as similar to ours. That, I think, was C. S. Lewis's position in his book, *Miracles*. A proper theism cannot accept that. God upholds *all* things, *all* the time. We ought to believe that and see it in our lives as well as in nature. Humans can, to a limited extent, affect the natural world. Perhaps we can be described as interfering with it. God, by contrast, *rules* it and controls our "interferences" all the time, so that the Bible speaks of his *creating* history and *creating* each new generation of living things (using the strongest word for creation in e.g., Isa. 43:1, 7; 45:7; 65:18; and Ps. 104:30). In fact, it is not clear that the Bible makes any distinction between creation and providence.

I suggest that our proper strategy is:

1. To go back to a strong biblical stress on God's sovereignty, however he chose to create, and to argue that since all processes are his, we should find as much joy and admiration in what we do understand, as in what we do not. No one would believe in the processes leading to the birth of a baby if it had happened only once. This is why strongly orthodox "Reformed" people like B. B. Warfield could see no problem in evolution, to the bafflement of those with a more deistic view of nature.

2. To move from the largely negative and defensive approach ("You cannot explain this!") to a much more aggressive attack on the philosophy of naturalism. After all, for a start, it is self-defeating. If naturalism, relativism, or chance rule, then we can know nothing, not even that everything is pure cause and effect or chance. And there are plenty of other arguments.

3. To show people how to see the world properly. We are, according to Romans 1, up against suppression of truths that are "evident" to *all* people. This is not so much in the obscure corners of science that few can appreciate, but in the common knowledge of the wonder of the creation. Let us build on this. Signs of design are not irrelevant here as the best way to interpret things, however they were created.

4. To get our Christian brothers to explain their position before they are put on the spot by opponents. It is not at all clear what they do believe, though they are clear about some things that they do not believe. If, like Johnson, they are not young earth advocates, then when and how did some of these adaptations to predation arise? Behe, for instance, makes much of the defense mechanism of the Bombadier beetle, and that is often quoted by others. Yet it implies a world of predation as do many other beautiful biological adaptations, like the spider's web, the structure of a lion, or the structure of a parasitic wasp. Were these created before the Fall, when everything was "very good"? If they were created after the Fall, were they the result of a sudden interference by God? If the latter, why is there no trace in Scripture of such a complete *re-creation* of vast numbers of organisms, such that many of them would have been unrecognizable as the same thing? In what sense were they created and by what means—sudden or gradual? Were they perhaps the slow result of some processes that God created in the beginning working themselves out gradually as needed? To reply that we simply do not know, which is true, leaves the Bombadier beetle as no evidence for anything except the general incredibly ingenious nature of the creation, which makes human skills look like child's play. It leaves no argument against biological evolution as a process that God might have used. ✣

Toward an Ethics of the Human Genome Project

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The application of genetic engineering culminates in the Human Genome Project (HGP) which is an attempt to understand our genetic makeup with the hope of developing cures for genetic diseases. This new genetics also brings with it ethical issues, such as accessibility to and controls of human genetic information. In this paper, several ethical principles and a theological model of a perfect human being within the Christian worldview are discussed. The ethical issue of genetic confidentiality and nondiscrimination is addressed in light of some of these motifs.

Genetic Diseases and the Human Genome Project

On March 24, 1993, most leading newspapers in the country published a story which they labeled as "the longest and most frustrating search in the annals of molecular biology." The genetic defect of a late onset neuromuscular disorder, Huntington's disease (HD), was finally located at about 3.5 million base pairs from the tip of chromosome 4. The normal gene contains the nucleotide triplet *CAG* which encodes the amino acid *glutamine*. Normal people have about twenty copies of this triplet. Individuals with HD, however, have more than 37 copies of it.[1] This discovery was the culmination of over 120 years of research since the disease was first described by physician George Huntington[2] and 24 years since Milton Wexler established the Hereditary Disease Foundation in the attempt to find its cure.[3]

In 1968, Wexler, a Los Angeles psychoanalyst, discovered that his ex-wife, Lenore, suffered from HD and his two daughters, Nancy and Alice, had a 50–50 chance of inheriting the fatal disease. His and Nancy's crusade to find a cure led to the discovery in 1983 of a diagnostic test for the disease. The identification of the gene simplified the presymptomatic testing by probing for the gene itself instead of probing for a complicated set of markers in its vicinity. It also eliminated the need to get blood from many family members. This simplified process of testing is far less expensive and is readily available to people who want to take it.

The knowledge that one has a genetic disease which has no cure may help in decisions about child bearing. Yet, it also affects the psychological well being and the social status of a potential carrier. It was probably for these reasons that the Wexlers have elected not to subject themselves to the genetic test for HD.[4] In 1989, Nancy, a molecular biologist, was named head of the advisory board to the Human Genome Project, which deals specifically with the ethical, legal, and social issues arising from the use or abuse of human genetic information. She was instrumental in cautioning the scientific community about the ethical concerns for genetic testing.[5] Can genetic testing be a tool for discrimination by social institutions, such as the insurance industry? The commercialization of genetic testing will inevitably lead to a race to collect as much patient genetic data as possible. Insurance companies also have to decide on the applications and the accessibility of the genetic information they gather. Genetic testing will complicate the issues in the health care reform debate in market economies.

*ASA Fellow

This paper was presented at the 1998 Annual Meeting of the American Scientific Affiliation and the Christians in Science in Cambridge, England on August 3, 1998.

Michael Crichton, a molecular biologist-turned science-fiction novelist, uses his character, the abrasive chaos theorist Ian Malcolm, to accuse the current scientific mindset of using technology, such as genetic testing, for personal gains:

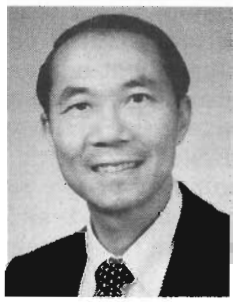
> Scientific power is like inherited wealth—attained without discipline. You read what others have done, and you take the next step. You can do it very young. You can make progress very fast. There is no discipline lasting many decades. There is no mastery; old scientists are ignored. There is only a get-rich-quick, make-a-name-for-yourself-fast philosophy. Cheat, lie, falsify—it doesn't matter. Not to you, or to your colleagues. No one will criticize you. No one has any standards. They are all trying to do the same thing: to do something big, and do it fast.[6]

While his blockbuster book and movie, *Jurassic Park,* seem to drive home the point that the misuse of genetic technology can bring disastrous consequences, a real life drama is being unfolded in the scientific world as it is gearing up to face the challenges of the ethical, social, and legal implications (ELSI) of the Human Genome Project (HGP). (ELSI is an acronym of a committee established for the HGP.) While alleviating human suffering by understanding the nature of genetic diseases was the primary motivating force behind the HGP, there may be scientists who pursue this project out of self interest, desiring fame and profit. What is the limitation of genetic technologies? By what criteria can we evaluate the use or misuse of human genetic information? How far should one pursue the improvement of human conditions by genetic manipulation? Fifty years after the liberation of the Nazi death camps, the gruesome pictures of human experimentation and the eugenic movement practiced in the Holocaust are still fresh in our minds. How can we prevent the abuse of human genetic information? This article attempts to give a brief synopsis of the HGP, delineate some ethical principles, and offer possible solutions to the ethical concerns for privacy raised by the HGP.

Brief Historical Perspectives and Future Prospect of the HGP

Ever since the historic publication of the *Double Helix Model of DNA* by Watson and Crick in 1953,[7] molecular biology has emerged as the dominating approach in life sciences. In 1973 Herbert Boyer and Stanley Cohen successfully created the first recombinant DNA molecule using the restriction endonuclease EcoRI and the plasmid pSC101. Their experiment unveiled the era of genetic engineering and biotechnology.[8] In 1983 Kary Mullis invented the polymerase chain reaction which can amplify a single DNA molecule more than a million fold in a matter of hours. This invention tremendously enhanced the power of these newly developed genetic tools.[9] The most far-reaching application of these powerful techniques is the Human Genome Project, officially launched on October 1, 1990 with James D. Watson as its first director. Congress allocated approximately three billion dollars and set a tentative time table of 15 years for the complete sequencing of the entire human genome.[10]

National laboratories and various research institutions established genome centers. Rapid advances in robotics and computer, as well as molecular, technologies have facilitated and economized the project. By the end of 1993, researchers at the Centre d'Etude du Polymorphism Humaine in Paris, France successfully completed the physical map of the 24 human chromosomes (22 homologous pairs plus X and Y chromosomes).[11] In late 1994, a full year ahead of the original schedule, an international collaborative team published the first linkage map of human genome.[12] Although genetics may be only one of many factors contributing to diseases (many polygenic as well as environmental factors should also be considered), the search for them has been fruitful. Besides HD, quite a few of the estimated 2,000 incurable genetic diseases have been located in the genome, including diabetes, cystic fibrosis, sickle cell anemia, muscular dystrophy, Alzheimer's disease,



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breast cancer, severe combined immunodeficiency syndrome (SCID), Gaucher's disease, dwarfism, baldness, colon cancer, and amyotrophic lateral sclerosis.

One of the most direct applications of the genetic information is *gene therapy*. If a copy of the normal gene is introduced into the patient's body and replaces the defective gene, the inherited disease is cured. Doctors performed the first successful gene therapy experiment on a 4-year-old SCID patient. SCID is caused by a single genetic defect which deprives the patient of adenosine deaminase (ADA). In the early 90s, genetically engineered T lymphocytes carrying the normal ADA gene were injected into the patient. Preliminary results indicate that the patient's immune system has been restored.[13] Although technical improvements using embryos and *rapidly differentiating stem cells* instead of lymphocytes are still needed to enhance the survival of the transplanted cells and to reduce the side effects of the procedure, gene therapy has been successfully applied to other treatments, such as targeting tumors. The medical establishment has increasingly accepted gene therapy. Since 1990 over one hundred gene therapy procedures have been carried out throughout the world. In 1996, more than fifty medical facilities were performing gene therapy on some 450 patients.

While the development of genetic technologies has been promising, potential ethical concerns are being raised by the [Human Genome Project].

While the development of genetic technologies has been promising, potential ethical concerns are being raised by the HGP. During a 1991 meeting sponsored by the University of Houston, the director of the Health, Law, Policy Institute, Dr. Mark L. Rothstein, pointed out that the HGP will usher in a new era with unprecedented legal implications.[14] It is very likely that credit-card-like codes will be used to carry the genetic information necessary for individuals to evaluate their medical risk and social liability. Will this genetic information be used as a weapon of discrimination? After Alice Wexler describes the discovery of the HD gene in her book, *Mapping Fate*, she concludes:

> Will we ensure that the ability to test not be translated into the imperative to test? Will the decision not to take the test be respected as a legitimate choice and not represented as a failure of courage or a desire to "remain ignorant"?[15]

Some issues raised by the HD scenario are: Does the presence of the genetic defect doom a child's future? Do parents have a right not to be subject to genetic testing to alleviate anxiety? Are medical professionals obligated to counsel patients in making these decisions? Should employers or insurance companies be given free access to the genetic information of potential employees or clients to determine their employability or set the insurance rates? What professional standards should be set for a physician about the amounts and varieties of genetic testing required for patients by whom malpractice litigation can be measured? Does a person have a right not to know about his or her genetic makeup? Will genetics become a weapon for social discrimination?

The Broadway show, *The Twilight of the Golds*, dramatized some of these issues.[16] When Suzanne Golds discovered by genetic testing that the child she was carrying had a 90% chance of growing up to be a homosexual person, the Golds' elation suddenly turned into gloom. In the conversation between Rob Golds and Suzanne's brother, David, a practicing homosexual, the threat which genetic testing imposes on human society was vividly portrayed. "Nature fails," Rob told David. "We have the technology, and we're going to have more and more information. There's no going back. Let's give people the choice. Let each family do what's right. It's nobody's business, not the government's, not some religious crackpot's, not even the doctor's." David responded negatively to Suzanne's query about aborting the *imperfect* fetus, "Because we'll lose too much ... All the things you love about me are tied to the one element that makes you queasy. Every human being is a tapestry. You pull one thread, one undesirable color, and the art unravels. You end up staring at the walls."

While Rob and Suzanne envisioned a world without genetic diseases, David saw a blatant Nazi philosophy of eugenics. Underlining this discussion was the issue of what constitutes a *perfect human being*. Biologists have long known that human beings carry certain mutations in an enormous number of genes. Yet because they are recessive and usually invisible, they are not manifested as genetic diseases. Therefore, there are no *perfect* people *per se*. The play ended in the divorce of the Golds and the abortion of the fetus. It portrayed a family tragedy, but also asked a more important question: Can a person transcend his genetic predisposition?

Behind all the discussions of nature vs. nurture looms the shadow of the ghostly philosophy of eugenics. During World War II, the Nazi's advocated the supremacy of the Germanic race. They systematically annihilated the *inferior* Jewish race to avoid *contamination of the superior stock of the Germans.* This racist attitude is also reflected in the claims that Europeans have superior intelligence because of their genetic stock, while Africans are lacking it. ELSI, however, developed a statement decrying the premature and exaggerated claims that IQ is largely genetically determined.[17] Nonetheless, the availability of sperm banks of Nobel laureates and certain "superior" men, for artificial insemination in infertile couples and even in single women who want to conceive out of wedlock, fuels the controversy. Is there such a thing as a *superior race*? The question itself connotes racism. The Declaration of Independence reminds us not to be self-centered and to respect the rights of others: "We hold these truths to be self-evident, that all men are created equal." Genetic engineering, just as any other intellectual product of modern civilization, is subject to the worldviews of its users.

The Christian worldview should incorporate at least the motifs of natural moral law, stewardship, and virtue when dealing with the ethical problems raised by the new genetics for the twenty-first century.

The Christian worldview should incorporate at least the motifs of natural moral law, stewardship, and virtue when dealing with the ethical problems raised by the new genetics for the twenty-first century. These motifs for the most part can be applied universally despite the cultural or religious milieu. Besides the technical difficulties encountered in altering the genetic makeup of a person, we must also consider the theological limitations of the finiteness of human existence. From a Christian perspective, the concept of a perfect human being connotes a mature or complete understanding of our nature in relationship to God the Father (Matt. 5:48 NIV). This understanding should be one of the standards by which we measure the limitation of the genetic technologies. The following are some thoughts on what constitutes a perfect human being based on these ethical principles.

Toward a Christian Model of Ethics

1. The Natural Moral Law

Various ancient systems of civilization have promulgated the moral law inherent in nature. The Chinese called it "The Heavenly Way," "The Force of Righteousness," or simply "Morality." Cicero (106–43 BC), the famous Roman philosopher, once said: "Law is the highest reason, implanted in nature, which commands what ought to be done and forbids the opposite. This reason, when firmly fixed and fully developed in the human mind, is the Law."[18] Thomas Aquinas (1225–1270) was the first thinker who systematically developed the system of divine law.[19] The Creator has designed purposes and directions for his creation which can be discovered in nature by all rational beings. This divine law finds its origin ultimately in the omnipotence and omniscience of God. Because of humanity's sinful nature, humans are unable and unwilling to perceive God's law. Thus, God must reveal it through the Scripture and the church so that humans can have a guide to live by. Aquinas extrapolated Aristotelian teleology: There is a cause of the being and doing of everything. God has given humans the rational faculty to discern the meaning of existence. The divine law is consonant with human nature. A person's survival instinct also depends on the survival of others. We have the obligation to follow the moral standards of society and to maintain the stability of its institutions, such as marriage and the legal system, for they are established to facilitate human survival. They are also ordained by God and can be applied universally.

2. The Ethics of Stewardship

Humans, created in the image of God, are God's stewards for his creation. The *imago Dei* concept defines humans as the culmination of God's creation. There are at least four interpretations of *imago Dei*: (1) human *spirituality*, the desire to communicate with God; (2) human *dominance* over all creation; (3) human *original righteousness*; and (4) human *interpersonal relationships*.[20] The most relevant meaning of *imago Dei* in the discussion of the interaction between science and theology is the concept of stewardship. After God completed his creation, he called it "good." He entrusted all creation to the stewardship of humans. Humans can use all the resources on earth for survival and for developing civilization. However, humans have to maintain two attitudes: to be grateful toward their Creator, and to be prudent toward managing the creation. Humans are both *imago Dei* (the image of God), representing God to the creation, and *imago mundi* (the image of the world), representing all other creatures to God. The enduring meaning of human existence lies in par-

ticipating with all the creation in praising the eternal, inexhaustible God.[21]

The responsibility of a steward is to supervise, manage, and exercise dominion over the creation. In addition, humans are God's vice regents who are co-creators, co-workers, and co-explorers with God.

Since the Renaissance and the scientific revolution which brought about the emphasis on human achievement, a new trend of thought has emerged. Arthur R. Peacocke, a distinguished British theologian and biochemist, championed the term *synergism* to describe the fact that although humans are creatures, they are also co-creators with their Creator.[22] The responsibility of a steward, then, is to supervise, manage, and exercise dominion over the creation. In addition, humans are God's vice regents who are co-creators, co-workers, and co-explorers with God. Because God's providence for his creation involves genetic and ecological changes in the biosphere, humans should use their God-given creativity, together with God, to direct biological changes. However, humankind's biological creation is nothing more than the "remodeling" of what God has originally created. Only the transcendent Creator can create ex nihilo. The cloning of genes and the creation of transgenic organisms only enhance the expression of the potentials endowed by the Creator. Moreover, as vice regents for God's creation, humans can also abuse their God-given power to wreak havoc in creation by creating monsters such as those depicted in *Jurassic Park*. Human participation in creation demands respect for nature, not exploitation. Thus, the traditional concept of prudent stewardship is still the best ethical system to describe the relationship between humankind and the creation.

3. The Ethics of Virtue

Virtuous people are driven to do good deeds not by the mores of social institutions, but by their own virtuous dispositions. What constitutes a *virtuous disposition* is a growing area for debate in ethical theories. Egoists and utilitarians relativize the standards for virtue. Deontologists, on the other hand, champion the virtue of rational self discipline.[23] Augustine, who sees loving God as the culmination of all virtues, reinterpreted Plato's four virtues. *Wisdom* is the love to discern what facilitates or inhibits one's love for God. *Self-control* is the love to discipline oneself because of one's love for God. *Courage* is the love to face persecution for God. *Justice* is the love to serve God alone and rule all else accordingly. Aquinas added the biblical virtues of faith, hope, and love to the list of seven God-given virtues.[24] The Scripture emphasizes human virtues as the fruit of the Spirit: love, joy, peace, long-suffering, kindness, goodness, faithfulness, gentleness, and self-control (Gal. 5:22–23 NIV). Virtuous actions are also described in the scriptural injunction "to act justly and to love mercy and to walk humbly with your God" (Micah 6:8). All ethical systems agree that humans need to foster and develop their virtues. The Chinese proverb defines it as: "[The ethics of a virtuous man starts with] disciplining himself, caring for his own family, ruling his nation, and then finally achieving peace in the world." Aristotle treats virtue as the product of human reason which can be cultivated externally by social institutions and internally by self-control.

All ethical systems agree that humans need to foster and develop their virtues ... Virtuous disposition is the internal desire to be good and to do good.

After the Renaissance, optimistic humanists posit that virtuous behavior depends solely on the complete realization of human reason. However, David Hume attributes human behavior not to the confines of reason, but to human volition and emotion. Augustine has emphasized the motivation of love in guiding one's action and behavior. Eastern mysticism, such as the Buddhist *nirvana* (emptiness) and the Hindu's *Atman is Brahman* (self-realization of the divine within), stresses self-control to purify one's sinful desires. It is the human effort in quest of the liberation from the sinful self.[25] Virtuous disposition, then, is the internal desire to be good and to do good. The ethical and theological issue is the quest for the origin of such disposition: is it from education, self discipline and cultivation, or is it divinely endowed? The Bible teaches the importance of education and discipline: "Train a child in the way he should go, and when he is old he will not turn from it" (Prov. 22:6 NIV). However, the theme of the Gospels is the grace of God. Christ calls sinners to repent, turn from their wicked ways, and return to God. "God presented (Christ) as a sacrifice of atonement, through faith of his blood" (Rom. 3:25 NIV). Those who repent and have faith in Jesus are no

longer condemned, because "through Christ Jesus the law of the Spirit of life set (us) free from the law of sin and death" (Rom. 8:2 NIV). Virtuous disposition, then, is only possible when Christians are liberated from the bondage of their sinful natures which are revealed through the Law. It is actually the fruit of the Spirit who indwells Christians (Eph. 1:13 NIV). Experience will confirm the futility of attaining virtuous disposition without God's help.

What Constitutes a Perfect Human Being?

In light of these motifs, I will define a *perfect human being* as follows:

1. A Perfect Human Being Is a Creature of God, Confined by Finitude

Since death entered the world through the sin of one man (Rom. 5:12), it is reasonable to assume that humans were created immortal before the Fall. Although Paul was emphasizing the spiritual aspect of death in relationship to humankind's separation from God (Rom. 3:23), the physical bodies of humans must have undergone some changes after the Fall to cause their eventual death. The fact that even before the Fall humans had to eat (Gen. 1:29) seems to suggest that the body needed the nourishment derived from the digested food. It is possible that humans were maintained physically immortal by a special providence of God symbolized by the fruits of the tree of life, which humans were allowed to eat before the Fall (Gen. 2:17). One reason why the fallen couple were expelled from the garden of Eden was to prevent them from eating of the tree of life and living forever (Gen. 3:22). It will not be until the time of the new heaven and new earth that death is eliminated and the fruits of the tree of life will again be freely accessible to the heavenly citizens (Rev. 22: 1, 2).

In this context, all medical procedures that attempt to maintain life are part of the provisions from God. However, there is a limit within which human intervention can operate. The spiritual death precipitated by the Fall can only be remedied by the new life in Christ through regeneration by the Holy Spirit (Rom. 8:1–2). The elimination of congenital diseases may be a primary objective for the Human Genome Project. Advancement in medical and genetic technologies can ultimately be the instruments that God chooses to manifest his work in ameliorating some effects of sin and decay. The prolonging of human life is in accord with the will of God for he is patient toward humankind, not wishing for any to perish but for all to come to repentance (II Peter 3:9).

2. A Perfect Human Being Was Created to Glorify God and to Enjoy Him Forever, not to Have Self-fulfillment

This proclamation of the Westminster catechism is in some sense contrary to the Declaration of Independence. The chief end of humankind is not to pursue liberty, property, and happiness. The popular notion of health is defined by the World Health Organization: "Health is a state of complete physical, mental and social well-being, not merely the absence of sickness and handicaps." This idealistic definition is largely based on the individual's aspiration for total fulfillment. Measured against this ideal, there are no healthy societies which can guarantee their members total well-being. The result is an unfulfilled expectation of what medicine and the advancements of medical sciences can provide. If we accept the inevitability of death, health can be redefined as "the ability to cope with pain, sickness and death autonomously."[26] "Health is not the absence of malfunctioning. Health is the strength to live with them."[27] In other words, health is not a state of well-being, but rather, "the strength to be human."[28]

While the HGP is motivated by the attempt to alleviate human suffering, the availability of genetic information does not mean a cure for the congenital disease.

The paradox of the evils in the world under the benevolence of the Creator can only be solved in the death and resurrection of Jesus Christ. Suffering brings salvation is a theme which permeates the whole Bible. God uses the evil of humankind to achieve his eternal purpose (Gen. 50:20). Christ suffers the most undeserved and violent death. Yet by his wounds, we are healed (Is. 53:5). The salvific purpose of God is achieved and God is glorified through Christ's accomplishment on the cross (John 17:4). While the HGP is motivated by the attempt to alleviate human suffering, the availability of genetic information does not mean a cure for the congenital disease. The ability to label a person with a defective gene may be less empowering than entrapping. For example, a woman who based on genetic testing has been determined to be 50% at risk to contract HD is denied the privilege of adopting a child.[29] Knowledge of such an incurable disease may also hurt her psychologically even though she may end up not having the disease at all. Therefore, genetic testing is not necessarily a blessing for the people who are most affected by it. Individuals should have a right

not to have their DNA tested and/or not to know its results. While eliminating human suffering is a noble cause, there may be a higher purpose for some incurable diseases after all human efforts are exhausted, as Paul experienced from the thorn in his flesh (II Cor. 12:7–9). Jesus did not confront the origins of congenital diseases. Yet he clearly said that the ultimate purpose of the healing of the man blind from birth was so that "the works of God might be displayed in him" (John 9:3).

3. A Perfect Human Being Became a Living Being by the Direct Involvement of God

Although its literal meaning is a subject of controversy, the act of breathing into the nostrils of man the breath of life to make him a living being (Gen. 2:7) strongly suggests a direct involvement of God in a person's life. After the creation of the first couple, God endowed the capability for procreation, that is, the potentials of the human gene pool that generated the entire human race (Gen. 1:28; 2:24). While the technology of gene therapy has been successfully applied to correct certain congenital defects in somatic cells, genetic engineering of germ cells should not be actively pursued. Besides the technical difficulties encountered, the philosophical implication of germ line gene therapy is more serious: are we changing the essence of a human being which can only be endowed by the Creator? If we define health as the strength to be human (see above), are we depriving our offspring yet to be born of the freedom to choose the direction of his or her life? Dr. W. French Anderson, the pioneering medical scientist who successfully treated SCID with genetic engineering (see above), believed that the human germ line belongs to the whole human race instead of individuals. Mistakes that may occur in germ line gene therapy can bring irrevocable damage to the human gene pool. Therefore, he also had strong reservations on germ line gene therapy.[30]

4. A Perfect Human Being Was Created in the Image of God: The Divine Law in Human Nature

One connotation of the image of God in humans is that humans were created as originally righteous beings who communicate with God (Gen. 1:17–30; 2:16–17). God called all of his creation "very good" (Gen. 1:31). Though there are disagreements on how much of the image of God has been affected by the Fall, all human beings have the remnant of this divine image regardless of whether or not they are Christians (James 3:9) and it is written in their hearts (Rom. 2:15). The Fall has depraved humans' divine conscience. It is up to the church and the social institutions to uphold the divine moral laws. God's moral standards are meant to bring welfare to individuals and to societies (Deut. 6:1–3). The divine law includes humans' responsibility toward God and their neighbors (Luke 10:27). What God wants from his people is "to act justly, to love mercy and walk humbly with your God" (Micah 6:8). The Golden Rule (Matt. 7:12) was meant to maintain the survival and the stability of human society. Humans were created to have the freedom to choose to follow God (Gen. 2:16). By the same token, members of each society should be allowed to choose their individual destiny. Because an individual's genetic information impinges on each person's social status and privileges, it should be respected as one's private property and guarded against unjustified intrusion. The proposed Genetic Confidentiality Act is an attempt to protect the individual's right to control his or her genetic information (see below).

5. A Perfect Human Being Is to Have Dominion over God's Creation: Stewardship of Life

Opposing the efforts that have already been dedicated for the HGP is unethical for any Christian, since we are stewards of God's creation (Gen. 1:28). Dr. Francis Collins, Director of the National Center of Human Genome Research, himself an outspoken evangelical, recently lamented on the misguided protest to the patenting of genetically-engineered organisms signed by 18 prominent church leaders and the outspoken critic of technology, nonbeliever Jeremy Rifkin.[31] The HGP, an outgrowth of the genetic revolution, was motivated by the desire to search for cures for congenital diseases. Humans are admonished to subdue the earth, which includes conquering diseases. The scientific world agrees on the efficacy of the HGP. What scientists need are ethical guidelines on how to use the information obtained from the HGP. Christians should be the salt and the light of the world and actively provide leadership in establishing ethical principles for the HGP, instead of being the obscurantists who oppose technological advance for the sake of tradition.

6. A Perfect Human Being Is a Creature of God, Representing the Creation to God in Need of Reconciliation

Human beings were the last being to be created. Adam was created from *'adama*, the motherly earth. When Adam died, he returned to the earth (dust) (Gen. 2:7; 3:19). God waited until all the rest of the creation had been finished before he created humans, because humans are dependent on the rest of the creation to live. Humans became living beings just like the other creatures. (In Gen. 1:21–24; 2:7, the same word *nephesh*, living being, is used to describe all of them). Human beings depend on food to sustain their lives, just as the other beasts do (Gen. 1:20,

30; 2:19). They find their living space as do the other creatures on earth. They were commanded "to be fruitful and multiply" (Gen. 1:28), as were the animals (Gen. 1:22).

As* imago Dei*, a human is the representative of God in creation. As* imago mundi*, a human is the representative of creation before God.

In the order of creation, the creation of heaven and earth is at the beginning and the creation of humans is at the end. However, in the order of redemption, the new human is at the beginning, with the new heaven and new earth at the end. The new creation starts with the incarnation, crucifixion, and resurrection of Jesus Christ, the Son of God. It was passed from him to all believers, who are made equal to their firstborn brother (Rom. 8:29). In Christ, they become a new creation through the Holy Spirit (II Cor. 5:17; John 3:5). The creation eagerly awaits its liberation from the bondage of decay and frustration into the glorious freedom of the children of God in the final resurrection of the body (Rom. 8:19, 21; I Cor. 15:22–24). The creation of humans is the culmination of all creation made by the same divine Designer.

As *imago Dei*, a human is the representative of God in creation. As *imago mundi*, a human is the representative of creation before God.[21] In this context, the Fall brought about the threefold *alienation* of humankind: (1) from the *Creator*, (2) from *fellow creatures*, and finally (3) from the *creation*, resulting in the loss of spiritual, social, and physical health respectively. Reconciliation in each level is necessary in the healing process to bring humans into harmony with God and the rest of creation.[32] Medical advances such as the HGP can deal only with physical health. Without the covenantal relationship of reconciliation at each of these three levels, holistic health in terms of reconciliation and wholeness in our crooked and perverted world can never be achieved (Phil. 3:12–15).

7. A Perfect Human Being Is Conformed to the Image of the Incarnate Word, Living through the New Creation and Leading All Creation into Consummation

Only the Incarnate Word, God the One and Only, has made him known (John 1:18), because he is the image of the invisible God. All things were created by him and for him (Col. 3:15–16). God justified sinners by sending his own Son in the likeness of sinful humankind to be a sin offering so that all who trust in him are proclaimed righteous (Rom. 8:4). Believers whom God foreknew are predestined to be conformed to the likeness of his Son (Rom. 8:29). Christ is before all things, and in him all things hold together (Col. 3:17). God indwells Christ with his fullness (Col. 3:19). As God's perfect image, Christ is the Mediator in creation, the Reconciler of the world, and the Ruler and Sustainer of all things. It is through Christ that the new creation begins (II Cor. 5:17). Believers unite with Christ by trusting in him and being identified with him in his death so that they no longer live, but Christ lives through them (Gal. 2:20; Rom. 6:8). Therefore, to be a perfect human being is to be conformed to the image of Christ.

It is wrong to look for the domination of creation, including the elimination of human suffering, in earthly powers, such as those of the state and of science and technology. The domination of creation is found only in the lordship of Christ.

Humans are justified and will be glorified when their lowly bodies are transformed to be like his glorious resurrection body (Phil. 3:21). Virtue comes as a result of God's grace through faith in Jesus Christ, not by works, for believers are God's workmanship, created in Christ Jesus to do good works (Eph. 2:8–10). It is also through the resurrected Christ that believers will reign with him in the consummation of creation (Matt. 28:18; Rev. 20:6). When Christ appears, we shall be like him (I John 3:2). The redemption of our bodies at his second coming is the consummation of all creation. Therefore, it is wrong to look for the domination of creation, including the elimination of human suffering, in earthly powers, such as those of the state and of science and technology. The domination of creation is found only in the lordship of Christ.

In summary, the limitations of the genetic technologies are confined theologically by the finitude of humans, their divine purpose for existence, their stewardship responsibilities, their moral conscience, their relationship to the creation, and their depend-

ence on God. To conclude, I will examine a legislative approach to deal with the one of the ethical issues raised by the HGP based on some of these considerations.

The Genetics Confidentiality and Nondiscrimination Act of 1996[33]

Various attempts have been made to address the issue of the confidentiality of genetic information. ELSI presented the Genetic Privacy Act to the joint DOE-NIH working group in Dec. 1994.[34] The overarching premise of the act is that no strangers should have or control identifiable DNA samples or genetic information about an individual without the person's authorization and control of their dissemination. The World Health Organization has also published preliminary ethical guidelines on medical genetics which include access to banked DNA.[35] A similar bill (S 1898) was introduced on June 24, 1996 by Senator Domenici to the 104th Congress of the United States and was referred to the Committee on Labor and Human Resources. Section 2, Findings and Purposes, of the proposed Act states:

> The DNA molecule contains an individual's genetic information that is uniquely private and inseparable from one's identity. Genetic information is being rapidly sequenced and understood. Genetic information carries special significance. It provides information about one's family, and more importantly, provides information about one's self and one's self perception. Genetic information has been misused, harming individuals through stigmatization and discrimination. The potential for misuse is tremendous as genetics transcends medicine and has the potential to penetrate many aspects of life including employment, insurance, finance, and education. Genetic information should not be collected, stored, analyzed, nor disclosed without the individual's authorization. Current legal protections for genetic information are inadequate. Uniform rules for collection, storage and use of DNA samples and genetic information are needed to protect individual privacy and prevent discrimination, such as in employment and insurance, while permitting legitimate medical research.

This legislation will (1) define circumstances under which genetic information may be created, stored, analyzed, or disclosed; (2) define rights of individuals and persons with respect to genetic information; (3) define responsibilities of others with respect to genetic information; (4) protect individuals from genetic discrimination; (5) establish uniform rules that protect individual genetic privacy and allow the advancement of genetic research; and (6) establish effective mechanisms to enforce the rights and responsibilities defined in this Act.

Evaluation of Three Aspects of this Act

1. The Individual Ownership of his or her Genetic Information (Purposes #1 and #2):

The Act requires written authorization from the owner of a DNA sample for collection, storage, analysis, and disclosure of genetic information. Since genetic information is very much associated with one's self-identity and self-perception, it is imperative that the individual is the ultimate authority of the gathering and dissemination of this information. God's divine law as laid down in the human heart demands that society protect the individual's right to his or her own genetic information. The proposed Act details the conditions under which DNA samples are to be collected, stored, analyzed, and disclosed. Before a DNA sample is collected, individuals are given a detailed explanation about the nature and uses of the genetic information to be obtained, their rights to revoke the authorization prior to the genetic analysis, their rights to destroy their samples, and the availability of optional genetic and psychological counseling. The only exception to the living individual's ownership of his or her genetic information is by court-ordered analysis. Even collecting, storing, or marking of human DNA samples by law enforcement agencies is limited only to authorized probable causes of DNA matching in criminal investigations.

Since genetic traits can be passed on only through heredity, genetic information is not an issue of public health.

Since genetic traits can be passed on only through heredity, genetic information is not an issue of public health. If an individual's genetic information is helpful to social policies and governmental actions, it can be obtained through the Act's provisions on medical research (see Point 3 below). The court then can be consulted in terms of the appropriateness of whether the government has a right to this information. This Act will probably ameliorate the situations portrayed in *The Twilight of the Golds* by insuring the rights of someone like Suzanne Golds to choose whether she would undergo genetic testing for her pregnancy and whether she would share this information with her husband and brother (see above).

2. Prohibition on Genetic Discrimination in Employment and Insurance (Purposes #3 and #4):

This provision seems to be the most far-reaching implication of the Act. It prohibits employers, poten-

tial employers, and/or insurance companies from using genetic analysis or a genetic precondition as a criterion in employment, benefits, insurability, insurance premiums and/or coverage. Since genetic heritage is endowed to an individual independently of his or her own volition or behaviors, it should not be among the criteria of personal qualification for employment. For health insurance, many of the genetic conditions will always remain only potentials for diseases, for example, couples who both are carriers of the cystic fibrosis gene have only a one in four chance that their offspring will have the disease. Advances in the HGP have made it possible for such couples to conceive healthy children by in vitro fertilization.[36] The justice motifs of the ethics of divine law and virtue would support the provision of this Act to prohibit discrimination against a genetic precondition which is beyond the individual's control.

[Employers and insurance companies] should be required to use demonstrable medical risks rather than the potential risks of a genetic defect as criteria for their decisions on employment, insurance coverage, or premiums.

From the perspective of stewardship of resources, however, employers and the insurance industry operate from minimum costs and maximum profits under the purview of just distribution. The productivity of a company and the coverage and premiums of insurance policies are contingent upon what is deemed to be the risk factors for certain individuals, i.e., smokers pay a higher premium than nonsmokers because of their higher health risks. To solve this dilemma, the scientists involved in the HGP should gather more data for the potentiality of medical ailments based on DNA sequences and other nongenetic risk factors. While employers and insurance companies can be given access to genetic data with informed consent of the affected individuals, they should be required to use demonstrable medical risks rather than the potential risks of a genetic defect as criteria for their decisions on employment, insurance coverage, or premiums. At the same time, some kind of national health care plan similar to Medicaid should be developed to cover those patients and their families with genetic diseases that incur medical expenses beyond the available coverage of their health insurance.

3. Establishment of Uniform Rule to Protect Genetic Privacy while Advancing Genetic Research (Purpose #5):

The results of fruitful genetic research can bring much blessing to a well-informed society. For example, thalassemia, a genetic defect causing a deficiency of beta globin (a component of hemoglobin), is endemic to the Greek and Cypriot populations. The country of Cyprus has three characteristics that contribute to the success of preventing genetic diseases: (1) the population is relatively small and homogeneous, (2) the living standards are quite high, and (3) its citizens have a high level of general education. The Cypriot government and the official church (Greek Orthodox) have teamed up to educate, counsel, and treat the people who have thalassemia or are carriers of the disease. They require a diagnostic genetic test for thalassemia before couples can be married in the church. The church provides medical facilities for the testing and treatment of thalassemia. In 1986 over two decades since the beginning of the national campaign, the frequency of thalassemia was reduced from 0.1% to negligible. Thalassemia has effectively been wiped out from Cyprus' medical records since 1992.[37] Other successful cases of prevention of genetic diseases include Tay-Sachs, endemic among Eastern European Jews.

The Act stipulates that any genetic research using individual DNA samples should have potential benefits which outweigh potential risks.

Genetic testing also impacts other areas of human societies besides marital relationships. For the first time, we can predict the occurrence of diseases based on the genetic makeup of a person. The stewardship motif should motivate us to do more genetic research. The Act stipulates that any genetic research using individual DNA samples should have potential benefits which outweigh potential risks. A comprehensive international research effort on a Human Genome Diversity Project (HGDP) is underway.[38] The goals of these pilot studies are twofold: (1) to improve the technical aspects of DNA collecting, amplification, and analysis; (2) to address the ethical and legal issues of DNA sampling in a cross-cultural setting. The questions proposed for the full-scale HGDP deal with topics such as population history, relatedness among populations, mechanisms of evolution, and disease resistance and susceptibility. De-

tailed guidelines concerning ethical issues such as informed consent, privacy and confidentiality, ownership and control, and education and racism have been drafted. While less comprehensive, the Act also defines some of these guidelines as well as making provisions for the parental authorization for genetic testing involving minors.

The Genetics Confidentiality and Nondiscrimination Act of 1996, with the suggested modification, is well worth the support of the Christian community as an attempt to address one of the dilemmas raised by the HGP. All ethical problems posed by the new genetics are pressing issues which need to be resolved. The new genetic tool is just like the genie in Aladdin's lamp which has been released from captivity and is awaiting the commands of its master. We must work to prevent the misuse of genetic engineering. If the ethical principles suggested in this paper can be practiced, I think that genetic engineering will become a benevolent force that will positively impact the world for the twenty-first century. ✣

Acknowledgment

The critical reading and rereading of the final revisions of this paper by Dr. Albert Smith of the Biology Department are much appreciated.

Notes

[1]Huntington's Disease Collaborative Research Group, "A Novel Gene Containing a Trinucleotide Repeat That is Expanded and Unstable in Hungtington's Disease Chromosome," *Cell* (March 25, 1993): 1–20.

[2]G. Huntington, "On Chorea," *Medical and Surgical Reporter* 26 (1872): 317–21.

[3]J. E. Bishop and M. Waldholz, "Genome," (New York: Simon and Schuster, 1990), Chapter 1.

[4]A. Wexler, "Mapping Fate," (New York: Random House, 1995), Chapters 12 & 14.

[5]National Center for Human Genome Research, "NIH Report of the Working Group on Ethical Legal and Social Issues Relating to the Mapping and Sequencing the Human Genome" (Bethesda, MD: 1989).

[6]M. Crichton, *Jurassic Park* (New York: Ballantine Books, 1990), 306.

[7]J. D. Watson and F. H. C. Crick, "Molecular Structure of Nucleic Acids," *Nature* 171 (1953): 737–8.

[8]J. D. Watson and J. Tooze, *The DNA Story* (San Francisco: Freeman, 1981).

[9]K. Mullis, "The Unusual Origin of Polymerase Chain Reaction," *Scientific American*, 262 (1990): 56–65.

[10]U.S. Dept. of Health and Human Services and U.S. Dept. of Energy, "Understanding Our Genetic Inheritance: The U.S. Human Genome Project: The First Five Years, FY 1991–1995."

[11]R. Lewis, "French Team Completes Physical Map of Human Genome," *Genetic Engineering News* (Jan. 1, 1994): 1.

[12]University Gene Beat, "International Research Team Creates First Linkage Map of Human Genome," *Genetic Engineering News* (Oct. 15, 1994): 26.

[13]J. R. Nelson, *On the Frontiers of Genetics and Religion* (Grand Rapids, MI: Eerdmans, 1994), 60.

[14]G. Taylor, "Houston Conference Explores Human Genome Project's Legal and Ethical Considerations," *Genetic Engineering News* (May 1991): 1.

[15]A. Wexler, op cit., 261.

[16]C. M. Fraser, J. C. Venter, "*Twilight of the Golds* Explores Question on the Ethics of Human Genetics Research," *Genetic Engineering News* (Oct. 1, 1993): 4.

[17]"ELSI Working Group Responds to the Bell Curve," *Human Genome News* 7, no. 5 (Jan–March, 1996).

[18]Quoted in R. Munson, *Intervention and Reflection: Basic Issues in Medical Ethics*, 4th ed. (Belmont: Wadsworth, 1992), 25.

[19]Ibid., 26.

[20]H. Blocher, *In The Beginning: The Opening Chapters of Genesis*, trans. D. G. Preston (Downers Grove, IL: InterVarsity Press, 1984), 79.

[21]J. Moltmann, *God in Creation, A New Theology of Creation and the Spirit of God*, transl. M. Kohl (San Francisco: Harper & Row, 1985), Chap. VIII.

[22]J. R. Nelson, op cit., 111–2.

[23]A. F. Holmes, *Ethics: Approaching Moral Decisions* (Downers Grove, IL: InterVarsity Press, 1984), Chapter 13.

[24]Holmes, *Ethics*, 116.

[25]J. M. Kitagawa, *Religions of the East* (Philadelphia: Westminster, 1968), Chapters 3 & 4.

[26]I. Illich, *Medical Nemesis: The Expropriation of Health* (New York: Bentam Books, 1976), 169.

[27]D. Rossler, *Der Arzt zwischen Technik und Humanitat* (Munich, 1977), 119, cited in Moltmann, 354.

[28]K. Barth, *Church Dogmatics* III, no. 4: 356, cited in Moltmann, op cit., 354.

[29]S. J. Alpers and M. R. Natowicz. "Genetic Discrimination and the Public Entities and Public Accommodation Titles of the American with Disabilities Act" *American Joural of Human Genetics* 53 (1993): 26–32.

[30]W. F. Anderson, "Prospects for Human Gene Therapy in the Born and Unborn Patient," *Clinical Obstetrics and Gynecology* 29, no. 3 (1986): 586–94. Also remarks given at the 1992 national conference on "Genetics, Religion and Ethics" held at Houston under the auspices of US Department of Energy and the National Center for Human Genome Research and the 1993 Annual Meeting of the American Society for Microbiology, held in Atlanta.

[31]Dr. Francis Collins, Director of National Center for Human Genome Research, National Institute of Health: remarks made in a plenary session in "Christian Stake in Genetics," a conference on genetics and bioethics, Trinity Evangelical Divinity School, Deerfield, IL, July 19, 1996.

[32]J. F. Jekel, "Biblical Foundation for Health and Healing," *Perspectives on Science and Christian Faith* 48, no. 3 (1995): 150–8.

[33]A slightly modified bill, S. 422, was introduced into the 105th Congress on March 11, 1998 by Senator Domenici. It was cosponsored by eight other senators, one of whom later withdrew his endorsement. The substance of the bill is essentially the same as its 1996 version. At press time, the bill is referred to the Committtee on Labor and Human

resources. A similar bill, H.R. 2198 was also introduced in the house on July 17, 1997 and has been referred to the Subcommittee on Health.

[34]"Human Genome Management Information System, Oak Ridge National Laboratory," *Human Genome News* 6, no. 6 (March/April 1995): 4.

[35]D. C. Wertz, J. C. Fletcher, K. Berg, and V. Boulyjenkov, "Guidelines on Ethical Issues in Medical Genetics and the Provision of Genetic Services," World Health Organization, Hereditary Diseases Programme, Geneva (1995): 76.

[36]A. H. Handyside, M. R. Hughes, et al., "Birth of a normal girl after invitro fertilization and pre-implantation diagnostic testing for cystic fibrosis" *The New England Joural of Medicine* 327, no. 13 (Sept. 24, 1992): 905–9.

[37]J. R. Nelson, op cit., 55.

[38]Human Genome Diversity Project (NSF 96–112), National Science Foundation, 1996.

1999 ASA Annual Meeting

John Brown University
Siloam Springs, AR

July 30–August 2, 1999

Topic: Industrial Science

Keynote Speaker: William D. Phillips

Phillips, an active Christian who is a researcher at the National Institute of Standards and Technology in Gaithersburg, Maryland, was awarded the 1997 Nobel Prize for his groundbreaking discoveries in physics.

"God has given us an incredibly fascinating world to live in and explore," Phillips said at a news conference October 15 in Long Beach, CA, where he was participating in a conference on high-powered telescopes.

Phillips, 48, is an active member of Fairhaven United Methodist Church in Gaithersburg. He sings in the Gospel Choir which he formed and also teaches Sunday School, leads Bible studies, and frequently conducts the "children's moment" portion of the worship service.

Phillips and Wanda, his wife of 27 years, have two teenage daughters.

Evolutionary Psychology Challenges the Current Social Sciences

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Evolutionary psychology is a new multidisciplinary field which promises to irrevocably change the traditional social sciences. This article introduces evolutionary psychology, explains how it challenges current social science, then discusses the opportunities it presents for Christian apologetics. To show that evolutionary psychology theories may be complementary, rather than antagonistic, to Christian views, a hypothesis within the Darwinian paradigm is proposed to explain the evolution of human awareness of supernature. Human awareness of supernature may be founded on the logical relationship between evolutionarily recent psychological adaptations in response to novel hominid social arrangements and more ancient mammalian psychologies. The hypothesis, though based on naturalism, paradoxically eclipses atheistic natural philosophy. Awareness of something beyond nature may be integral to human survival.

Once again, there is much ado about Darwinism in the popular press.[1] Darwinism is poised to deliver a serious blow to the social sciences of the past century. The Standard Social Science Model focused on culture as the underlying cause of human behavior. Evolutionary psychology promises to usher in a new science of human behavior based on the Darwinian paradigm. Just as our taste guides us to nutritious foods (for the environment of evolutionary adaptation), our psychological adaptations guide us to seek certain types of information in the social environment. Culture is one resource that provides such information. Culture is both a product and director of individual striving, but it is not the "cause" of our striving. Our striving is the product of our evolved psychological architecture. Or perhaps we can say, our human nature.

The purpose of this article is to describe evolutionary psychology and the challenge it poses to traditional social science, then to discuss opportunities evolutionary psychology opens for Christian apologetics.

*ASA Member

What is Evolutionary Psychology?

Evolutionary psychology is a multidisciplinary approach within the Darwinian paradigm that seeks to apply theories of evolutionary biology in order to understand human psychology.[2] This sounds similar to the goal of sociobiology, a controversial field that emerged about twenty years ago. However, evolutionary psychology is not sociobiology. Sociobiology attempted to explain social structures strictly in terms of evolutionary selection pressures, particularly in terms of maximizing reproductive fitness.[3] Such an approach advanced evolutionary biological theories, such as kin selection,[4] by linking relatedness and social structure.[5] However, sociobiology desired to go directly from genes to society, ignoring the individual and the way the individual thinks. This led to a mistaken implication that individuals acted to maximize fitness. Evolutionary psychology avoids this misinterpretation by emphasizing the product of adaptations—the individual's mind/brain.

Evolutionary psychology claims that natural selection in the "environment of evolutionary adapta-

tion" led to inherited psychological mechanisms which are modular, specific, and numerous. One objective of evolutionary psychology is to identify psychological mechanisms. They are as varied as our ability to pick a face out of a crowd, our romantic desires, our ability to hear spoken words over background noise, and our joy of speaking to each other. These mechanisms are best described in terms of cognitive psychology rather than behavior or neurological structure. They "unfold" and develop in response to the social and natural environment. According to John Tooby and Leda Cosmides, editors of *The Adapted Mind*, humans are executors of adaptive psychological mechanisms, rather than fitness maximizers.[6]

Another objective of evolutionary psychology is to propose hypotheses on the adaptive functions underlying each universal psychological phenomenon. These adaptations were generated in the "environment of evolutionary adaptation," consisting of the social and natural environment of the Pleistocene, rather than of the present day. Data used to evaluate hypotheses in evolutionary psychology are potentially limitless—from physiological stimulus-response to character portrayal in literature to anecdotal observations of human activities in the unplanned experiments of modern society. Currently, the most compelling tests of evolutionary psychology hypotheses are cross-cultural surveys designed to elucidate psychological universals.[7]

Not surprisingly, recent books have publicized the racy application of evolutionary psychology to human perceptions of sexual attractiveness.[8] For example, men prefer nubile women with a waist-to-hip ratio of 0.7 (whether fat or thin). Men have different "mate" criteria for marriage and flings. Women seek men with status who are willing to commit resources. According to cross-cultural surveys, these sexual preferences are universal. They indicate psychological adaptations addressing mate choice, a specific dilemma experienced in the environment of evolutionary adaptation. Consistent environmental clues allowed individuals to recognize and prefer certain features in a mate. Over generations, individuals with certain preferences experienced greater reproductive success. Therefore, through natural selection, such preferences became psychological adaptations among all individuals of the species.

Evolutionary psychology does not claim that individuals must seek certain features in a mate or that seeking certain features maximizes a particular individual's fitness. This is the erroneous implication of sociobiology. Donald Symons claims that a science of human behavior cannot be directly based on analysis of the reproductive consequences of human action.[9] Fitness maximization is a general result of striving for specific goals, such as finding food or a suitable mate. Symons warns that it is a logical error to say that specific goals are consequent upon a general goal. Unfortunately, books popularizing the Darwinian approach to understanding human action may confound the evolutionary psychology and sociobiological perspectives. For example, Robert Wright's *The Moral Animal*, properly relates how an individual's behavior may be seen as exemplifying specific psychological mechanisms proposed by evolutionary psychology (with the general consequence of reproductive success).[10] Other popularizers erroneously link individual or group behavior directly to fitness maximization.[11]

In sum, evolutionary psychology postulates that the mind/brain mechanisms that collectively constitute human nature were designed by natural selection in the environment of evolutionary adaptation and must be described as solutions to specific cognitive problems in that environment. Evolutionary psychology conceptually integrates psychology and evolutionary biology by tying together psychological phenomena and theories of adaptive function. Conceptual integration between disciplines has been one distinguishing feature of the natural sciences. Consequently, evolutionary psychology is on the "natural science" side of the fence in human studies. The Standard Social Science Model consciously re-

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jects integration with the natural sciences and is vulnerable to criticism on that basis.[12]

The Logic of the Standard Social Science Model

The Standard Social Science Model's rejection of conceptual integration with the natural sciences is sustained by a false dichotomy of nature versus nurture.[13] (This dichotomy follows from its moral assumptions, which will be discussed later.) First, the Standard Social Science Model claims that only genetically determined human behavior is "natural" or biological. Certain infant reflexes and adult facial expressions fall in this category. Next, the Standard Social Science Model asserts that all human infants have the same design and potential. So "nurture" must account for the profound differences in behavior and mental organization among human societies. The content of "nurture" comes from "culture" and is "learned" by the individual. Since the causal arrow points from society to the individual, social structure, rather than the individual, generates culture. The sociocultural level of human interaction is distinct, autonomous, and self-caused. Within the Standard Social Science Model, the idea of human nature (or, for evolutionary psychology, evolved psychological architecture) is eliminated as a useful concept. The individual can "learn" any "culture."

Within the Standard Social Science Model, the idea of human nature ... is eliminated as a useful concept. The individual can "learn" any "culture."

The structure of the social sciences flow from its internal logic. A particularistic, content-specific anthropology examines cultures with an eye to emphasizing variability. A content-independent psychology designs experiments to elucidate how the brain is a general information processor. In this regard, Skinnerian behaviorism may be seen as an experimental protocol designed to exclude evolutionarily organized responses by eliminating biologically significant stimuli.

Ironically, the field of cognitive psychology developed in frustration with behaviorism.[14] Cognitive psychology studied behavioral and neurological responses to sensory stimuli and found that the brains of all animals, including humans, had numerous and specific responses to stimuli and that these were associated with neurological structure.[15] In this way, cognitive psychology began to undermine the concept of the brain as a general information processor and established a vocabulary for evolutionary psychology to propose mind/brain adaptations. Evolutionary psychology now directly challenges the scientific integrity of the Standard Social Science Model by claiming that culture is the manufactured product of evolved psychological mechanisms situated in individuals living in groups.[16] The rich variability of culture has been generated by the intricate and contingent set of functional programs used by human beings to process information from an environment provided by other human beings.

A Christian View of Evolutionary Psychology versus the Standard Social Science Model

The Standard Social Science Model is founded on a moral rejection of biological views of human nature. It claims that (1) humankind shares a psychic unity, (2) all human infants have similar potential, and (3) the only thing that separates us is culture, not biology.[17] Since culture is relative and constructs perceived reality, cultures cannot judge one another. The Standard Social Science Model promises that humans may be ideologically trained. Since there is no human nature, we are programmable. Such a view appeals to moral elitists who intend to help the (culturally) deprived through government action. Social scientists present their values as "scientific" judgments and support an impersonal agenda of cultural reform (i.e., by changing social structures).[18]

While the moral claims of the Standard Social Science Model sound familiar to Christians, we differ in justifying these values. The ideas of the psychic unity of humankind, the importance of developing human potential, and the imprudence of judging one another flow from a contemplation of divine revelation, rather than human knowledge, and support an agenda of cultural reform through personal conversion. Because the Standard Social Science Model has founding moral values that appear to agree with Christian morals, but actually support a relativistic and totalitarian agenda, an assault on its scientific validity by evolutionary psychology provides relief from this stagnant and dangerous worldview.

In the short run, social scientists will respond to evolutionary psychology in the same manner as they responded to sociobiology, with moral outrage. Those who question the scientific validity of the

Standard Social Science Model will be labeled as contradicting its moral claims. Questioners will be classified as the moral equivalents of the past demagogues who relied on biological claims of human nature to justify inhuman action. The tactics of this defense applies to other fields of modern thought, such as law.[19]

While the moral claims of the Standard Social Science Model sound familiar to Christians, we differ in justifying these values.

But will evolutionary psychology be any better? Because it derives from Darwinism, evolutionary psychology harbors naturalistic assumptions potentially dangerous to the Christian perspective.[20] However, we must remember that Darwinism is the best natural explanation of human origins yet proposed, and, in modified form, is likely to remain so.[21] In the long run, the benefits and risks of evolutionary psychology will be tied to its scientific progress. Evolutionary psychology will eventually construct a description of human nature within the Darwinian paradigm. And here is where the challenge for the Christian may be seen. Christianity already has a description of human nature. It comes from a long tradition of debating the nature of God and humans while contemplating the experience of divine revelation. It is intimately tied to Genesis. The opportunity for Christian apologetics comes with the question: Will descriptions of human nature by evolutionary psychology and by Christianity be complementary?

This question sounds straightforward, but one must keep in mind that both evolutionary psychology and Christianity seek a deeper understanding of the truth. They are both "moving targets." The relationship between Christianity and science has been a peculiar one. Since the Christian culture successfully gave birth to science, science appears to have undermined the Christian worldview.[22] The Copernican, Newtonian, and Darwinian revolutions forced Christianity to make choices and self-discoveries that have tended to demythologize and naturalize its revelation. Here, the term "demythologize" means "to connect a story with actual or historical events" and "naturalize" means "to rationalize reports of miracles in terms of natural processes."

As Dick Fischer pointed out in *The Origins Solution*, demythologization reinforces the sense that biblical events (especially miraculous ones) were real.[23] Today, compared with other world religions, Christianity is the most historically-oriented and free from myth. Naturalization, on the other hand, rejects the reality of biblical events. Attempts to completely naturalize Judeo-Christian revelation are necessarily speculative and may be challenged on epistemological grounds.[24] However, a weak form of naturalism prefers to isolate sections of the Bible and label them as myth.[25] In doing so, reality is denied on one plane (the physical) and not on another (the moral). This attempt has been successful, particularly regarding the early chapters of Genesis.[26]

The mirror process, the mythification of (or the finding of ultimate purpose or beauty in) the natural and evolutionary sciences, has been the focus of Christian resistance.[27] We all know the price paid when "what is" has been elevated to "what ought to be." Since nearly everyone today agrees that the mythification of science violates the founding assumptions of naturalism, expressions of purpose in nature border on nihilism.[28] Richard Dawkins states that life has no higher purpose than to perpetuate the survival of DNA.[29] Steven J. Gould emphasizes contingency—pure luck—in the evolution of humans.[30] As in the past, Christians will demand that these views be either rejected or reinterpreted critically from the perspective of revelation.

Christians are now taking the task of mythification of the natural and evolutionary sciences upon themselves by attempting to recognize a complementarity between Christian thought and the evolutionary sciences.

Christians are now taking the task of mythification of the natural and evolutionary sciences upon themselves by attempting to recognize a complementarity between Christian thought and the evolutionary sciences. For myself, I hold that this recognition may be achieved by aesthetically demythologizing the early chapters of Genesis, a process that may be possible despite its literary construction.[31] Finally, I believe that the process begins by connecting the early chapters of Genesis artfully with discoveries in the evolutionary sciences.

Already, Christian writers have expressed a sense of this complementarity while keeping in mind the

limitations of previous approaches.[32] The creation of humans in Genesis 1:27 has been pondered in relation to the earliest appearance of anatomically modern humans.[33] The stories of Adam and Eve have been correlated to the earliest organized irrigation in Mesopotamia.[34] My own work artistically rendered a resemblance between the first chapter of Genesis and the evolutionary record,[35] including the origin of humans (Gen. 1:26–30).[36] Mechanisms for divine intervention within the evolutionary paradigm have been proposed.[37] These creative reflections recommend novel and aesthetic approaches to express this recognition. At the same time, these approaches recommend that Christians understand and participate in the formulation of natural theories within the evolutionary sciences. This is where evolutionary psychology comes in.

Christians [should] understand and participate in the formulation of natural theories within the evolutionary sciences. . . . [They] can propose evolutionary psychology theories explaining why the religious impulse is a species-specific trait.

If the creation of humans in the first chapter of Genesis may be aesthetically correlated with the earliest appearance of anatomically modern humans, then how might the discoveries of the evolutionary sciences, particularly evolutionary psychology, resonate with the phrase "created in the image of God"? While Christians cannot propose evolutionary psychology hypotheses that humankind was created in the image of God or that humankind evolved to believe in Jesus, Christians can propose evolutionary psychology theories explaining why the religious impulse is a species-specific trait.[38] The existence of a universal human impulse toward God is a crucial starting point for Christian apologetics.[39]

In the remainder of this article, I will propose a hypothesis in evolutionary psychology concerning the evolution of human awareness of something beyond nature. The hypothesis will discuss adaptive functions that may explain the psychological mechanisms behind our widely expressed awareness of something beyond nature. If this type of theory succeeds, then the discovery could imply that atheistic natural philosophy alone is insufficient for human survival. Paradoxically, humans may need God to perpetuate their DNA.

The Limitations of this Proposal

The essential task of evolutionary psychology is to explain human psychological mechanisms in terms of adaptive functions in the environment of evolutionary adaptation.[40] The human religious impulse appears to be one set of these species-specific psychological traits.[41] Evolutionary psychology offers an opportunity for scientists to propose adaptive functions explaining the religious impulse. I believe such proposals will reveal a striking complementarity between natural and Christian descriptions of human psychology.

Because evolutionary psychology is a proto-science, a field which has some but not all the qualities of a mature science, the following proposal will necessarily be speculative.[42] However, the hypothesis must be expressed before others can explore the evidence for and against its acceptability. The hypothesis does not address underlying social and philosophical problems associated with Darwinism.[43] However, it does elucidate a line of thought which could dramatically impact the social sciences and natural philosophy.

Why Are Humans Aware of Something Beyond Nature?

Ancestral Social Adaptations

During hominid evolution, species ancestral to humans adopted novel social arrangements. One social arrangement was monogamy.[44] Neither gorillas nor chimpanzees, human's closest relatives, practice this social arrangement. The gibbon does. One explanation for gibbon monogamy is that an adult male will slaughter the infants of a new female mate (most likely, infants sired by other males).[45] A male who remains with his cohort will experience greater reproductive success than one who does not, because such behavior protects his infants. Under these circumstances, monogamy increases the reproductive fitness of the male.

Human monogamy probably solved a different adaptive function. C. Owen Lovejoy, in "The Origin of Man," proposed that monogamy arose to solve problems associated with the combination of long childhood (characteristic of all great apes) and the economy of a resource-poor environment which favored walking over tree dwelling.[46] Although C. Owen Lovejoy's claim that monogamy and walking coevolved has been criticized on the basis that the

australopithecines were sexually dimorphic,[47] the selection pressures he delineates may have played a role in speciation toward the *Homo* genus.[48] *Australopithecine* males were much larger than females. Male and female *Homo erectus* were of similar stature. Survival of *Homo* (and possibly, *australopithecine*) children may have depended on both parents providing resources. The female provided them from short distances and the male from longer.

Monogamy could not evolve without assurances that the providing male was the father of the child. Otherwise, adaptations favoring a monogamy-based psychology could not be propagated. These assurances were not communicated in spoken language. Rather, they were expressed through "body language" by the mate and other members of the group, both intentionally and unintentionally.

During hominid evolution, species ancestral to humans adopted novel social arrangements. . . . These social arrangements helped the individual in a variety of ways and maintained group cohesion in the face of group competition.

C. Owen Lovejoy's analysis allows the proposal of a rich variety of adaptive psychological mechanisms regarding mate selection and child rearing. Besides a reduction in sexual dimorphism, hominid brain size increased dramatically with speciation from the *Australopithecus* to *Homo* genus, suggesting that the neurological structures accommodating these adaptations were overlaid onto and integrated into an older mammalian neural architecture.[49]

The larger brain of the *Homo* genus may be correlated by interspecies comparison with fairly large group sizes.[50] Whether *Homo habilis* and *erectus* traveled in large groups or in associations of small groups, each individual had to recognize members of the group or association and behave appropriately. Appropriate behaviors took place within social arrangements characteristic of individuals pursuing their own reproductive interest among a group of related individuals. These social arrangements have been described by Richard Alexander in *The Biology of Moral Systems*.[51] They extend from direct reciprocity, to indirect reciprocity, to reciprocal altruism, to unreciprocated altruism. These social arrangements helped the individual in a variety of ways and maintained group cohesion in the face of group competition. Each individual's reproductive fitness was increasingly mediated by others within the group. Alexander sees competition between groups as a social selection pressure decoupled from environmental selection pressures. The result was an evolutionary "arms race" selecting for higher and higher levels of intragroup cohesion.

Richard Alexander must be read with care, since he approaches behavior from a sociobiological perspective.[52] However, his analysis provides a basis for postulating a wide array of psychological mechanisms devoted to surviving and cooperating in a social environment where group cohesion is a matter of life or death.

Psychological Adaptations

Our purpose is not to speculate on the wealth of psychological mechanisms suggested by these two social adaptations. Rather, we will focus on the inherent "logical" relationship between psychological mechanisms adaptive to the novel social arrangements and previously evolved psychological mechanisms. Humans share a previously evolved psychology with other mammals. With few exceptions, mammals behave according to a psychology of pleasure-seeking and pain-avoidance. Exceptions include mating and raising the young, when other psychologies override pleasure-seeking and pain-avoidance to some degree. These psychological mechanisms increase reproductive success as parents "invest" or (perhaps better) "sacrifice" to protect and rear their own.

Mating, gestation, and rearing of young are brief and seasonal in lower mammals. Here, parental sacrifices are limited in duration. In higher mammals, more parental investment is required, which explains the long delay between births observed in species like the chimpanzee.[53] Ancestral monogamous hominids, like humans, would have a long, perhaps lifelong, investment due to overlapping periods of child rearing. Under these circumstances, nature would select, for the long-term, psychological mechanisms capable of overriding the standard mammalian psychologies based on pleasure-seeking and pain-avoidance. The "arms race" character of selection due to intergroup conflict favored evolution of similar psychological mechanisms devoted to eliciting intragroup cooperation and reducing intragroup conflict. The individual had to sacrifice for others in the group.

The social arrangements adopted by ancestral hominids favored the evolution of a novel psychology designed to control behaviors motivated by pleasure-seeking and pain-avoidance. The focus of the new psychology was to nurture, cooperate with, and protect relatives and other members of the group. On the other hand, the focus of the old psychology was to nurture and protect self without regard for others. The relational logic between the two psychologies is transcendent. Novel psychological adaptations served to "rise above" an older psychology common to all mammals. If animals think "naturally," then this novel transcendent psychology may be construed as rising above (Latin: super) nature. Most likely, these psychological adaptations were originally manifest as emotional responses. However, once emotions were attributed to experiences or relationships,[54] cognition of something beyond nature would have also evolved in order to communicate this transcendent psychology.

The Emotional and Cognitive Structure of Human Awareness of Something Beyond Nature

Evidence for human awareness of something beyond nature may be found in the visual arts, music, and ritual acts of every culture and historical period. Some of the earliest archaeological evidence is found in Upper Paleolithic art and burials.[55] These relics may be regarded as manifestations of mental capabilities dating from the earliest anatomically modern humans. These expressions of awareness did not involve rational or scientific modes of thought.[56]

What information does religious expression convey? Evolutionary psychology understands nature and nurture to be inseparable. We learn religion from others and are transformed in the process. Among other things, religious acts "teach," both consciously and unconsciously, transcendent emotional and cognitive psychological mechanisms that serve to control "natural" responses motivated by pleasure-seeking and pain-avoidance. Every individual may be genetically predisposed to learn particular information from the social environment necessary for these transcendent psychological mechanisms to function. With that learning, the individual prepares for the trials and tribulations of raising a family and of adult compromise.

Religious rituals convey meaning in subtle and complex manners that can only be described as otherworldly. Anthropologists have long attempted to explain the multilevel communication of ritual acts.[57] If religious rituals "teach" transcendent psychological mechanisms, then the otherworldly aspect may be critical for effective communication. In particular, our mammalian heritage prepares us to analyze the world according to natural constants. It also disposes us to orient to gravity, to eat when hungry, to mate, to seek pleasure, to avoid pain, and so forth. Religious rituals may contest these "natural constant" forms of analysis in order to teach our transcendent psychological mechanisms that natural responses and modes of thought are insufficient for survival. This may explain why humans practice religious traditions in which natural laws are defied and rational explanations fail to adequately explain ritual practices and claims.

Evidence for human awareness of something beyond nature may be found in the visual arts, music, and ritual acts of every culture and historical period.

Let me give two examples of how aspects of religious tradition may be appreciated by this hypothesis. First, the hypothesis suggests basic traits shared by all sustained religious traditions. For example, in the faith-oriented Victorian society, adults judged one another's behavior on criteria reminiscent of a transcendent psychology. Pleasure-seeking and pain-avoidance were condemned. Restraint and duty praised.[58] Second, the hypothesis points out the relevance of education in a religious tradition that defies "natural constant" forms of analysis. For example, the Victorians viewed the education of youth in a religious framework. The rationale for teaching pragmatic skills, such as reading, was stated in religious terms. Religious tradition was taught to youth through supernature-rich stories and rituals. Failure to successfully teach religion was viewed as a cause of family and moral decay.[59]

Clearly, the hypothesis that our human awareness of something beyond nature is explained by the evolution of transcendent psychological mechanisms adapted to novel hominid social arrangements is speculative and warrants further investigation. But just as obvious is the conclusion that this type of hypothesis will impact all social science and provide the impetus for a wide range of academic work. It establishes religious activity as biologically, as well as intellectually and emotionally, motivated. Intellectual and emotional responses are mental and behavioral consequences of evolved psychological mechanisms. They vary in degree among individu-

als, but not in kind. The variety of religious expression derives from individuals in groups constructing methods to activate and use psychological programs within historical, social, and natural contingencies.

Mind-Boggling Implications

This hypothesis paradoxically eclipses the naturalist philosophy which inspired Darwinism. Humans psychologically require the divine in order to raise children productively and to maintain group (or societal) cohesion. The developing human innately anticipates the presence of a religious tradition within his or her social environment. Inherited psychological mechanisms "unfold" and "learn" in response to the challenge of religious rituals that evoke an awareness of something beyond nature. With that cognitive and emotive learning, the person integrates into family and community. Our recognition of something beyond nature, our search and our longing, may well be legacies of our evolutionary past. However, naturalism alone cannot provide that "something beyond nature" so crucial to our natural design.

Whether or not one subscribes to Darwinism, one has to be amazed at the turn of events occasioned by this hypothesis. We have achieved a perspective where the essence of the biblical creation of humans in the image of God is unexpectedly imaged by a proposal in evolutionary psychology on the adaptive function of human awareness of something beyond nature. In achieving this perspective, we recognize a "mythic" or "supernatural" implication to evolutionary science that complements Judeo-Christian tradition. ✣

References

[1]Robert Wright, "The Evolution of Despair," *Time* 146, no. 9 (1995): 50–7 and John Horgan, "The New Social Darwinists," *Scientific American* 273, no. 4 (1995): 174–81.

[2]John Tooby and Leda Cosmides, "The Psychological Foundation of Culture," in *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, ed. Jerome H. Barkow, John Tooby, and Leda Cosmides (New York: Oxford University Press, 1992), 19–136.

[3]Edward O. Wilson, "Sociobiology and the Test of Time," in *Man and Beast Revisited*, ed. Michael H. Robinson and Lionel Tiger (Washington, DC: Smithsonian, 1991), 77–80.

[4]David W. Pfenning and Paul W. Herman, "Kin Recognition," *Scientific American* 272, no. 5 (1995): 98–103.

[5]Phillip A. Morin, James J. Moore, Ranajit Chakraborty, Li Jin, Jane Goodall, and David S. Woodruff, "Kin Selection, Social Structure, Gene Flow and the Evolution of the Chimpanzees," *Science* 265 (1994): 1193–1201, reviewed by Virginia Morrell, "Decoding Chimp Genes and Lives," *Science* 265 (August 26, 1995): 1172–3.

[6]John Tooby and Leda Cosmides,"The Psychological Foundation of Culture."

[7]Ibid.

[8]David M. Buss, *The Evolution of Desire: Strategies of Human Mating* (New York: Basic, 1994).

[9]Donald Symons, "On the Use and Misuse of Darwinism in the Study of Human Behavior," in *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, ed. Jerome H. Barkow, John Tooby, and Leda Cosmides (New York: Oxford University Press, 1992), 137–62.

[10]Robert Wright, *The Moral Animal: Evolutionary Psychology and Everyday Life* (New York: Vintage, 1994).

[11]J. P. Rushton, *Race, Evolution and Behavior: A Life History Perspective* (New Brunswick: Transaction, 1995) as reviewed by Henry D. Schlinger, Jr., "How the Human Got Its Spots: A Critical Analysis of the Just-So Stories of Evolutionary Psychology," *Skeptic* 4, no. 1 (1996): 68–76.

[12]Frank Salter, "Sociology as Alchemy," *Skeptic* 4, no. 1 (1996): 50–9.

[13]John Tooby and Leda Cosmides,"The Psychological Foundation of Culture."

[14]Steven Pinker, *The Language Instinct* (New York: Harper Perennial, 1994), 21–3.

[15]Michael I. Pisner, Steven E. Peterson, Peter T. Fox, Marcus E. Raichle, "Localization of cognitive operations in the human brain," *Science* 240 (1988): 1627–32.

[16]John Tooby and Leda Cosmides, "The Psychological Foundation of Culture."

[17]Robin Fox, "Aggression: Then and Now," in Michael H. Robinson and Lionel Tiger, eds., *Man and Beast Revisited* (Washington, DC: Smithsonian, 1991), 81–94.

[18]Thomas Sowell, *The Vision of the Anointed: Self-Congratulations as a Basis for Social Policy* (New York: Basic, 1995), 104–42.

[19]Ibid., 242–60.

[20]James Patton Clark, "Fact, Faith and Philosophy: One Step Toward Understanding the Conflict between Science and Christianity," *Perspectives on Science and Christian Faith* 46, no. 4 (1994): 242–52.

[21]Robert F. DeHaan, "Paradoxes in Darwinian Theory Resolved by a Theory of Macro-Development." *Perspectives on Science and Christian Faith* 48, no. 3 (1996): 154–63.

[22]Stanley L. Jaki, *The Origin of Science and the Science of its Origin* (Indiana: Regnery Gateway, 1978).

[23]Dick Fischer, *The Origins Solution* (Ohio: Fairway, 1996), 28, 98–9, 183, 213.

[24]David Snoke, "The Problem of the Absolute in Evidential Epistemology," *Perspectives on Science and Christian Faith* 47, no. 1 (1995): 2–22.

[25]Dick Fischer, *The Origins Solution*, 98–105.

[26]Bruce K. Waltke, "The Literary Genre of Genesis, Chapter One," *Crux* 27, no. 4 (1991): 2–10.

[27]Robert C. Newman, "Scientific and Religious Aspects of Origins Debate," *Perspectives on Science and Christian Faith* 47, no. 3 (1995): 164–75.

[28]Clark, "Fact, Faith and Philosophy."

[29]Richard Dawkins, "God's Utility Function," *Scientific American* 273, no. 5 (1995): 80–5.

[30]Michael Shermer, "Gould's Dangerous Idea: Contingency, Necessity, and the Nature of History," *Skeptic* 4, no. 1 (1996): 91–6.

[31]Meredith G. Kline, "Space and Time in Genesis Cosmogony," *Perspectives on Science and Christian Faith* 48, no. 1 (1996): 2–15.
[32]Newman, "Scientific and Religious Aspects of Origins Debate."
[33]David L. Wilcox, "Adam, Where Are You? Changing Paradigms in Paleoanthropology," *Perspectives on Science and Christian Faith* 48, no. 2 (1996): 88–96.
[34]Dick Fischer, "In Search of the Historical Adam: Part 1," *Perspectives on Science and Christian Faith* 45, no. 4 (1993): 241–51.
[35]J. Raymond Zimmer, "The Creation Story and Evolution," *Journal of Interdisciplinary Studies* 5 (1993): 77–92.
[36]J. Raymond Zimmer, "The Creation of Man and the Evolutionary Record," *Perspectives on Science and Christian Faith* 48, no. 1 (1996): 16–27.
[37]C. Gordon Mills, "A Theory of Theistic Evolution as an Alternative to the Naturalistic Theory," *Perspectives on Science and Christian Faith* 47, no. 2 (1995): 112–22.
[38]Victor Turner, "Body, Brains and Culture," in Kenneth Moore, ed., *Waymarks: The Notre Dame Inaugural Lectures in Anthropology* (Notre Dame, IA: University of Notre Dame Press, 1987), 71–105.
[39]Acts 17:26–28.
[40]John Tooby and Leda Cosmides, "The Psychological Foundation of Culture."
[41]Victor Turner, "Body, Brains and Culture."
[42]Harmon R. Holcomb, "Moving Beyond Just-So Stories: Evolutionary Psychology as a Protoscience," *Skeptic* 4, no. 1 (1996): 60–7.
[43]Clark, "Fact, Faith and Philosophy."
[44]R. A. Foley and P. C. Lee, "Finite Social Space, Evolutionary Pathways, and Reconstructing Hominid Behavior," *Science* 243 (1989): 901–7 and Rodseth Lars, Richard W. Wragham, Alisa M. Harrigan, and B. Barbara Smuts, "The human community as primate society," *Current Anthropology* 32, no. 3 (1992): 221–54.
[45]Matt Ridley, *The Red Queen: Sex and the Evolution of Human Nature* (New York: Macmillan, 1944), 214–5.
[46]C. Owen Lovejoy, "The Origin of Man," *Science* 211 (1981): 341–7.
[47]Richard Leakey, *The Origin of Humankind* (New York: Basic Books, 1994), 17–8.
[48]Ibid, 34–5.
[49]Antonio R. Damasio, *Descartes' Error: Emotion, Reason and the Human Brain* (New York: Avon Books, 1994), 126.
[50]Leslie C. Aiello and R. I. M. Dunbar, "Neocortex Size, Group Size and the Evolution of Language," *Current Anthropology* 34, no. 3 (1993): 184–92.
[51]Richard D. Alexander, *The Biology of Moral Systems* (New York: Aldine de Gruyter, 1987).
[52]Donald Symons, "On the Use and Misuse of Darwinism in the Study of Human Behavior," in Jerome H. Barkow, John Tooby, and Leda Cosmides, eds. *The Adapted Mind: Evolutionary Psychology and the Generation of Culture* (Oxford: Oxford University Press, 1992), 137–62.
[53]Lovejoy, "The Origin of Man."
[54]Bernard Weiner and Sarah Graham, "An attributional approach to emotional development," in Carroll E. Izard, Jerome Kagan and Robert Zajonc, eds., *Emotion, Cognition and Behavior* (Cambridge, UK: Cambridge University Press, 1984).
[55]Klima Brouslav, "A triple burial from the Upper Paleolithic of Dolni Vestonice, Czechoslovakia," *Journal of Human Evolution* 16 (1988): 831–5.
[56]Margaret W. Conkey, "New approaches in the search for meaning? A review of research in Paleolithic art," *Journal of Field Archaeology* 14 (1987): 413–30.
[57]Edmund Leach, *Culture and Communication: The Logic by Which Symbols Are Connected* (New York: Cambridge University Press, 1976).
[58]Robert Wright, *The Moral Animal: Evolutionary Psychology and Everyday Life* (New York: Vintage, 1994).
[59]John Trickett and Edgar Stephenson, *The Christian Faith in the Secondary School* (London: Faith Press, 1963).

Evolutionary Psychology: A Paradigm Whose Time May Come:

A Response to J. Raymond Zimmer

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Evolutionary Psychology (EP) is a controversial modern psychological theory. An offshoot of sociobiology, EP proposes that humans have developed psychological mechanisms which reflect their evolutionary past, but which may not currently maximize fitness for survival. Proponents contend that EP offers a meta-model which can unify and transform modern psychology—which they point out is now fragmented by many micro-theories and detached empirical findings, and further divided by the emergence of hermeneutical approaches. Zimmer, an EP enthusiast, proposes (PSCF 50, no. 3: 176–84) that EP offers a paradigm which is compatible with Christian beliefs. We agree that EP offers some unique integrative features, but—along with other critics—doubt that it will soon become a dominant psychological theory. Also, while EP provides some opportunities for integration with Christian beliefs, major EP proponents are hostile toward religion—except as an evolutionary social phenomenon—and their anti-Christian views are likely to be thoroughly interwoven into EP. Thus EP must be approached with care to identify the ways it is in tension with Christian beliefs as well as the ways it is compatible with them.

Zimmer enthusiastically recommends Evolutionary Psychology (EP) on the premises that (a) EP is a paradigm that "promises to irrevocably change the traditional social sciences" in the coming years,[1] and (b) it is a paradigm that is compatible with Christian beliefs and "establishes religious activity as biologically, as well as intellectually and emotionally, motivated."[2] He illustrates this compatibility by proposing an evolutionary-flavored hypothesis of religion that, Zimmer declares, indicates human awareness of something beyond nature and offers unique starting points for integrating EP theories and Christian views.

While Zimmer is not alone in his support for EP—and many are similarly impressed by this paradigm—the overall reviews of EP are decidedly mixed, as others have offered significant questions and criticisms of this emerging perspective. We tentatively agree that EP does have unique areas of compatibility with Christian beliefs, but we also acknowledge particular areas of existing and potential conflict. The specific hypothesis that Zimmer offers has been addressed in the literature, and indirectly dismissed; but other concepts may prove to be fruitful starting points for dialogue between Christianity and EP.

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Evolutionary Psychology: Playing to Mixed Reviews

EP proposes that there is variation in hereditary traits, that some traits are more conducive to survival and some less so, and that those traits that are more conducive to survival at any given time tend to become prevalent within the population. Many have proposed that this evolutionary history provides the framework through which human psychology can be understood.[3]

Proponents of sociobiology, a forerunner of EP, postulated that traits (or mechanisms) evolved in a way that predisposed humans toward "inclusive fitness," or the goal of maximizing their gene representation in future generations.[4] Evolutionary psychologists differed by declaring that these traits or mechanisms, rather than having a nature or purpose of their own, merely represented the psychological grid that was crafted in the past by evolution and through which information from our current environments is filtered.[5] Mechanisms, therefore, could be activated in ways that were not necessarily fitness maximizing. Evolutionary psychologists have proposed that by understanding the environments in which these mechanisms evolved we come to know our inherited psychological grid and can better understand our interaction with present stimuli.[6]

Dispassionate discourse on the proposals of EP seems to be the exception rather than the rule. For its enthusiasts, EP is often characterized as the coming paradigm that will vanquish lesser pretenders: a meta-theory that will restore the scientific underpinnings to a foundationless community of social scientists. To its detractors, it is sometimes portrayed as a field in which research designs and methods are suspect, conclusions are vulnerable to unscrupulous political use, and more parsimonious explanations of behavior are ignored.

Support for EP

Zimmer is not alone is his belief that EP "will usher in a new science of human behavior based on the Darwinian paradigm."[7] Key apologist David M. Buss declared that EP was a paradigm "whose time had come," and that only those in the "backwaters of academia" could fail to understand the basics of its various theories.[8] Others have suggested that EP is a theory around which psychology can organize itself.[9]

The current state of the social sciences has been described by EP proponents as conceptual confusion in which there are mixtures of mini-theories and empirical findings that proliferate but do not connect or complement.[10] Psychology, with its embrace of postmodernistic relativism, has been characterized as becoming increasingly distant from the natural sciences. EP advocates suggest this is a precarious position in an age when advances in the biological study of the human mind are influencing both scientific and political communities.[11] Tooby and Cosmides observed that the growing separation from the rest of science has greatly hampered progress for psychology and the social sciences.[12]

In answer to this purported disarray and lack of progress in the social sciences, evolutionary psychologists have promoted EP as a strong, organizing meta-theory. Buss declared that psychology "must be anchored or informed by evolutionary principles,"[13] and Tooby and Cosmides have presented their Integrated Causal Model as an evolution-based bridge between the social sciences and the rest of science.[14]

LaCerra and Kurzban asserted that a renaissance in the sciences has been achieved as evolutionary psychologists working in various fields have provided bridges among disciplines—a synthesis "long awaited by scholars and scientists."[16] They attributed this accomplishment to the evolutionary psychologist's acknowledgment of the human species as a part of the natural universe and, as such, subject to natural laws. The reemphasis on natural laws and "hard" science is a theme with evolutionary writers. Tooby and Cosmides sharply criticized what they have called the Standard Social Science Model (SSSM) for encouraging "intellectual isolationism" in abandoning causal analysis in favor of approaching social phenomena as "texts to be interpreted ... as one might interpret literature."[17]

Embracing EP has been proposed as the antidote to such "soft science." Harris and Pashler proposed that an understanding of Darwinian principles could help psychologists become more disciplined

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in advocating functional explanations for behavior within the conceptual framework of evolution.[18] Knight argued that focusing on functionalism, in the context of EP, could foster a return to a hypothetico-deductive theoretical base.[19] Holcomb—who is not necessarily an EP advocate—declared that research in EP had a firm basis in evolutionary biology.[20]

Criticisms of EP

Others are less convinced of the scientific integrity and validity of EP research. They point to research design flaws, dubious scientific methods, and controversial applications of EP conclusions as areas of concern. Additionally, critics charge that more parsimonious explanations for behavior are ignored or inadequately dealt with by EP researchers.

It is ironic that EP, which is billed by its supporters as the paradigm by which psychology can return to an emphasis on the scientific method, is harshly criticized as a theory which emphasizes "just so" stories consisting of post hoc explanations for common behaviors. Some conclusions from EP research, such as "findings" that men like pretty, young, healthy women, hardly seem noteworthy—and invite derision when combined with evolutionary post hoc analysis of such "mechanisms." Holcomb noted that such post hoc explanations preclude falsifiability and must be regarded as pseudoscientific reasoning.[21]

Holcomb also noted the dearth of EP research that involved testing novel predictions as opposed to predictions that have already been demonstrated in alternative theories. Resolving this problem would require EP hypotheses that would predict behavior which rival models, such as strict cultural explanations, would not predict. Merely predicting the familiar, he concluded, keeps EP from being completely scientific.[22] Said differently, there is little reason to adopt a new theory which merely explains old data which is already adequately explained by existing theories.

Others have criticized the methodology of EP as consisting of non-experimental—sometimes non-quantitative—approaches that rely on poorly defined attitudes and concepts, measured by surveys and questionnaires of equally dubious reliability. Similarly, EP findings have been challenged as capricious and weak due to poor research designs and methods. Schlinger complained that evolutionary theorists don't conduct experiments or cite experimental data but rely on questionable anecdotal and statistical evidence to support their theories.[23]

EP theorists, additionally, are faulted for depending on cross-species analysis in formulating theories about environmental challenges and adaptations.[24] The appropriateness of such methods has been challenged on the basis that seemingly identical behaviors in separate species may indicate superficial, as opposed to functional, similarities. EP has not proposed an objective way of resolving this issue, Schlinger noted.[25]

In addition to criticisms of theory as inadequately developed, concern has been raised about the political nature and potential misuse of EP conclusions. Caporael and Brewer asserted that evolutionary positions are sometimes linked to social agendas, based on the worldview belief that what is, should be—or will be.[26] In other words, if mechanisms exist within us as a result of evolution, there is a tendency to believe that these mechanisms are inevitable.[27] The fear exists that this perspective may be used to justify a passive social response to violent, racist, or sexist behavior because it merely expresses our true natures.[28]

Some of the harshest criticism of EP, however, involves the complaint that theorists ignore or underestimate alternative explanations of behavior. Harris and Pashler rejected the domain specific adaptations proposed by EP to explain mate choice.[29] They proposed a more parsimonious explanation in terms of domain general faculties of rational choice and cognition. Cultural evolution and the transfer of

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information across generations may also resolve certain adaptive problems in more economical ways than domain specific mechanisms.[30] Buss, particularly, has been criticized for dismissing culture merely as dependent on evolved mechanisms for its existence.[31]

Many also charge that EP theorists' perspectives of behavior have neglected group variables and social context.[32] For example, proponents of feminist theory have claimed that membership in dominant versus subordinate groups offers a more parsimonious assessment of gender differences than does EP.[33]

EP Responses to Criticisms

The criticisms of EP have been addressed, to one degree or another, in the literature. Wright responded to the charge of post hoc storytelling by admitting that coming up with plausible stories is, in a way, what evolutionary theorists do.[34] He quickly added, however, that some "just so stories" are clearly better than others and are helpful in conceptualizing the nature of past adaptive information processing problems and solutions. Others have pointed out that once this initial "story-telling part" of conceptualization has occurred, specific, empirical hypotheses can then be formulated and tested.[35]

Buss addressed additional criticisms by declaring that, while certain levels of evolutionary theory were not subject to falsification, derivatives of larger concepts were indeed subject to being disproved.[36] He further stated that the empirical methods used by EP psychologists—such as experimental methods, questionnaire methods, analysis of public documents, observational methods, and psychophysiological techniques—are the same as the ones used by psychologists from other perspectives. Additionally, EP was presented as a paradigm that did not imply genetic determinism or ignore social context and environment.[37]

EP's Current Status

Zimmer's statement that EP may "irrevocably change the traditional sciences"seems premature in view of the concerns presented by its critics.[38] EP appears to be an adolescent paradigm at present—enthusiastic, speculative, and pushing boundaries. Holcomb described and endorsed it as a protoscience;[39] Zimmer concurs. In Holcomb's view, EP has some qualities of a mature science and lacks others; it is more than mere speculation, but not ready to be measured as a mature scientific entity.

Many critics seem to endorse EP as a useful paradigm—but one that is not likely to take over the scientific community.[40] Evolutionary perspectives are declared likely to have an impact on psychological theory, some training in EP is advocated as a part of the education of every psychologist, and evolutionary psychologists are commended for proposing interesting hypotheses for examination and debate.[41] Nevertheless, the proposals that EP theorists have offered are characterized as far from conclusive. While the impact of EP on the social sciences may be less than its advocates propose, the evolutionary perspective does seem to offer intriguing possibilities for dialogue with religion and, ironically, with an old foe—Christianity.

Evolutionary Psychology and Christianity

Zimmer declares that EP theories may be complementary, and not antagonistic, to Christian views.[42] We agree that there are definite areas in which EP perspectives appear to be compatible with Christianity, and certain areas of interaction may prove interesting starting points for dialogue between these two fields. There are also elements which suggest potential and actual conflict and which suggest needed cautions as integration with Christian views is considered.

Particular Compatibilities: EP and Christian Theology

Human nature is flawed. Buss described what he termed an anti-naturalistic fallacy—the tendency for people to have grandiose visions of what it is to be human. According to Buss, humans want to see themselves as one with nature and each other; war and aggression are seen as aberrations, as corruptions of the grand human nature by cultural inadequacies.[43] This view is sharply at odds with the EP position that, through evolution, aggressive and selfish traits have become inherent qualities.[44]

Proponents of what Tooby and Cosmides have labeled the Standard Social Science Model (SSSM) staunchly resist attempts to declare that humans have anything resembling inherent qualities. For SSSM theorists, human nature is essentially viewed as an empty container waiting to be filled by socialization. Accordingly, psychology's role in the SSSM is reduced to the study of the process of socialization and how this process influences domain general capacities. In the SSSM, these capacities must be conceptualized as content free and content independent; the strong emphasis is on human malleability. The

moral appeal of the SSSM, Tooby and Cosmides claim, comes from this malleability and the hope that social interventions can prevent or alleviate the sufferings and problems of humanity.[45]

Wright presented the opposing EP perspective—that accepting the idea of a human nature is the first part of becoming an evolutionary psychologist. He further added that the picture of human nature, understood in EP terms, is not flattering. Wright wrote of the tendencies of this inherent nature: "We are addicted to status ... we are self promoters and social climbers ... our generosity and affection have a narrow underlying purpose ... we value the affection of high status people ..."[46]

The traditional Christian view of humanity closely resembles what EP theorists have proposed: that human nature is inherently self-centered.

As competing paradigms collide, an ideological and moral conflict ensues. Tooby and Cosmides described this conflict as a morality play in which those who view humans as having a nature—and a nature that is selfish—are accused of adopting ideological perspectives that constrain and limit.[47] Buss acknowledged that evolutionary psychologists are often accused of being ideologically driven; in response, he pointed out that many that make this criticism are themselves ideologically driven by the idea—despite the evidence—of human malleability and improvability.[48]

The traditional Christian view of humanity closely resembles what EP theorists have proposed: that human nature is inherently self-centered. All forms of what Christians call sin have been attributed, at least by some theologians, to selfishness.[49] This view of human nature, too, has been criticized by some social scientists as constraining—and also as limiting the potential malleability of human nature. Traditional Christianity has even been attacked as one of the cultural inadequacies that has had a corrupting influence on humans.

The compatibility between the Christian and EP views of human nature is obvious. It is ironic, in view of the past conflicts between these two perspectives, that Christianity and EP—at least on the issue of human nature—are ideologically compatible and similarly criticized by many in the social sciences as morally deficient in "constraining" human potential.

Relativism and Subjectivism Rejected

Tooby and Cosmides said that the social sciences have abandoned the scientific enterprise, and they criticized this turning away from natural sciences toward explanations of social behavior based on relativistic frames of reference. The growing popularity of this perspective, they somewhat cynically suggested, has less to do with illumination than with an aversion on the part of scholars for the difficult task of producing scientifically valid knowledge which is consistent with other knowledge and which can withstand critical examination. They concluded with a damning indictment:

> Those who jettison the epistemological standards of science are no longer in a position to use their intellectual product to make any claims about what is true of the world or to dispute the others' claims about what is true.[50]

Agreement with this statement is evident in the writing of David Snoke, who declared that inductive epistemology was not only the basis for science, but that it provided the foundation for universal ethics from the Christian context. The position of many in modern philosophy that inductive epistemology is dead rests on the premise that there is no absolute certainty which can be used as a starting point. Snoke suggested that science and modern religion had "painted themselves in a corner" in declaring that "anyone can choose to believe anything, and there is nothing we can do about it."[51]

Snoke noted that philosophers and theologians seemed to struggle with ideas of probability and uncertainty in ways that working scientists did not—and that while absolute certainty was philosophically unattainable, working certainty (through the laws of evidence and experience) was imminently feasible—and has served as the basis for most of the scientific advances that have occurred. He also argued that we become certain of religious propositions in Christianity in much the same way. Rather than an emphasis on a large "leap of faith," Snoke contended that the Bible portrays faith as a smaller jump subsequent to a person being convinced through experience and evidence obtained through examining Scripture, witnesses, testimony, and signs.[52] Our view is that faith is an essential element of all scientific—and even nonscientific—views: faith that what has happened in the past will continue to happen in the future, and that we know with

sufficient certainty so that we can base our lives on our understanding of the world around us.

Finally, EP and traditional Christianity may be thought of as sharing concerns about the encroachment of relativism into areas that have heretofore been informed by inductive epistemology. Tooby and Cosmides viewed the anti-scientific sentiment as "leaving a hole in the fabric of our organized knowledge of the world where the human sciences should be."[53] Snoke, who acknowledged that some have sought to protect the faith by constructing epistemologies that prevent any experiences from conflicting with Christianity, viewed such efforts as leading to a relativism that ultimately renders Christian belief incoherent and irrelevant.[54]

Peaceful Coexistence: EP and Genesis

At first glance, the area that has traditionally been the battleground between evolutionists and Christians—how we interpret Genesis—now seems to be the epitome of peaceful coexistence for EP. A common Christian perspective in recent scientific literature seems to be that literary consistency in Genesis is achieved only through a poetic interpretation of the first few chapters of the Bible. There are, however, some interesting evolution-friendly variations on this theme—and some questioning perspectives that echo concerns raised by evolutionary theorists themselves.

Many Christians in the scientific community interpret the early chapters of Genesis as a message filled with poetry and symbolism which was never intended to be a scientific, literal description of creation.[55] The text itself, Waltke asserted, argues against a sequential, historical narrative; the creation of light on the first day—and of the sun, moon, and stars on the fourth day—should serve as indicators that Genesis 1 has been constructed for theological rather than scientific reasons.[56] The conclusion reached by proponents of this view is that interpretations of this passage provide few constraints for scientific conceptualizations of origins.[57]

Other evolution-friendly theories are interesting though more speculative. Wilcox, arguing from evidence in paleoanthropology, suggested that changes in artifacts and behavior occurred around 150,000 years ago which indicated the sudden appearance of anatomically modern beings that bore the "image of God";[58] Zimmer used Genesis 1:26–31, to compare the six days of creation with six epochs of evolutionary development proposed by scientists;[59] and Fischer argued for the insertion of an historical Adam and Eve into an existing race of evolving humans.[60]

While evolution-friendly accounts of Genesis—in both standard and creative form—seem to predominate, other Christian scientists, who incorporate the fossil record and the questions of evolutionists themselves, raise concerns. Clark wrote of a traditional Darwinian view of a slow, continuous evolution as having become untenable for many scientists—many of whom have subscribed to a newer theory known as punctuated equilibrium.[61] Mills also wrote of this theory, proposed by Eldredge and Gould in 1972, which described evolution as progressing with sudden jumps punctuated by longer periods of little change. He noted that this theory was formulated to account for fossil gaps in the geological record—but complained that the theorists provided no mechanism for the sudden appearance of new life forms at the macroevolutionary level. Mills, a professor of biochemistry, proposed that his idea of God as a provider of new genetic information at critical points did not alter but complemented this theory of punctuated equilibrium. This proposal of God as a provider of genetic information also addressed his concerns about the mathematical improbabilities of genetic information needed by complex organisms being supplied from simple one-celled organisms.[62] Newman stated similar concerns, which he declared invalidated evolutionary perspectives; he opted for old-earth creationism—a view which acknowledges the geological record—but advocated (as did Mills) the miraculous interventions of God.[63]

Many Christians in the scientific community agree that evolutionary perspectives and Christianity are at least partly compatible.

Some Christians, however, continue to reject evolution entirely. Johnson, for example, contends that scientific creationism was inadequate on two grounds. First, he argued, evolution has been defined in such a way as to presume metaphysical naturalism—a view inherently in conflict with creationism. Second, he claimed that the data do not support the evolutionary hypothesis. For Johnson, evolution fails both as worldview and as science.[64]

Johnson's view notwithstanding, many Christians in the scientific community agree that evolutionary perspectives and Christianity are at least

partly compatible. Despite this agreement among many Christians and EP advocates, an important area of potential conflict involves the question of whether the field of EP is as open to Christianity.

Potential Conflict: EP's View of Christianity

Zimmer proposes that a universal impulse toward God represents a significant opportunity for Christian integration with EP. He contends that humans have evolved so that they are aware of something beyond nature—something transcendent, otherworldly, or supernatural—because such awareness was adaptive in fostering monogamy and long-term care of offspring. He postulates that religious activity is at least in part biologically motivated. As a result "humans psychologically require the divine in order to raise children productively and to maintain group (or societal) cohesion." He concludes that "the essence of the biblical *creation of humans in the image of God* is unexpectedly imaged by a proposal in evolutionary psychology on the adaptive function of human awareness of something beyond nature."[65]

While Zimmer and many other scientifically minded Christians have been fairly open to evolutionary perspectives, the writing of some EP proponents suggests that evolutionary psychologists may not view Christianity—or religion in general—so charitably. Thus they will likely reject Zimmer's proposals. EP advocate Wright was particularly pointed in declaring that religion allowed the ancient sages to expand their power, keeping the masses satisfied with limited material goods by fostering a future-world orientation. Wright proposed that religious teachings were comparable to the act of injecting heroin to produce a feeling of harmony in the short-term—but with adverse long-term consequences.[66]

At other times EP advocates have been more appreciative of the practical aspects of religion. Wright declared religion to be useful in curbing appetites harmful to evolutionary self-interest, in serving as an intergenerational vehicle for conveying fitness maximizing maxims, and as a proponent of monogamy. He viewed these factors as a stabilizing force in society.[67] Gould theorized that the evolution of larger brains and consciousness forced humanity to deal with mortality. Gould believed that the development of religion was the human answer to this challenge.[68]

EP proponents' reactions to religion may be characterized as cynical and pragmatic. It is the latter position which seems to give the most trouble to Zimmer's belief that a universal impulse toward God represents a significant opportunity for Christian integration with EP. For EP proponents the "God idea" can be easily invoked as an explanation without serious consideration of "the God who is there" (the ontological reality of God).[69] We concur with Zimmer that transcultural expression has been a mark of significance as evolutionary psychologists attempt to identify adaptive mechanisms. However, the ease with which alternative explanations have been constructed for this particular transcultural expression points simultaneously to two areas of concern: the capricious nature of EP's post hoc analysis, and the evidence that EP psychologists often reject the notion that religion points to anything beyond nature.

EP proponents' reactions to religion may be characterized as cynical and pragmatic.

The ease of incorporating Zimmer's hypothesis suggests that hypotheses that are congruent with EP—such as conceptualizing religious mechanisms which fit evolutionary paradigms—may prove less fruitful for integrative efforts than proposals which start from EP expectations and propose counterintuitive hypotheses. Wright touched on this issue when he expressed wonder at the longevity of a religion that proposed parameters that seemed to him counter to evolved appetites.[70] Might other religious practices which are counterintuitive to the EP paradigm prove interesting as beginning points of dialogue between the two fields as well?

Summary and Conclusion

While in agreement with Zimmer that EP provides some unique opportunities for integrative efforts, we are neither so positive about the prospects of EP as a unifying psychological theory, nor so optimistic about its potential for integrative gains. In particular, we are concerned that many EP psychologists hold worldviews no less hostile toward Christianity that those of major proponents of other psychological theories. We are concerned that easy acceptance of EP may be an easy way which is less fruitful than an effort to examine the ways in which EP is in tension with widely held Christian views. Ultimately both agreements and tensions must be explored. But we are concerned that a too-casual endorsement of EP may lull us into eschewing the more difficult—but more important—task of discovering important tensions and disagreements.

Integrative Implications of Evolutionary Psychology

EP's Strengths

- Seeks to develop general theory rather than mini-theory or detached data
- Embracing evolution offers a strong link between social and natural sciences

Criticisms of EP

- Use of post hoc "just-so" stories
- Has not shown support for predictions inconsistent with existing theories
- Methodological weakness and lack of sophistication
- Lacks parsimony
- Linked to controversial social agendas
- EP's weakness: EP is a new psychological theory with unrealized potential

Integrative Implications of EP

- Both EP and Christian theology view human nature as flawed by selfishness
- Both EP and Christian theology reject relativism and subjectivity, affirming a reality which we can trust and which can be sufficiently known to guide our lives
- EP is compatible with the views of origins of some Christians—but not others
- EP largely rejects the ontological reality of God and views religion as only an evolved pattern of behavior

Table 1. Integrative Implications of Evolutionary Psychology

The worldview issues are both subtle and pervasive. They are also vitally important. In the words of Bevan and Kessel,[73]

> most often implicit, ideologies are complex, not easily broken into elements ... they are like sand at a picnic: they get into everything. All of this means that to talk of scholarship and science as separate from the life experience, the intentions, the values, the worldview, and social life of the people who create it is to deny its fundamental character as a human activity.[71]

The challenge for us in dealing integratively with EP psychology is to distinguish sand and sandwich, to consume the one while not being choked by the other.

In short, EP remains a minor theory within psychology. Thus an enthusiastic embrace of EP seems premature. This is equally true for EP as a psychological theory per se and for EP as a theory for integration with Christian beliefs. (See Table 1.) We advocate that Christians proceed with caution rather than full speed ahead. ✣

Notes

[1]J. R. Zimmer, "Evolutionary Psychology Challenges the Current Social Sciences," *Perspectives on Science and Christian Faith* 49, no. 3 (September 1998): 176–84.

[2]Ibid., 176, abstract.

[3]D. M. Buss, "Evolutionary Psychology: A New Paradigm for Psychological Science," *Psychological Inquiry* 6, no. 1 (1995): 1–30; L. Cosmides, J. Tooby, and J. H. Barkow, "Introduction: Evolutionary Psychology and Conceptual Integration," in J. Barkow, L. Cosmides, and J. Tooby, (Eds.), *The Adapted Mind* (New York: Oxford University Press, 1992), 3–15; R. Wright, *The Moral Animal: Why We Are the Way We Are: The New Science of Evolutionary Psychology* (New York: Pantheon Books, 1994).

[4]D. M. Buss, "Evolutionary Social Psychology: Prospects and Pitfalls," *Motivation and Emotion* 14, no. 4 (1990): 265–86.

[5]J. H. Barkow, J. Tooby, and L. Cosmides, *The Adapted Mind*.

[6]R. Wright, *The Moral Animal*.

[7]J. R. Zimmer, "Evolutionary Psychology Challenges the Current Social Sciences," 1.

[8]D. M. Buss, "The Future of Evolutionary Psychology," *Psychological Inquiry* 6, no. 1 (1995): 81.

[9]M. Knight, "Darwinian Functionalism: A Cognitive Science Paradigm," *The Psychological Record* 44 (1994): 271–87.

[10]D. M. Buss, "Evolutionary Psychology."

[11]P. LaCerra and R. Kurzban, "The Structure of Scientific Revolutions and the Nature of the Adapted Mind," *Psychological Inquiry* 6, no. 1 (1995): 62–5.

[12]J. Tooby and L. Cosmides, "The Psychological Foundations of Culture," in J. H. Barkow, J. Tooby, and L. Cosmides, (Eds.), *The Adapted Mind: Evolutionary Psychology and the Generation of Culture.* (New York: Oxford University Press, 1992), 19–36.

[13]D. M. Buss, "The Future of Evolutionary Psychology," 81.

[14]J. Tooby and L. Cosmides, "The Psychological Foundations of Culture." It may be noteworthy that Christian psychologists have proposed that a Christian worldview can unify psychology. G. R. Collins, *The Rebuilding of Psychology* (Wheaton, IL: Tyndale House, 1977); R. L. Koteskey, *Psychology from a Christian Perspective* (Nashville, TN: Abingdon, 1980); R. L. Koteskey, *Psychology from a Christian Perspective*, 2d ed. (Washington, DC: University Press of America, 1991).

[16]P. LaCerra and R. Kurzban, "The Structure of Scientific Revolutions," 62.

[17]J. Tooby and L. Cosmides, "The Psychological Foundations of Culture," 22.
[18]C. R. Harris and H. E. Pashler, "Evolution and Human Emotions," *Psychological Inquiry* 6, no. 1 (1995): 44–6.
[19]M. Knight, "Darwinian Functionalism."
[20]H. R. Holcomb, "Moving Beyond Just-So Stories: Evolutionary Psychology as Protoscience," *Skeptic* 4, no. 1 (1996): 60–6.
[21]Ibid.
[22]Ibid.
[23]H. D. Schlinger, Jr., "How the Human Got Its Spots: A Critical Analysis of the Just So Stories of Evolutionary Psychology," *Skeptic* 4, no. 1 (1996): 68–76.
[24]S. W. Gangestad, "The New Evolutionary Psychology: Prospects and Challenges," *Psychological Inquiry* 6, no. 1 (1995): 38–41.
[25]H. D. Schlinger, Jr., "How the Human Got Its Spots."
[26]L. R. Caporael and M. B. Brewer, "Reviving Evolutionary Psychology: Biology Meets Society," *Journal of Social Issues* 47, no. 3 (1991): 187–95.
[27]N. Cantor, "Social Psychology and Sociobiology: What Can We Leave to Evolution?" *Motivation and Emotion* 14, no. 4 (1990): 245–54.
[28]S. Oyama, "Bodies and Minds: Dualism in Evolutionary Theory," *Journal of Social Issues* 47, no. 3 (1991): 27–42.
[29]C. R. Harris and H. E. Pashler, "Evolution and Human Emotions," *Psychological Inquiry* 6, no. 1 (1995): 44–6.
[30]J. A. Simpson, "A Paradigm Whose Time Has Come," *Psychological Inquiry* 6, no. 1 (1995): 71–5.
[31]R. A. Hinde, "The Adaptionist Approach Has Limits," *Psychological Inquiry* 6, no. 1 (1995): 50–3.
[32]Ibid.; C. B. Travis and C. P. Yeager, "Sexual Selection, Parental Investment, and Sexism," *Journal of Social Issues* 47, no. 3 (1991): 117–29; L. R. Caporael and M. B. Brewer, "Hierarchical Evolutionary Theory: There is an Alternative, and It's Not Creationism," *Psychological Inquiry* 6, no. 1 (1995): 31–4.
[33]L. B. Silverstein, "Evolutionary Psychology and the Search For Sex Differences," *American Psychologist* 51, no. 2 (1996): 160–1.
[34]R. Wright, *The Moral Animal*.
[35]D. M. Buss, "Evolutionary Psychology" and L. Cosmides, J. Tooby, and J. H. Barkow, "Introduction: Evolutionary Psychology and Conceptual Integration."
[36]D. M. Buss, "Evolutionary Social Psychology."
[37]Ibid.
[38]J. R. Zimmer, "Evolutionary Psychology," 176, abstract.
[39]H. R. Holcomb, "Moving Beyond Just-So Stories."
[40]Ibid.; W. G. Graziano, "Evolutionary Psychology: Old Music, But Now on CDs?" *Psychological Inquiry* 6, no. 1 (1995): 41–4; and C. R. Harris and H. E. Pashler, "Evolution and Human Emotions."
[41]C. R. Harris and H. E. Pashler, "Evolution and Human Emotions."
[42]J. R. Zimmer, "Evolutionary Psychology."
[43]D. M. Buss, *The Evolution of Desire: Strategies of Human Mating* (New York: Basic Books, 1994).
[44]R. Wright, *The Moral Animal*.
[45]J. Tooby and L. Cosmides, "The Psychological Foundations of Culture."
[46]R. Wright, *The Moral Animal*, 313, 314.
[47]J. Tooby and L. Cosmides, "The Psychological Foundations of Culture."
[48]D. M. Buss, "The Future of Evolutionary Psychology."
[49]H. C. Thiessen, *Lectures in Systematic Theology* (Grand Rapids, MI: Eerdmans, 1949).
[50]J. Tooby and L. Cosmides, "The Psychological Foundations of Culture," 22.
[51]D. Snoke, "The Problem of the Absolute in Evidential Epistemology," *Perspectives on Science and Christian Faith* 47, no. 1 (1995): 7.
[52]Ibid.
[53]J. Tooby and L. Cosmides, "The Psychological Foundations of Culture," 23.
[54]D. Snoke, "The Problem of the Absolute in Evidential Epistemology."
[55]B. K. Waltke, "The Literary Genre of Genesis, Chapter One," *Crux* 27, no. 4 (1991): 2–10; D. L. Migliore, *Faith Seeking Understanding: An Introduction to Christian Theology* (Grand Rapids, MI: Eerdmans, 1991); M. G. Kline, "Space and Time in Genesis Cosmogony," *Perspectives on Science and Christian Faith* 48, no. 1 (1996): 2–15.
[56]B. K. Waltke, "The Literary Genre of Genesis, Chapter One."
[57]M. G. Kline, "Space and Time in Genesis Cosmogony."
[58]D. L. Wilcox, "Adam, Where Are You? Changing Paradigms in Paleoanthropology," *Perspectives on Science and Christian Faith* 48, no. 2 (1996): 88–96.
[59]J. R. Zimmer, "The Creation of Man and the Evolutionary Record," *Perspectives on Science and Christian Faith* 43, no. 1 (1996): 16–27.
[60]D. F. Fischer, "In Search of the Historical Adam: Part 1," *Perspectives on Science and Christian Faith* 45, no. 4 (1993): 241–51.
[61]J. P. Clark, "Fact, Faith and Philosophy: One Step Toward Understanding the Conflict Between Science and Christianity," *Perspectives on Science and Christian Faith* 46, no. 4 (1994): 242–52.
[62]G. C. Mills, "A Theory of Theistic Evolution as an Alternative to the Naturalistic Theory," *Perspectives on Science and Christian Faith* 47, no. 2 (1995): 112–22.
[63]R. C. Newman, "Scientific and Religious Aspects of the Origins Debate," *Perspectives on Science and Christian Faith* 47, no. 3 (1995): 164–75.
[64]P. E. Johnson, *Darwin on Trial* (Downer's Grove, IL: InterVarsity Press, 1991).
[65]J. R. Zimmer, "Evolutionary Psychology," 183.
[66]R. Wright, *The Moral Animal*.
[67]Ibid.
[68]S. J. Gould, "Exaptation: A Crucial Tool for an Evolutionary Psychology," *Journal of Social Issues* 47, no. 3 (1991): 43–65.
[69]J. R. Zimmer, "Evolutionary Psychology."
[70]R. Wright, *The Moral Animal*.
[71]W. Bevan and F. Kessel, "Plain Truths and Home Cooking: Thoughts on the Making and Remaking of Psychology," *American Psychologist* 49 (1994): 505–9.

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Religion and the Search for Extraterrestrial Intelligence

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Some scientific visionaries have suggested that the best hope for achieving peace and prosperity on Earth, and perhaps immortality itself, is through help obtained by communicating with extraterrestrial civilizations. The idea of a plurality of worlds has a long history, but the scientific search for extraterrestrial intelligence (SETI) began only about forty years ago. Although large amounts of money and scientific effort have been expended in pursuit of these ideas, analysis shows how extremely improbable they are. Recent SETI literature reveals that this effort is sustained by quasi-religious motivations, but both the possibility and improbability of alien contact have theological implications relating to Christology and human significance.

The August 1996 announcement by NASA of meteoritic evidence that life might have existed on Mars some 3.6 billion years ago has given new hope to those who believe that extraterrestrial intelligence exists elsewhere in the universe.[1] This announcement was hailed as "the biggest thing that has ever happened," even though it was qualified by several disclaimers.[2] If evidence for microbial life on Mars is confirmed, it raises new questions about the ubiquity of life. It also does not begin to resolve many other problems that the idea of extraterrestrial intelligence and the quasi-religious faith which sustains it present.

For many centuries, extraterrestrial spiritual beings have been a part of the faith of Western religions. They appear in the form of immortal angels, servants of God who visit Earth with special messages of guidance and salvation. With the rise of modern science and the development of radio astronomy, a new faith has emerged for some scientific visionaries, who believe in the possibility of extraterrestrial material life. It is their hope that such life might have evolved on other planets among the billions of stars in our galaxy, producing higher forms of intelligence which could communicate to us the knowledge and wisdom of their experience, perhaps even imparting the secrets of peace and immortality. Yet a careful analysis of this idea reveals the futility of a search for extraterrestrial intelligence (SETI) and the religious motivations behind it. Such an analysis, however, can lead to a new appreciation for the miracle of human life as we know it.

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The idea of extraterrestrial life and intelligence is not necessarily inconsistent with a Christian perspective. The Roman Catholic theologian and former president of the University of Notre Dame, Father Theodore M. Hesburgh, is enthusiastic about this idea:

> It is precisely because I believe theologically that there is a being called God, and that He is infinite in intelligence, freedom and power, that I cannot take it upon myself to limit what He might have done. Once He created the Big Bang ... He could have envisioned it going in billions of directions as it evolved, including billions of life-forms and billions of kinds of intelligent beings ... As a theologian, I would say that this proposed search for extraterrestrial intelligence (SETI) is also a search of knowing and understanding God through His works—especially those works that most reflect Him. Finding others than ourselves would mean knowing Him better.[3]

Evangelical astronomer Owen Gingerich of the Harvard-Smithsonian Center for Astrophysics agrees: "In Genesis there's a sacred story being told that focuses on us. But there is nothing that precludes intelligent life elsewhere in the universe. It would be extremely arrogant to limit God's creativity to human beings as the only contemplative creatures in the universe."[4] Yet moving from the possibility of extraterrestrial intelligence to an expensive search for radio signals from advanced extraterrestrial civilizations should be based on a rational assessment of the probability that such beings exist. The fact that this probability turns out to be extremely low has significant religious implications.

Historical Background

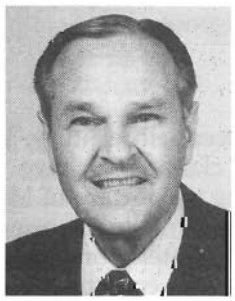
The medieval synthesis of Christian doctrine and Aristotelian cosmology by Thomas Aquinas established the centrality of the Earth and the special place of humans within a finite universe, discouraging the idea of other worlds. Although Thomistic theology came to dominate medieval Christianity, a tradition soon emerged to challenge Aristotelian ideas that might limit the omnipotence of God. In 1277 the Bishop of Paris, Etienne Tempier, issued a condemnation of some 219 propositions that he considered too restrictive of divine omnipotence, including that God could not make several worlds.

Several theologians who questioned Aristotelian ideas raised the possibility of a plurality of worlds. Basing his opinion on Augustine's idea that God could have made a perfect man, William of Ockham, the fourteenth-century Oxford Franciscan, declared it probable that God could create a better world than ours, and certain that he could create an infinite number of worlds identical to ours. Fifteenth-century Cardinal Nicholas of Cusa not only recognized that the universe can have no center, but also suggested the possibility of other earth-like planets, including more illustrious extraterrestrials close to the sun and lunatics on the moon. Although it became heretical to deny that God could create other worlds, it was dangerous to claim that he had.[5]

The Sun-centered system of Nicholas Copernicus not only displaced human life from the center of the universe, but it also implied that the stars are suns like our own. This belief led the Dominican monk, Giordano Bruno, to suggest that there might be an infinite number of suns with inhabited planets and that even stars might be inhabited.[6] He was attracted by the Greek atomic theories of Democritus and Epicurus, who had suggested the idea of an infinity of worlds, as atoms form different combinations in infinite space. Bruno believed that God's omnipotence and infinitude could only be expressed by creating an infinite number of worlds in reality, not just as a hypothetical possibility. Unfortunately, he was arrested in 1592 and his works were condemned by the Inquisition, leading to his death in 1600 when he was burned at the stake.

Protestants also reacted to the plurality of worlds, especially with the increasing Reformation emphasis on the authority of Scripture. In 1578 L. Danaeus stated that the idea of life on other planets should not be accepted since it was not taught in Scripture.[7] This argument is complicated, however, by the fact that planets also are not mentioned in Scripture. Philip Melanchthon argued against the plurality of worlds because their inhabitants might be left without a knowledge of Christ or that his death and resurrection might have been required more than once. Furthermore, Genesis states that God rested on the seventh day and thus did not start work on other worlds.[8]

In the seventeenth century, the scientific revolution brought more speculation about other worlds. Kepler suggested that the moon might be inhabited by beings with large bodies to withstand the long, hot lunar days. He also believed that the four moons of Jupiter, discovered by Galileo, were made by God for the benefit of Jovian inhabitants, proving that other planets are inhabited. This led Kepler to wonder if such beings would infringe on God-given human dominion over his creation.[9] Galileo was more cautious in his *Dialogues Concerning the Two Chief*



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World Systems (1632) when discussing the possiblity of habitation on the moon and planets. His friend Ciampoli warned him against such speculations, since it would invite awkward questions about how the descendants of Adam and Eve reached the moon.[10]

By the end of the seventeenth century, the idea of other worlds became more widely accepted, but with decreasing emphasis on the doctrine of redemption.

English clergyman (later Bishop) John Wilkins took the silence of Scripture not as a ban, but as an invitation to consider the possibility of other worlds. In his book, *Discovery of a World in the Moone* (1638), Wilkins strongly argued for lunar inhabitants, insisting that this idea did not conflict with Scripture. He suggested that intelligent beings on other worlds need not be like humans—fallen from grace; but even if they had, Christ could have died for them also.[11] By the end of the seventeenth century, the idea of other worlds became more widely accepted, but with decreasing emphasis on the doctrine of redemption. Fontenelle's influential book, *The Plurality of Worlds* (French, 1686; English, 1688), shifted attention from the Earth and its puny drama to the vastness of the universe and science as a new kind of theology that believed in many worlds.[12]

Newton's law of universal gravitation implied the universality of natural laws. Other stars, therefore, might have their own planetary systems. His friend, Richard Bentley, used Newtonianism to argue that God would not have made so many stars just for human purposes, and thus they must be for the benefit of their own planetary inhabitants. English theologian Robert Jenkin tried to relate other worlds to a Christian view:

> I observe, that though it should be granted, that some Planets be habitable, it doth not therefore follow, that they must be actually inhabited, or that they ever have been ... And since the fall and mortality of mankind, they may be either for mansions of the righteous, or places of punishment for the wicked, after the resurrection ... And in the meantime, being placed at their respective distances, they do by their several motions contribute to keep the world at a poise, and the several parts of it at an equilibrium in their gravitation upon each other, by Mr. Newton's principles.[13]

For eighteenth-century thinkers, creation prevailed over redemption and the plurality of worlds became commonplace. Alexander Pope's *Essay on Man* (1734) expressed the spirit of the day with its faith in other inhabited worlds:

> He who thro' vast immensity can pierce,
> See worlds on worlds compose one universe,
> Observe how system into system runs,
> What other planets circle other suns,
> What vary'd being peoples ev'ry star,
> May tell why Heav'n has made us as we are.[14]

English naturalist John Ray believed that life on other planets could be used to contemplate God's creative work just as the multitude of species reveal the wisdom and power of God.[15] By the end of the century, Immanuel Kant wrote extensively on extraterrestrial beings without fear of ridicule.

By the middle of the nineteenth century, a new attitude of caution began to discourage extraterrestrial speculation.

By the middle of the nineteenth century, a new attitude of caution began to discourage extraterrestrial speculation. In 1853 philosopher and historian of science William Whewell, Master of Trinity College, Cambridge, and formerly a supporter of other inhabited worlds, published a tract entitled *Of the Plurality of Worlds: An Essay* which attacked the idea of alien beings. This tract produced intense debate on the issue of extraterrestrial life on philosophical, theological, and scientific grounds. Alfred Russell Wallace, the co-founder of the theory of evolution, was especially impressed with the contingent nature of evolution and the sheer improbability of the emergence of human intelligence. Late in life he used this argument against astronomers searching for signs of intelligent life on other planets in a book called *Man's Place in the Universe* (1903). Despite this growing skepticism, a few astronomers persevered in their search for alien intelligence.

The Origins of SETI

By the beginning of the twentieth century, U.S. astronomer Percival Lowell claimed to have observed 437 canals crisscrossing the surface of Mars, leading to speculation that they formed an enormous irrigation network to channel water from melting polar caps to vegetation near the equator.[16] Some feared that such efforts on a dying planet might

lead to an invasion of the Earth for its resources. This fear was exploited in 1938 by Orson Welles' Halloween radio broadcast which dramatized H. G. Wells' novel, *War of the Worlds* (1898), and convinced many that Martians had invaded. The development of new technologies during and after World War II, including radar, rockets, satellites, and space probes, led to a postwar rise in fascination with aliens by nonprofessionals and scientists alike.

The development of new technologies during and after World War II, including radar, rockets, satellites, and space probes, led to a postwar rise in fascination with aliens by nonprofessionals and scientists alike.

During the 1960s, three American Mariner spacecraft passed near Mars and sent back pictures revealing that the canals were an optical illusion. In 1976 two Viking spacecraft which landed on Mars found no evidence of life of any kind. Most scientists agree that life must be based on the chemistry of carbon and water since only carbon has the kind of bonding that can produce the complex molecules necessary for life, and water is its best solvent. The recent discovery that a Martian meteorite contains evidence for life, including carbonate globules that crystallize in the presence of water, minerals in the globules similar to bacterial residue, hydrocarbon compounds, and tubular microfossils similar to but much smaller than the oldest bacteria fossils found on Earth, suggests that microbial life might once have existed on Mars 3.6 billion years ago, continuing the Martian mystique.[17]

Of the nine planets in the solar system, only Earth is known to harbor intelligent life. Recent theories and observations of planet formation suggest that planets might be fairly common for sun-like stars. Among a few hundred billion stars in our galaxy, many could have planets and thus the possibility of life elsewhere seems worthy of consideration. About 100 billion galaxies in the universe vastly increases this possibility, but light from the nearest spiral galaxy (with sun-like stars) takes two million years to reach us. Thus, any realistic possibility of communicating with extraterrestrial civilizations would appear to be limited to our own Milky Way galaxy.

In 1961, at the National Radio Astronomy Observatory in Green Bank, West Virginia, Frank Drake developed a simple equation to estimate the number N of intelligent civilizations in our galaxy.[18] The Drake equation, which came from the agenda for the first SETI meeting (ten participants at Green Bank), is a product of seven factors:

$$N = R_* \times f_p \times n_e \times f_l \times f_i \times f_c \times L$$

where R_* is the rate of star formation per year, f_p is the fraction of stars that have planets, n_e is the average number of planets per star with environments suitable for life to develop, f_l is the fraction of planets with life, f_i is the fraction of planets where intelligent life develops, f_c is the fraction of planets with advanced civilizations, and L is the lifetime of advanced civilizations. At the Green Bank meeting, the product of the first six factors was optimistically assumed to be one, reducing the equation to $N = L$.[19] Thus the lifetime of an advanced civilization became the critical factor, but also the most uncertain.

In 1966, Russian astronomer Iosef Shklovskii and American astronomer Carl Sagan assumed that the factors in the Drake equation are $R_* = 10$ stars/year (100 billion stars formed over the last 10 billion years), $f_p = n_e = f_l = 1$, $f_i = f_c = 0.1$ and $L = 10$ million years to estimate that the maximum possible number N is about a million advanced civilizations in our galaxy (0.001% of all stars).[20] More recent discoveries have shown that the factors in this equation are much smaller than these values. Yet even with this optimistic estimate, which is often quoted in the SETI literature, the average distance between stars with such civilizations would be about five hundred light years.

Two-way communication with extraterrestrial civilizations appears to be all but impossible, since anyone sending a message at the speed of light would have to wait at least a thousand years for a response. However, with the development of radio astronomy since World War II, some astronomers have had high hopes that a properly tuned radio telescope might be able to intercept intelligent radio signals from extraterrestrial civilizations that would have reached a high level of technology several thousands of years ago. A search for extraterrestrial intelligence using radio telescopes has been compared with looking for a needle in a cosmic haystack, since radio signals from even a million advanced civilizations among the hundreds of billions of stars in our galaxy would require observations of several hundred thousand stars to have a chance of finding just one star emitting such signals toward us. Furthermore, for each observed star, a radio telescope

would have to be tuned sequentially to billions of radio-frequency channels.

The modern radio-frequency search for intelligent signals was initiated by SETI pioneers, Giuseppe Cocconi and Philip Morrison in 1959.[21] They called attention to the microwave window from about one GHz (a billion vibrations per second) to ten GHz, where natural radiation noise reaches a minimum value between noise from the galaxy and absorption in the Earth's atmosphere. They also suggested that a natural channel for communicating across space might be the 1.420 GHz frequency (21-cm. wavelength) at which hydrogen atoms vibrate in interstellar space, since an advanced civilization would presumably realize that astronomers would often tune their radio telescopes to this frequency to study the distribution of hydrogen in the galaxy. The hydroxyl (OH) molecule, which combines with hydrogen to form water, also vibrates near this frequency, so this region of the microwave spectrum is called the "cosmic waterhole" by SETI enthusiasts.[22] Extraterrestrial transmitters would have to be beamed toward Earth with higher power than the most powerful radio transmitters on Earth, since these can send signals discernible from cosmic noise only about 500 light years into space.

In 1960 Frank Drake attempted the first modern SETI with an 85-foot dish radio telescope at Green Bank ...

In 1960 Frank Drake attempted the first modern SETI with an 85-foot dish radio telescope at Green Bank in a project he called Ozma, named after the queen of the imaginary land of Oz.[23] He focused on two nearby sun-like stars for about 400 hours and soon picked up radio signals from the direction of the second one, only to find later that they were interference from a terrestrial source. In recent years, multi-channel receivers have been developed that can match Drake's effort in less than a second.

In 1967 a graduate student at Cambridge University named Jocelyn Bell picked up rapid radio pulses from several sources in the galaxy with a new radio telescope consisting of hundreds of wire antennas spread over five acres. Eventually these "pulsars" were shown to be natural sources that could be explained as radio emissions from rapidly rotating neutron stars. After eight years of "listening" with a large radio telescope at Ohio State University, an unusual signal was detected in 1977, but this so-called "Wow!" signal never appeared again. Since 1960, astronomers from half a dozen countries have conducted about 60 SETI searches of several hundred stars with no confirmed results.[24]

The Futility of SETI

The inability to detect artificial radio signals from space led some scientists, including Shklovskii, to question the existence of extraterrestrial intelligence. In 1975 at Cambridge University, Michael Hart argued that advanced civilizations lasting a few million years would explore and colonize the galaxy much like we have explored and colonized the Earth in the last five hundred years.[25] With space travel at about 10% of the speed of light, less than a million years would be required to colonize the entire galaxy. Thus many extraterrestrials, perhaps with advanced medicine giving them life spans of several millennia or longer, should have reached us by now. The fact that no such beings have arrived led him to conclude that there are no such advanced civilizations in our galaxy.

In 1981 U.S. physicist Frank Tipler finally succeeded in publishing an article entitled "Extraterrestrial Intelligent Beings Do Not Exist," after Sagan had refused its publication in two journals.[26] Tipler reasoned that if the galaxy has contained advanced civilizations for millions of years, at least one of them would have sent unmanned probes into our solar system by now. These views echoed a statement by Nobel physicist Enrico Fermi in 1950 known as the Fermi Paradox: "Where are they?" This argument was convincing enough to lead Senator William Proxmire to propose an amendment in 1981 that killed NASA's proposed SETI Cyclops Project. This ten-billion-dollar project would have constructed 1,500 closely spaced radio telescopes, each with a 300-foot dish. Frank Drake claimed it would have been "probably the most rewarding use of tax dollars in history."[27] Despite this setback, more than 100 million dollars of taxpayer money was spent on SETI programs in the 1980s. A similar sum was approved for the NASA-SETI Microwave Observing Project (MOP), which features a megachannel analyzer that can scan 28 million frequencies and automatically identify intelligent signals.[28] MOP was canceled in 1995, but continues as the privately funded Project Phoenix.

Since Shklovskii and Sagan's original optimistic estimate of one million possible extraterrestrial civilizations, many other factors have been identified for inclusion in the Drake equation that lead to a

very low probability for any life-supporting planet. For example, Michael Hart has used computer simulations to show that only G (spectral class) stars have the right mass and luminosity to support a continuously habitable zone for planets.[29] This reduces the rate of suitable star formation (R_*) from 10 stars per year to about 0.001 star per year.

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The fraction of stars with suitable planets (f_p) is also much less than early estimates. Only about 10% of G stars are single (not part of a multiple-star system) and therefore could have stable planetary orbits. In addition only 10% of these rotate slowly enough to have planets. Recent evidence suggests that the formation of sun-like stars with solar systems is strongly affected by the relatively rare phenomenon of a nearby supernova explosion, which occurs only about once every century in our galaxy. In spite of these improbable factors, Rood and Trefil offer a generous probability of 0.1 for planet formation about a suitable star.[30]

Another study by Hart shows that the number of habitable planets per star (n_e) is greatly limited by the fact that only planets differing about 5% from the equivalent earth-sun distance can avoid either a runaway greenhouse effect or runaway glaciation.[31] A similar narrow range for the size, tilt, and rotation rate of a habitable planet is required to retain the right atmosphere and climate. Recent studies show that the unusually large moon of the Earth is critical in maintaining a stable tilt of the Earth's axis and the associated climatic stability required for life.[32] The best theories of the moon's origin suggest that it was captured in a grazing collision by a Mars-size asteroid, an event that may be extremely rare for an earth-size planet.

A habitable planet may also require a Jupiter-size planet beyond its orbit to sweep up asteroids and comets that would otherwise hit it. The Earth is struck by asteroids large enough to cause mass extinctions about every 100 million years. Without Jupiter this rate would be one every 100,000 years—too often to permit the development of higher forms of life.[33] Recent observations of 120 stars have revealed seven with tiny wobbling motions that could be caused by Jupiter-size planets, but all have been much closer than Jupiter to their host star, suggesting that our solar system is not a typical planetary arrangement.[34] Such giant planets moving so closely would have completely disrupted any earth-like planets, perhaps even capturing them by their huge gravitational effects.

The fraction of habitable planets on which life might develop (f_l) is even more problematic, but certainly less than early suggestions of a probability of 1. If the discovery of evidence for microbial life billions of years ago on Mars is confirmed, this fraction might be enhanced, but it also would show that such life does not develop inevitably into higher forms. The development of life depends on many chemical and biological factors, including the formation of simple organic molecules and amino acids, the joining of these molecules into long chains (polymerization), the separation of these polymers into isolated systems, the development of reproductive capacity by these systems, and the formation of these simple reproducing systems into cells and complex organisms. These factors in turn depend on such physical conditions as the formation of ozone to protect from ultraviolet radiation, the right magnetic field strength to prevent excessive cosmic radiation and ozone depletion, and sufficient lightning to fix nitrogen in the atmosphere. Even without considering the special molecular ordering required for viable life, the probability of these events is very low. Rood and Trefil offer a generous probability of 0.01 for these events.

Hart believes that the probability for the formation of a self-replicating gene dominates any of the other probabilities. Using very generous assumptions about the formation of amino acids, nucleotides, polymerization, uniform molecular helicities (right or left handed), and chemical effects that favor the formation of DNA strands, Hart calculates the probability of spontaneous formation of a relatively short strand of DNA (600 nucleotide residues with 100 in the proper order) to be less than 10^{-30} in a period of ten billion years. The simplest known organism, containing about 100 different genes, has a chance of less than $(10^{-30})^{100} = 10^{-3000}$ of spontaneous formation![35] These vanishing probabilities are contested by writers such as Richard Dawkins and Stuart Kauffman, who propose multiple-step selection processes and self-organizing systems to suggest that the origin of life is not very unusual.[36] If such ideas are confirmed, it is hard to understand why life did not begin several times on Earth, pro-

ducing diverse genetic ancestries. Even the simplest form of life on Mars might support the idea that life is not so unusual, unless it originated only once on either Mars or Earth and was then transplanted between them. Hugh Ross gives several reasons to expect microbial life on Mars ejected from Earth.[37]

Most biologists insist that the course followed by evolution is unrepeatable, and that no species can ever evolve twice.

For development of intelligence (f_i) and of advanced technological civilizations (f_c), Rood and Trefil offer very optimistic estimates of 0.5 each, higher even than the Sagan and Shklovskii values of 0.1 for each of these fractions. Most biologists insist that the course followed by evolution is unrepeatable, and that no species can ever evolve twice. Billions of species on Earth over billions of years have resulted in only one with enough intelligence to develop technology, compared to about 40 species that have developed various kinds of eyes. Thus, most evolutionary biologists such as George Gaylord Simpson tend to be much more pessimistic than SETI enthusiasts about the development on other planets of any kind of intelligence with which we could communicate, concluding that its probability is vanishingly small.[38] This neo-Darwinian consensus would be challenged if an independent origin for life on Mars is confirmed, and would be completely shattered if signals were received from alien civilizations.

Depending on how many parameters are considered in each of the first six factors of the Drake equation, combined probability estimates range from a "conservative" value of about 10^{-7} by Rood and Trefil to a very "pessimistic" value of only 10^{-42} by Hugh Ross.[39] Ross considers only astronomical factors that are much less likely to benefit from correlating factors such as the multiple-step processes or self-organizing systems in biology. Thus, even if the Mars data show that life is not improbable in the right environment, and if the lifetime of an advanced civilization (L) is as long as a million years, the probable number (N) of planets in a galaxy with an advanced civilization is still less than one. Taking into account all the factors considered by Ross leads to a vanishing probability that life could exist anywhere in the observable universe of some 10^{22} stars, suggesting that the existence of life as we know it is nothing short of amazing.

Religious Implications of SETI

Both the possibility and the improbability of extraterrestrial intelligence have interesting religious implications. In view of the many new parameters entering into the Drake equation that reduce the probability of finding extraterrestrial intelligence to a very small value, it is surprising that SETI efforts continue to attract so much interest and funding. Frank Drake's recent autobiographical history of the SETI movement reveals some interesting religious motivations. In fact, his desire to communicate with extraterrestrials from early childhood appears to be a substitute for his traditional religious (Baptist) background:

> I have been waiting for this moment nearly all my life. Indeed, if there is anything unusual about my otherwise normal childhood, it is that I started tracing my ties to alien civilizations of intelligent life in the universe at age eight. I did this in spite of my family's fundamentalist religious beliefs and despite their scorn for fantastic ideas.[40]

SETI enthusiasts have a strong faith in a higher intelligence which is seeking to communicate with us and which can change our lives and solve our problems. Drake begins his book with these confident affirmations:

> Now, after all our efforts over the past three decades, I am standing with my colleagues at last on the brink of discovery ... the imminent detection of signals from an extraterrestrial civilization. This discovery, which I fully expect to witness before the year 2000, will profoundly change the world. The point of this book, as of my life's work, is that interstellar contact will enrich our lives immeasurably.[41]

The SETI hope is that contact with alien civilizations, even if limited to one-way radio reception, will provide a higher level of knowledge that might lead to world peace and human salvation. Drake expresses this hope with the eloquence of a true believer:

> I fully expect an alien civilization to bequeath to us vast libraries of useful information, to do with as we wish. This "Encyclopedia Galactica" will create the potential for improvements in our lives that we cannot predict. During the Renaissance, rediscovered ancient texts and new knowledge flooded medieval Europe with the light of thought, wonder, creativity, experimentation, and exploration of the natural world. Another, even more stirring Renaissance will be fueled by the wealth of alien scientific, technical and sociological information that awaits us.[42]

The SETI hope extends to the possibility of immortality itself; but it falls short of eternal life since it can't survive the end of the universe, whether by a bang or a whimper:

> I suspect that immortality may be quite common among extraterrestrials. By immortality I mean the indefinite preservation, in a living being, of a growing and continuous set of memories of individual experience ... Sometimes, when I look at the stars... I wonder if, among the most common interstellar missives coming from them, is the grand instruction book that tells creatures how to live forever.[43]

Although these religious motivations in the SETI movement may appear naive, other more meaningful religious implications follow from the possibility of extraterrestrial life. Nancey Murphy, theologian and philosopher of science at Fuller Theological Seminary, argues that our significance lies not in being the only intelligent creatures, but in our capacity for relationship with God. Thus she believes "that God's design of the universe should allow for as many relationships as possible," so it is "theologically conceivable that God's creative intentions should include the evolution of other life forms, wherever possible, with comparable intellectual and emotional capacities." She concedes that this possibility raises questions about the special place of humans in the biblical account and the uniqueness of Jesus in the Incarnation.[44]

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One answer to the problem of the uniqueness of Jesus and the Incarnation was suggested in 1952 by Oxford cosmologist E. A. Milne:

> God's most notable intervention in the actual historical process, according to the Christian outlook, was the Incarnation. Was this a unique event, or has it been re-enacted on each of a countless number of planets? The Christian would recoil in horror from such a conclusion. We cannot imagine the Son of God suffering vicariously on each of a myriad of planets.[45]

Appealing to the new science of radio astronomy, Milne suggested a possible solution through interstellar radio evangelism by beaming the Christian message into space:

> In that case there would be no difficulty in the uniqueness of the historical event of the Incarnation. For knowledge of it would be capable of being transmitted by signals to other planets and the re-enactment of the tragedy of the crucifixion in other planets would be unnecessary.[45]

This resolution was rejected by Oxford philosopher and Anglican priest E. L. Mascall in his 1956 Bampton Lectures. He argued that Milne's theology is deficient concerning the Passion of Christ in supposing that "the necessary and sufficient condition for it to be effective for the salvation of God's creatures is that they should *know about it*." Mascall felt that this was in sharp contrast with the classical tradition of Christian thought:

> For the latter, the essence of redemption lies in the fact that the Son of God has hypostatically united to himself the nature of the species that he has come to redeem ... It would be difficult to hold that the assumption by the Son of the nature of one rational corporeal species involved the restoration of other rational corporeal species (if any such exist) ... Christ, the Son of God made man, is indeed, by the fact that he has been made man, the Saviour of the world, if "world" is taken to mean the world of man and man's relationships; but does the fact that he has been made man make him the Saviour of the world of non-human corporeal rational beings as well? This seems to me to be doubtful ... [46]

Mascall also rejected Milne's view of "the tragedy of the crucifixion" as incomplete in not recognizing that the "horror of the crucifixion of God incarnate has been transformed by his resurrection into the supreme glory of the redemption of the human race ... If the horror is not unrelieved but is changed into victory and glory, why cannot the change happen again and elsewhere?" This led Mascall to his preferred alternative that the Incarnation is repeated on other planets:

> The suggestion which I wish to make, with all the tentativeness that is proper to a matter about which we are in almost complete ignorance, is that there are no conclusive *theological* reasons for rejecting the notion that, if there are, in some other part or parts of the universe than our own, rational corporeal beings who have sinned and are in need of redemption, for those beings and for their salvation the Son of God has united (or one day will unite) to his divine Person their nature, as he has united to it ours ... [If] the Incarnation takes place not by the conversion of the Godhead into flesh but by

> the taking up of manhood into God, there seems to be no fundamental reason why, in addition to human nature being hypostatically united to the Person of the divine Word, other finite rational natures should not be united to that Person too.[47]

This solution seems preferable to Milne's on both Christological and scientific grounds, since it recognizes the true nature of the Incarnation and would apply to alien civilizations too far removed in time and space from Earth to ever hear about the crucifixion of Jesus. Paul Tillich seems to agree with this view, but from a cosmic perspective:

> Man cannot claim to occupy the only possible place for Incarnation ... The interdependence of everything with everything else in the totality of being includes a participation of nature in history and demands a participation of the universe in salvation. Therefore, if there are non-human "worlds" in which existential estrangement is not only real ... but in which there is also a type of awareness of this estrangement, such worlds cannot be without the operation of saving power within them.[48]

Another theological problem arising from the possibility of a message from an alien civilization is that it would very likely be far in advance of ours, challenging Christian ideas about human dominion over creation. Since our solar system is only about five billion years old compared to other stars known to be as much as ten billion years old, any other alien community that communicates with us is likely to be at least a few million years more advanced than our rather recent technological society. Since even a modest advantage in technology can easily appear as magic, such super-advanced aliens who have survived this long would be a challenge to our traditional religious values. Thus they might appear to be gods and raise further questions about human significance in the universe. In Sagan's 1985 novel *Contact*, advanced alien signals lead to secrets about the universe that reveal an intelligent design. Fred Hoyle's 1983 nonfiction book, *Intelligent Universe*, offers a similar view of godlike aliens who design the conditions needed for carbon-based life and spread it through the universe.[49]

Religious implications follow not only from the possibility of extraterrestrial life, but also from the failure of SETI efforts to detect alien signals and from the increasing evidence that intelligent life may be unique to the Earth. For five hundred years, Western culture has been dominated by the Copernican idea that humans are not a central aspect of the universe, but only an accidental result of impersonal forces acting on an average planet circling a typical star among billions in the universe. If evidence that confirms increasingly smaller probabilities for the conditions for life to occur elsewhere continues to accumulate, then the existence of human life on Earth might again be seen as unique and special, reinforcing the biblical revelation of human significance.

The apparent uniqueness of human life has begun to lead some scientists to recognize that our existence must influence the way we understand the universe ...

The apparent uniqueness of human life has begun to lead some scientists to recognize that our existence must influence the way we understand the universe, rather than the usual argument that the existence of humanity is accidental and insignificant. In 1974 British physicist Brandon Carter coined the term "anthropic principle" to describe this kind of reasoning. In its strong form, the anthropic principle asserts "that the Universe ... must be such as to admit the creation of observers within it at some stage." The weak form states "that our location in the universe is *necessarily* privileged to the extent of being compatible with our existence as observers."[50]

The evidence that life requires such fine tuning to beat impossible odds has been compelling enough to lead some to suggest the existence of numerous universes, and that ours just happened by chance to have the right conditions for life. Others have suggested that an oscillating sequence of universes has finally produced one that supports life, in the same way that enough throws of the dice will eventually give the desired result. Although a multiple-universe hypothesis might be one way to resolve the vanishing probability problem, it is a solution with no observable basis and seems to violate the principle that the simplest among equivalent explanations is the best.

If our existence determines the design of our universe, it would seem far simpler and more rational to accept the traditional theistic principle that a Creator has designed our finely tuned universe specifically to contain intelligent life that could understand and appreciate his creation. George Greenstein expresses it this way:

> As we survey all the evidence, the thought insistently arises that some supernatural agency—or rather, Agency—must be involved. Is it possible that suddenly, without intending to, we have stumbled

upon scientific proof of the existence of a Supreme Being? Was it God who stepped in and so providentially crafted the cosmos for our benefit?[51]

The infinitesimally small probabilities in the microcosm of the gene and the macrocosm of the universe suggest that biology and cosmology are mutually intelligible only if the conditions for human existence were specified in advance by a Creator, who continues to pervade and guide the universe with his presence. ✣

Notes

[1]John Wilford, "Signs of Primitive Life on Mars are Found in Ancient Meteorite," *New York Times* (August 7, 1996): A1, 11.

[2]John Pike, Federation of American Scientists, quoted in *Newsweek* (August 19, 1996): 56.

[3]Quoted by Frank Drake and Dava Sobel in *Is Anyone Out There? The Scientific Search for Extraterrestrial Intelligence* (New York: Delacorte Press, 1992), 191.

[4]Quoted by Kenneth L. Woodward in "A Vindication of God," *Newsweek* (August 19, 1996): 58.

[5]John Hedley Brooke, *Science and Religion: Some Historical Perspectives* (Cambridge: Cambridge University Press, 1991), 62–3.

[6]Giordano Bruno, *On the Infinite Universe and Worlds* (1584), translated by Dorothea Waley Singer, in *Giordano Bruno: His Life and Thought* (New York: Henry Schuman Publishers, 1950).

[7]L. Danaeus, *The Wonderful Workmanship of the World* (London: 1578), 22.

[8]Brooke, *Science and Religion*, 97.

[9]Paul Davies, *Are We Alone? Philosophical Implications of the Discovery of Extraterrestrial Life* (New York: Basic Books, 1995), 5–6.

[10]Brooke, *Science and Religion*, 105.

[11]Brooke, *Science and Religion*, 88–9.

[12]Arthur Lovejoy, *The Great Chain of Being* (Cambridge: Harvard University Press, 1953), 131.

[13]Robert Jenkin, *The Reasonableness and Certainty of the Christian Religion* (London, 1700), II, 222.

[14]Alexander Pope, *Essay on Man*, Maynard Mack, ed. (New Haven: Yale University Press, 1951), I, lines 23–28.

[15]John Ray, *The Wisdom of God Manifested in the Work of Creation* (11th ed., 1743), 368–9.

[16]Percival Lowell, *Mars as the Abode of Life* (New York: The Macmillan Company, 1908), excerpted by Donald Goldsmith in *The Quest for Extraterrestrial Life: A Book of Readings* (Mill Valley, CA: University Science Books, 1980), 76–9.

[17]David S. McKay, et al., "Search for Past Life on Mars: Possible Relic Biogenic Activity in Martian Meteorite ALH84001," *Science* 273 (August 16, 1996): 924–30.

[18]Drake and Sobel, *Is Anyone Out There?* 52.

[19]Ibid., 55–62.

[20]Iosef Shklovskii and Carl Sagan, *Intelligent Life in the Universe* (San Francisco: Holden-Day, 1966), 410–3.

[21]Giuseppe Cocconi and Philip Morrison, "Searching for Interstellar Communications," *Nature* 184 (1959): 844.

[22]See, for example, Emmanuel Davoust, *The Cosmic Waterhole* (Cambridge, MA: MIT Press, 1991).

[23]Frank Drake, "Project Ozma," *Physics Today* 14 (1961): 40.

[24]A list of SETI searches is given by Drake and Sobel in *Is Anyone Out There?* 253–7.

[25]Michael H. Hart, "An Explanation for the Absence of Extraterrestrials on Earth," *The Quarterly Journal of the Royal Astronomical Society* 16 (1975): 128.

[26]Frank J. Tipler, "Extraterrestrial Intelligent Beings Do Not Exist," *Physics Today* 34 (April 1981): 9.

[27]Drake and Sobel, *Is Anyone Out There?* 140.

[28]Ibid., 222.

[29]Michael H. Hart, "Habitable Zones about Main Sequence Stars," *Icarus* 37 (1979): 351–7.

[30]Robert T. Rood and James S. Trefil, *Are We Alone? The Possibility of Extraterrestrial Civilizations* (New York: Charles Scribner & Sons, 1981), 31–9, 48–59.

[31]Michael H. Hart, "The Evolution of the Atmosphere of the Earth," *Icarus* 33 (1978): 23–39.

[32]William R. Ward, "Comments on the Long-Term Stability of the Earth's Obliquity," *Icarus* 50 (1982): 444–8; Jacques Laskar and P. Robutel, "The Chaotic Obliquity of the Planets" and "Stabilization of the Earth's Obliquity by the Moon," *Nature* 361 (1993): 608–12, 615–7.

[33]Robert Naeye, "OK, Where are They?" *Astronomy* 24 (July 1996): 37–43.

[34]David C. Black, "Other Suns, Other Planets?" *Sky and Telescope* 92 (August 1996): 20–7; Robert Naeye, "New Solar Systems," *Astronomy* 24 (April 1996): 50–5.

[35]Michael H. Hart, "Atmospheric Evolution, the Drake Equation, and DNA: Sparse Life in an Infinite Universe," *Physical Cosmology and Philosophy*, ed. John Leslie (New York: Macmillan, 1990): 256–66.

[36]Richard Dawkins, *The Blind Watchmaker* (New York: W.W. Norton, 1986), Ch. 3; Stuart Kauffman, *The Origins of Order* (Oxford: Oxford University Press, 1993).

[37]Hugh Ross, *The Creator and the Cosmos* (Colorado Springs: NavPress, 1993), 144–5.

[38]George Gaylord Simpson, "The Nonprevalence of Humanoids," *Science* 143 (1964): 769.

[39]Rood and Trefil, *Are We Alone?* 80–96, 122; Hugh Ross, *The Creator and the Cosmos*, 134.

[40]Drake and Sobel, *Is Anyone Out There?* 2.

[41]Ibid., xii–xiii.

[42]Ibid., 160

[43]Ibid., 160–2.

[44]Nancey Murphy, "Jesus and Life on Mars," *Christian Century* 113 (October 30, 1996): 1028–9.

[45]E. A. Milne, *Modern Cosmology and the Chrisian Idea of God* (Oxford University Press, 1952), 153.

[46]E. L. Mascall, *Christian Theology and Natural Science* (New York: Ronald Press, 1956), 37–9.

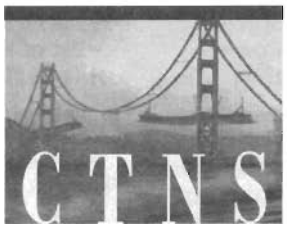
[47]Ibid., 39–41.

[48]Paul Tillich, *Systematic Theology*, Vol. II (Chicago: University of Chicago Press, 1957), 96.

[49]Carl Sagan, *Contact* (New York: Simon and Schuster, 1985); Fred Hoyle, *The Intelligent Universe* (New York: Holt, Rinehart and Winston, 1984).

[50]Brandon Carter, "Large Number Coincidences and the Anthropic Principle in Cosmology," in M. S. Longair, ed., *Confrontation of Cosmological Theories with Observational Data* (International Astronomical Union, 1974): 291–8.

[51]George Greenstein, *The Symbiotic Universe: Life and Mind in the Cosmos* (New York: William Morrow and Company, 1988), 27.



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The Prospects for a "Theistic Science"*

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Phillip Johnson argues that evolutionary theory rides on the metaphysical coattails of a scientific naturalism, and he claims that one may reject this in favor of a theistic science. I examine the prospects for such a science. Could science investigate the creation hypothesis in the same manner that it investigates the natural world? The answer depends upon one's conception of the Creator. I explore two concepts—a supernatural and a naturalized notion—using historical and hypothetical examples. In the first case "theistic science" is not science, and in the second case it is scientific, but not truly theistic.

Phillip Johnson argues that evolutionary theory rides on the metaphysical coattails of a scientific naturalism which denies by fiat any supernatural intervention, and that if it were not for this "dogmatic speculative philosophy" creationism would be recognized as the better theory. In my published exchange with Johnson in *Biology and Philosophy*, I showed that Johnson failed to recognize that science is not based upon a dogmatic ontological or metaphysical naturalism. Rather, science uses naturalism only in a heuristic, methodological manner.[1] I also argued that methodological naturalism is not assumed dogmatically but follows from reasonable evidential requirements—most importantly, that hypotheses be intersubjectively testable by reference to law-governed processes. In his reply, Johnson, citing Newton, claimed that one could pursue a theistic science.[2]

Although Newton did bring in God to underpin his physics, he explicitly endorsed many of the methodological rules that naturalism recommends.[3] Johnson goes much further than Newton and advocates a theistic science that incorporates supernatural interventions and allows appeal to divine explanations. In this paper I examine the prospects for such a theistic science. Could science investigate the creation hypothesis in the same manner that it investigates the natural world and the human intelligent creators that populate it? The answer, I argue, depends upon one's conception of the Creator. One who assumed God's omniscience and omnipotence, for example, might argue that positing ad hoc supernatural interventions to, say, "recall" the dinosaurs and regularly introduce new life forms is not a very high view of the Deity. But such arguments would take us into dangerous theological waters. As a simplification, I will consider just two sorts of concepts of the Creator—a supernatural notion and a naturalized notion. My argument is that in the first case "theistic science" is not science, and that in the second case it is not theistic.

Johnson's definition of "creationism" gives the essential features of his proposed new science. The key elements are a Creator who is *supernatural*, who not only initiates, but miraculously intervenes to *control* the process with some *purpose* in mind.[4] Our question is whether science should continue to pur-

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sue naturalistic explanations or whether it should entertain supernatural "explanations" of this sort. I argue that science should eschew appeal to supernatural explanations as a methodological heuristic, but this is not because of any bias against creationism. The recommendation holds for any supernatural theory, because of the characteristics of the idea of the supernatural.

The most basic characteristic of supernatural agents and powers is that they are above and beyond the natural world and its agents and powers—they are not constrained by natural laws. Indeed, this is the very definition of the term. Some views say that since a supernatural creator made the laws in the first place, that being has the (miraculous) power to break them.

The second characteristic of the supernatural is that it is inherently mysterious to us. As natural beings, our empirical knowledge must come via natural laws and processes. If we could use natural knowledge to understand supernatural powers, then they would not be supernatural. The lawful regularities of our experience do not apply to the supernatural world. If there are other sorts of "laws" that govern that world, then they can be nothing like those that we understand. For this reason, occult powers are profoundly mysterious to us.

The same point holds true about divine beings—we cannot know what they would or would not do in any given case. God works, they say, in mysterious ways. When Ptolemy's epicycle theory of the planetary system was explained to Alphonso X, king of Castile, he reportedly commented that if God had consulted him at the creation, the universe would have been on a better and simpler plan.[5] Defending the complexity of his theoretical models against another critic who made the same point, Ptolemy purportedly replied, "You may complain that these models are not simple, but from the point of view of God, who knows what is simple." Ptolemy was right; we cannot say that our notion of simplicity is at all relevant to what God's might be, or if it is even an important property for him. Scientific models must be judged on natural grounds of evidence, for we have no supernatural ground upon which we can stand.

A third characteristic is that supernatural beings and powers are not controllable by natural beings. Though our secret desire may be to gain esoteric power through contact with the supernatural, we seem to recognize at a deep level that such control would be impossible. The very notion of the "Faustian bargain" carries this warning against the temptation of thinking one can control supernatural powers. This holds true of our relationship to the divine Creator as Christian creationists usually conceive him. God controls the world and, though we may control ourselves, we cannot control God. Indeed, part of what it means to accept Christ, on the evangelical view, is to relinquish even the control we have of ourselves and to turn our lives over to God's will. We may control the natural world only because it is governed by physical laws that must be obeyed even when we are pulling the strings. Inherent in the very idea of the supernatural is the fact that it stands above natural laws and thus outside the possibility of our control. If God were really under our control in any sense, then we could not say he was omnipotent or very godlike.

This is why supernatural explanations should never enter into scientific theorizing. Science operates by empiricist principles of observational testing; hypotheses must be confirmed or disconfirmed by reference to intersubjectively accessible empirical data. One supports a hypothesis by showing consequences obtain which would follow if what is hypothesized were true. But supernatural theories can give no guidance about what follows from their supernatural components. We can cite no constraints upon the powers of supernatural agents. Usually this is the picture of God that Johnson presents. He says that God could create out of nothing or use evolution if he wanted; God is "omnipotent."[6] He says God created in the "furtherance of a purpose,"[7] but that God's purposes are "inscrutable"[8] and "mysterious."[9]

A god that is all-powerful and whose will is inscrutable may be called upon to "explain" *any* event in any situation, and this is one reason for the methodological prohibition against such appeals in science. Because of this feature, supernatural hypotheses remain immune from disconfirmation. Also, we confirm causal laws by performing controlled experiments in which the purported independent variable is made to vary while all other factors are held constant and we observe the effect on the dependent variable. But, again, we have no control over supernatural entities or forces. Finally, if we allow science to appeal to supernatural powers in any way without a test, then the scientist's task would become too easy. One could always call upon the gods for quick theoretical assistance. Once supernatural explanations are permitted all empirical investigation could cease, for scientists would have a ready-made explanation for everything.

I believe that such abstract considerations provide sufficient reason to reject appeals to supernatu-

ral explanations in science. Nevertheless, it will be worthwhile to make the point concrete by showing the problems of introducing the possibility of supernatural interventions in a practical setting. I will consider another area that Johnson recommends—the law. I will focus on just two problematic ways that Johnson's view would transform our legal system.

The first follows from Johnson's insistence that science admit the reality of supernatural influences in the daily workings of the world. For the law to take this seriously, it would have to be open to both suits and defenses based on possible divine and occult interventions. Imagine the problems that would result if the courts had to accept legal theories of this sort. How would a judge rule on whether to commit a purportedly insane person to a mental hospital for self-mutilation when that person claimed that the Lord had told her to pluck out her eye because it offended her? How could the legal system handle torts if it had to consider accusations that a defendant caused the plaintiff's miscarriage by casting an evil eye on her, or had hexed the plaintiff's cow? We need only look to legal history to see the sorry effects of such a system.

The law once did take such accusations of occult interventions seriously. Witchcraft is a good example. Taking the Bible seriously, the law incorporated the scriptural command that one not suffer a witch to live. In the Renaissance, the Catholic Church wrestled with the legal implications of this worldview; in 1484 Pope Innocent VIII appointed Heinrich Kramer and Jakob Sprenger as inquisitors and they developed procedures to investigate and prosecute people accused of witchcraft.

This leads us to the second significant effect of introducing Johnson's view into the law—a radical dismissal of ordinary standards of evidence. The most common evidence upon which someone was found guilty of witchcraft was simply the accusations of others. Interestingly, a few physical signs also were supposed to count as evidence, such as the "Devil's mark," an area of skin that seemed to be insensitive to pain, supposedly caused by contact with the devil's claw when the pact was sealed. Confessions under torture were also accepted, though again defendants were at a disadvantage for it was thought that *refusing* to confess under torture was also a sign of guilt. They thought that only a witch, insensitive to pain (perhaps with supernatural aid), could withstand the torture. Judges were warned to be especially wary because the interventions of demons could cause illusions. As proof of this power, one author cited the story from St. Gregory's first Dialogue telling of a woman "who thought she was eating lettuce but instead ate a devil in the form of a lettuce or, possibly, invisible within it."[10] The authority of a saint was supposed to be proof of this supernatural power, but how could we, ordinary natural folk, know a supernatural being was in the lettuce?

I claim that a theistic science cannot overcome this evidential problem. It has arisen in the creationism debate before, when "mature earth" creationists suggested that the earth is, in fact, only six thousand years old, but that God gave it the appearance of great age. The issue is not just whether God would deceive us in this way, but how we could *ever* check such a possibility. We philosophers like to have our beginning students consider a hypothetical scenario in which the universe was created just five *minutes* ago with ourselves having been given a seamless set of memories of a past that never occurred. No empirical evidence could rule out such a scenario.

Given that the core creationist hypothesis invokes special supernatural interventions, we should expect some answer to the demon lettuce problem. The Darwinian view holds that the evolutionary processes are working all the time, and we may observe mutation, recombination, inheritance, natural selection, and the resultant changes in gene frequencies in populations. What can the theistic scientist do? On this point I now issue a challenge to Johnson: Are divine interventions occurring today in particular cases? If so, which ones, and how do we check? If not, how do we know?

Returning to Johnson's definition of creationism, we see that the problem of the lettuce affects his view in still deeper ways. Johnson dismisses deistic views of creation and demands ongoing direct control. Therefore, it is fair to ask how he supposes that control to work. The Darwinian can specify a fair number of the sorts of causal processes that control evolution, fulfilling the basic requirement for a scientific explanation. The second challenge to creationists is to tell us their alternative divine control process. May theistic science appeal to ex nihilo miracles or other control processes? Does God create life forms by selecting the variations that will survive, or by causing the variations upon which selection occurs? The lettuce problem reappears in all these possibilities.

Finally, consider the third element of Johnson's definition—that God creates for a *purpose.* How is a theistic science to discover God's purposes? Consider creationist Jerry Falwell's claim that AIDS was created by God to punish homosexuals, drug-users,

and others for their sinful lifestyle. Naturalistic science simply proceeds by seeking a natural explanation and treats AIDS like other diseases, and nothing in its methodology allows it to test such moral or teleological hypotheses about God's possible purposes. The problem of the demon lettuce is particularly keen here, and its implications especially chilling. How could a theistic science test Falwell's teleological hypothesis about God's ultimate purpose for AIDS, or for anything whatsoever?

Such considerations show why a "theistic science" would not be scientific if it contained a supernatural conception of God. Let us now turn to the second horn of the dilemma I posed earlier.

When the methodological naturalist says that science should not deal with "the supernatural" that does not mean that everything which we currently think of as supernatural—ghosts, for example—necessarily is. Perhaps these are natural, law-governed phenomena that we have not discovered yet. Philosophers love to use *Star Trek* examples to illustrate hypothetical conceptual possibilities, so let me take a case from one episode to develop my point.

The episode involved the people of a world who transported themselves to an asteroid in the belief that their souls would be set free of their bodies to live on in a blissful afterlife. The usual conflicts and misunderstandings are worked out as the crew tries to deal with this seemingly absurd practice. In the end, however, they are forced to reevaluate their skepticism when their sensors detect unusual energy patterns around the asteroid. These energy patterns exhibit individual coherence and excitations which appear to match the electrical activity patterns of people's brains. In this science-fiction example, it looks as if science has tested and confirmed the existence of ghosts and a spirit afterlife.

In one sense this seems right. If such evidence were found, then a new scientific specialty could arise which investigates hypotheses about this afterlife. In our own real world, we have not found such evidence but is it not possible that we could? If we agree with this, then, similarly, why could there not be a science that incorporates theistic interventions? But here is the rub: even in the *Star Trek* example, are we really talking about "ghosts" and a "spirit afterlife" in the way we ordinarily conceive of them? In the episode, the departed "souls" turn out to be "coherent energy patterns." They interact causally with other matter and energy, of course, or the sensors would not have picked up their "energy signatures." However, if they were energy in the ordinary scientific sense, then it now would be possible to exert causal influence upon them in the usual ways. Presumably we could manipulate or disrupt them as we can other forms of energy. Perhaps we could "kill" them. At this point we should be beginning to feel a little uncomfortable about our earlier conclusion about what was confirmed here.

By discussing the confirmation of "ghosts" in this way we have tacitly taken them out of the supernatural realm and placed them squarely in the natural world. To conceive of ghosts as supernatural entities is to consider them to be outside the natural realm, outside the law-governed world of cause-and-effect physics. But to say that science could test and confirm their existence, as in our hypothetical case, is to reconceive them as natural entities. Perhaps there really are "coherent energy patterns" as the story postulates, but such "ghosts" are no longer supernatural—they have been naturalized. Surely the Christian will properly object that, whatever these things are, they are definitely not departed souls in the religious sense of the term.

So what does this tell us about theistic science? How does God figure in this picture? Will theists be happy to think of the Creator as a scientific hypothesis as we just considered the hypothesis of a spirit afterlife? For the creation hypothesis to be scientific, it must be intersubjectively testable and fit within the framework of law-governed cause-and-effect relationships. This is the core of what it means to be a natural object and to be amenable to scientific investigation. Being constrained by this sort of epistemological approach as the means of gathering public knowledge about the empirical world is just what it is to be a methodological naturalist. This is no different from what we tacitly assume in everyday situations. All science does is make careful extensions of our ordinary experience in what is simply a more precise and explicit version of the ordinary way we get such knowledge.

In proposing a theistic science, Johnson claims to be expanding science to supernatural possibilities undreamed of in naturalist philosophy. Yet what he is really doing is reducing God to a scientific object. Ironically, Johnson may not be a supernaturalist after all, but a super naturalist. On such a naturalized conception of God, one could have a theistic science, but like the *Star Trek* example, it is not theistic in the religious sense.

The design argument works in just this way, drawing an inference to the nature of God from what is already known and familiar to us in human, natural terms. God becomes a watchmaker in the sky, a divine genetic engineer, or a soupped-up "in-

telligence." But philosophers long ago revealed the flaws in the design argument, and Scripture itself warns against analogizing God to human experience. As Isaiah 40:18 rhetorically asks, "To whom then will you liken God, or what likeness compare with him?"

Johnson quotes John 1:1–3 as the scriptural basis of his theistic science, but Christians might better judge this passage and the prospects for a theistic science in the light of another New Testament passage:

> O the depth of the riches and wisdom and knowledge of God! How unsearchable are his judgments and how inscrutable his ways! (Rom. 11:33). ✣

References

[1]Robert T. Pennock, "Naturalism, Evidence and Creationism: The Case of Phillip Johnson," *Biology and Philosophy* 11, no. 4 (1996): 543–59 and ———, "Reply: Johnson's Reason in the Balance," *Biology and Philosophy* 11, no. 4 (1996): 565–8.

[2]Phillip Johnson, "Response to Pennock," *Biology and Philosophy* 11 (1996): 561–3.

[3]Robert T. Pennock, "Reply: Johnson's Reason in the Balance," 568.

[4]Phillip E. Johnson, *Darwin on Trial*, 1st ed. (Washington, DC: Regnery Gateway, 1991), 4.

[5]William Whewell, *History of the Inductive Sciences*, 3d ed. with additions (New York: Appleton and Company, 1894), 151.

[6]Phillip E. Johnson, *Darwin on Trial*, 14, 113.

[7]Ibid., 4.

[8]Ibid., 71.

[9]Ibid., 67.

[10]Wayne Shumaker, *The Occult Sciences in the Renaissance: A Study in Intellectual Patterns*, (Berkeley & Los Angeles: University of California Press, 1972), 78.

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Did Israel Cross the Red Sea?

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Many English translations of the Old Testament (especially in the Book of Exodus) state that the children of Israel, fleeing from Egypt and from an Egyptian military force, crossed the Red Sea. Even the sermon of Stephen, on the day of his martyrdom in Jerusalem, includes such a statement (Acts 7:36, as commonly translated into English). From these translations, the reader is entitled to think that the water body crossed was, indeed, the Red Sea. People berate skeptics for not believing plain, clear, pointed statements in the Bible. Let's take a closer look.

Modern Geography

First, let's review some modern knowledge. The Red Sea is 180–300 kilometers wide, and the long narrow trough, the deepest part, is 1,200–2,600 meters below the water surface. We may choose to believe that the crossing was made at the narrowest point, along the shallowest bottom (although these two requirements are not compatible). One recorded depth along the axial line is a bit more than 1,200 meters, or 4,000 feet. From the simple geometry of the case, the fleeing people would be required to walk at least 180 kilometers (112.5 miles) if the route were straight. However, the coast is marked by a wide band of coral reefs which provide rugged relief (at many places five hundred or so meters high, at very steep angles), and the sea floor is tectonically-controlled and irregular, with no road or smooth surface for pedestrians to use. Therefore, the path was more nearly 220 kilometers (about 140 miles). The trip from their homes to the edge of the sea, a similar or somewhat longer distance, required four to six weeks. The trip across the sea took less than ten hours (Ex. 14:21–27). A walk of 220 kilometers in ten hours requires 22 km/hr (13.75 mi/hr), in this example, over extremely rough terrain. This speed is close to the world record for running—on an ideal, smooth, and level track, for relatively short race distances.

Even if these fleeing pedestrians could have found a straight smooth path (a first-class paved highway) so that the speed requirement would be only 18 km/hr (11.25 mi/hr), they would need to overcome several major problems: (1) this is much too fast for sustained travel on foot, by ordinary adults and children, even on level ground; (2) the transverse coral reefs have vertical relief of 500 or so meters, which must be climbed in two directions (up and down), providing very inefficient travel; (3) the second half of the trip would involve a climb of perhaps 1,200 meters (4,000 feet—to the top of a 330-story building), which means that travel would be significantly slower than normal; and (4) crossing the Red Sea places the traveler in the Arabian Peninsula, not in the Sinai Peninsula. The data given here show that a crossing of the Red Sea, within the ten or so hours specified in Exodus, is not possible, and that even the goal is mistaken. Without any other considerations, the ubiquitous coral reefs eliminate "Red Sea" as a viable rendition.

The long, narrow water body between Egypt, on the west, and the Sinai Peninsula, on the east, is the Gulf of Suez. Perhaps in ancient times this water body was known by the name of the larger sea with which it was connected, in which case "Red Sea" might be appropriate. The Gulf of Suez is only about 25–30 kilometers wide, and up to two hundred meters deep (666 feet). If the terrain were not too rough, ten hours might be enough for the crossing. This appears to be conceptually possible, but probably not practical for a crowd of more than two million people on foot, including small children (Ex. 13:37). Two million people cannot travel down a given road on the same time schedule as twenty or two hundred

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people. A column ten persons wide, each separated from the persons ahead and behind by one meter respectively (not much room), walking at 5 km/hr, requires forty hours to pass a single fixed point. If the column is one hundred persons wide, the elapsed time is four hours, but this still does not include transit time, and does not permit any rest stops.

None of the discussion in the previous paragraph allows for the problem of crossing the high, narrow, rugged ridge reefs which are present. Therefore, even the Gulf of Suez appears to have been too wide and too difficult for a crossing in a single night. If this were indeed the pertinent water body, then one would have to assume a certain elasticity in the use of names. Nevertheless, translators who believe that "Gulf of Suez" was meant, and who understand the modern designations, should not use "Red Sea."

Modern Translations

Second, let's look at the documents. Where do we get the idea that the Israelites crossed the Red Sea, or even the Gulf of Suez? Popular modern English renditions of the Old Testament were translated from the Hebrew version known as the Masoretic text, dating back perhaps about eight hundred years. The Masoretic text uses the Hebrew expression "*Yam Suph*" ("Sea of Reeds"; note Ex. 10:19; 15:18; 15:4; 15:22; 23:31).

The Martin Luther translation into German, as revised in 1951, shows "*Schilfmeer*" ("Sea of Reeds") in each case, whereas the Spanish version of 1960 shows "*Mar Rojo*" ("Red Sea") in each case, with no footnotes. The New International Version uses "Red Sea" but has footnotes that provide "Sea of Reeds," as does the New American Standard Bible of 1971. (If the translators, in each case, knew the correct rendition and could show it in footnotes, why did they deliberately use an erroneous one in the text?) The King James version, as revised in 1962, uses "Red Sea" with no footnotes.

The *Tanakh* (Jewish Publication Society, 1985) is very interesting. It uses "Sea of Reeds" in the text, and provides footnotes to the effect that this expression has been translated, *traditionally but incorrectly*, as "Red Sea." The Lamsa translation (1933, from an Aramaic version that is not readily available) uses "Red Sea" with no footnotes. The Interlinear Bible (Green, 1976) provides the Masoretic text (in Hebrew), an interlinear word-for-word English rendition immediately below the Hebrew, and a smooth English translation in a parallel column. The "Sea of Reeds" (*Yam Suph*) is obvious in the Hebrew, the interlinear English uses—correctly—"Sea of Reeds," but the "smooth translation" gives "Red Sea," with no explanation of any kind for the discrepancy.

The "Sea of Reeds" is something quite different from "Red Sea." Neither the Red Sea nor the Gulf of Suez has extensive coverage of salt grass ("reeds"). The Hebrew term suggests that neither of these two water bodies is the pertinent one, and it is unlikely that "Sea of Reeds" would be considered appropriate by anyone living on the shores of, or attempting to cross, either one. Instead, fringing coral reefs are common on the edges of marine water bodies in the area, and steep-sided "ridge reefs" occur in slightly deeper water. Pedestrians cannot "walk" over extensive exposed coral reefs; they would have to climb, without the benefit of suitable hand holds, and the climbing would be difficult and dangerous. No one who crossed either type of coast would ever confuse it with the other.

The word for "reef" and the expression for "coral reef" do not occur in the Bible. "Coral" is used in a few places in English versions (e.g., Job 28:18), but (1) this usage may refer to an item of trade, such as red coral which is an attractive oddity, and (2) it is probable that "coral" is not the correct translation.

New Testament Greek

According to the Book of Acts, Stephen preached a sermon which was largely a recapitulation of Jewish history. In Acts 7:36, he referred to the Jewish exodus from Egypt. Presumably he spoke in Aramaic, the language of the community, because he was understood clearly by an angry mob for whom the everyday language was Aramaic. He is reported (in the Greek account which has been preserved for us) to have used the term "Erythrean Sea." This expression is an ancient equivalent of "Eritrean Sea," which in turn refers to the more southerly part of the Red Sea, and which was also used to mean "Indian Ocean." (This last expression is something like what one would get if the residents of New York were to insist on calling the large water body east of them the "New York Ocean.")

However, there are several problems here: (1) we cannot know what Stephen actually said in Aramaic; (2) we do not know how restrictive or how general the translation into Greek may have been; and (3) "Erythrean Sea" may have been used in a sense that is different from what we would infer today. In any case, translators have commonly opted to render this phrase as "Red Sea," with no compelling reason

for doing so. The result does not look like a valid interpretation.

Old Testament Hebrew

The Masoretic (Hebrew) text commonly uses the expression "*Yam Suph*" (the first word means, among other things, sea or coast, and the second, reeds, hence "Sea of Reeds"), which is a descriptive term that is not appropriate for the Gulf of Suez, Red Sea, Eritrean Sea, or Indian Ocean. A few selected references, taken from the Book of Exodus, are given above. In these verses, the expression is typically translated into English as "Red Sea," although the rational connection—if there was any—is mysterious, at best. Some English versions (as stated above) give the correct translation in footnotes, but not in the text.

Never is "coral reef" or "reef" or "coral" used. If the fleeing Israelites had clambered over the rugged coral reefs along the margins of the Red Sea or the Gulf of Suez, it would have caused many injuries, and would have made an indelible impression on them, so that this fact would have been repeated many times in later accounts. Furthermore, Egyptian charioteers would not have even ventured to follow the refugees, and could not have done so if they had tried. The statement in the Book of Exodus that the Egyptian military force got well into the basin, and then was overwhelmed by the returning water, is consonant with the concept of a salt marsh ("Sea of Reeds"), but not with the idea of coral reefs ("Red Sea").

Old Testament Greek

The Septuagint is an Alexandrian Greek translation of the Old Testament, made long before the birth of Christ, and widely cited in the New Testament. It has been criticized for being what is commonly called an "infelicitous" translation, and in many places it contains what seem to be awkward expressions: what may be Hebrew grammar and/or colloquialisms clothed with Greek words. It also differs markedly, at various places, from the Masoretic text. Most modern scholars have felt that the Hebrew version—though not very old as manuscripts go—has the merit of being in the original language, and, therefore, is to be preferred over a translation into some other language, such as Greek, especially where the latter shows various, obvious imperfections. This presumption overlooks the bothersome fact that we have very little information about the manuscripts that necessarily preceded the Masoretic text, and thus we have few clues as to changes that many copyists probably made, either by accident or on purpose. Single words or short phrases, dealing with well-known matters, therefore, may be more accurate when taken from "the Septuagint" which predates the existing Masoretic text by more than one thousand years.

In many places in the Old Testament—especially in the book of Exodus—the Septuagint uses the expression "Erythrean Sea," which requires that we recognize these instances as cases of "general, or broad, usage, or incomplete knowledge." For example, a person might be identified as being about 30–50 years old, whereas he is actually 41. The broader statement is not of itself erroneous, and may be adequate in certain cases, but does not provide any detail, and should not be used for purposes of definition. "Erythrean Sea" is a very broad statement, and therefore not a good source for detailed information. It is even possible that it does not actually include the correct answer. Stephen probably used the Greek Septuagint regularly as his Old Testament (as Paul did); therefore, in extemporaneous speech in a stressful situation, he may have fallen back on the usage "Erythrean Sea" ("Eritrean Sea") without worrying about geographic niceties. Luke, who got Stephen's remarks secondhand at a much later date and then recorded them, would have reported the speech without emendations: he did not edit it, but only reported it.

The Greek word "*schoinos*" (in which the letters "ch" represent the single Greek letter *chi*) is equivalent to the Latin word "*iuncus*," or "*juncus*," and the word in each language has basically the same meaning as the modern English "Juncus," which is a botanical name referring to a salt-tolerant plant variety. This is a needle grass which is one of the important plant constituents in the coastal tidal marsh. Another important member of the coastal salt-marsh plant community is "Spartina," likewise a generic name. To a casual observer, they look pretty much alike. The two, together, apparently make up most of the plant assemblage identified in ancient writings as "*juncus*" or "*schoinos*."

The Greek word "*schoinos*" appears in the Septuagint at various places. A good example is Micah 6:5, where the desert wanderings of the Israelites are lumped under the expression "from the juncus (but the word is in plural form), to the camp by the River Jordan." In English, we do not ordinarily use the plural expression "juncuses." The plural form of the noun probably indicates that this means from the "place of much juncus, to ..." The proper English word for "a wetland covered by much grass" is

"marsh" (but not "swamp"). Therefore, a smooth and accurate translation would be: "From the salt marsh, to ..." Another smooth and accurate translation might be: "From the Juncus marsh, to ..." (Other uses of the same Greek word can be found in the Psalms, Jeremiah, and Joel.)

In this statement, Micah had a first-rate opportunity to make a reference to coral reefs, if they had been part of the history. "From the rugged coral reefs, to ..." makes a very impressive statement, and recalls the almost-impossible task of getting across those features. Today, we do not appreciate the difficulties that would be memorialized in such a statement, because we never see living coral reefs exposed by a sudden removal of the water. Furthermore, the Greek word for "coral" is well known (*korallion*); it appears neither in Micah 6:5, nor in Job 28:18, nor anywhere else in the Septuagint. The Septuagint rendition of Job 28:18 is the Greek word "*meteora*," meaning "high, exalted, lifted up." This may be an accurate translation, because the Hebrew word at this point appears to be closer to "high" than it is to "coral." The reason Micah summarized the nomadic history of Israel as "reeds to Jordan" rather than as "reefs to Jordan" is because the "crossing" was made in a marsh, not in the Red Sea or the Gulf of Suez. (The fact that "reed" and "reef" are, in English, almost the same is not pertinent; the modern similarity is accidental, and does not carry back to either ancient Greek or ancient Hebrew.)

The information available at this point indicates these important facts: The water-crossing was made in an area of salt marsh (Juncus)—an area without coral reefs, rocky cliffs, or rough bottom; not too wide or too deep for the huge crowd to get across in ten hours or less; and not too rough for Egyptian charioteers to follow.

The "Dry" Crossing

The history of the crossing, as given in the Book of Exodus, requires a strong wind which could blow a good part of the water out of the basin so that the Israelites could travel on "dry" ground (firm, but not necessarily without moisture). After the refugees had, more or less, reached safety on the other side, the wind would need to subside, leaving the water to return to its usual place, thus drowning the Egyptian military force. This phenomenon is well known today as super-elevation, but it has physical limits.

Super-elevation, caused by the wind blowing steadily and strongly for hours, can drive much of the water out of a very shallow basin. The height of super-elevation (from one side of the basin to the other) may be one to two or so meters. However, it is not a reasonable mechanism for water one hundred meters deep, or one thousand meters deep, and, therefore, is not applicable to either the Gulf of Suez, or to the Red Sea. And since the historical text is very clear about what happened, the reader is not entitled to use a "miraculous augmentation." Thus, the reader should be careful to distinguish between (1) a supernatural mechanism (which requires no rational physical limitations or causes, and therefore cannot even be discussed in any detail within a rational framework), and (2) a supernatural cause for the *timing* of a natural mechanism. The writer of Exodus clearly chose the latter.

Such a shallow basin is precisely what is needed to have a "Sea of Reeds." Neither Juncus nor Spartina grows in water more than about a meter deep.

The evidence includes: (1) the actual words used (e.g., *schoinos*, in the Greek, but in plural form; "*Juncus*," or "*juncuses*"), and these words are definitive rather than very broad in meaning; (2) by implication, the width and relief of the area to be crossed; (3) the number of people, traveling on foot, who had to make the crossing; (4) the time available for the crossing; and (5) the mechanism for removing the water from at least a good part of the basin. The water body that we should deduce from these constraints was shallow (not more than a very few meters deep), partly covered by salt tolerant grasses such as Juncus (and Spartina), and only a few kilometers wide. Most modern coastal salt marshes have runnels or other channels occupied (especially at high tide) by water more than one to two meters deep. Therefore, they are not actually quite 100% covered by salt-tolerant plants, but this fact does not keep such an area from being a marsh ("*juncuses*," to follow the Greek usage).

An extensive Juncus cover (although not necessarily 100%) requires salt water, but Juncus ordinarily thrives in salinities *less than* normal marine, or in areas where seawater reaches the plants only briefly at high tide. Waters along the coasts of the Red Sea and the Gulf of Suez are typically *saltier than* average seawater, because of the very high evaporation rate in the area (about two meters per year).

The Suez Lakes

There is, in fact, one wide, shallow lake which meets these requirements, as well as a few smaller such lakes, on the route of the Exodus. These lakes

are now crossed by the Suez Canal. The largest, by far, is Great Bitter Lake; it is about forty kilometers long, north-to-south, and about ten kilometers wide at the widest place. This lake would be an ideal place for a large group of people to cross on their way from Egypt eastward into the Sinai Peninsula to escape a pursuing army *provided* they could benefit from a strong, properly-timed wind that would drive much of the water from the shallow basin so that they would have an avenue of escape. Then as the water returned to the basin proper, the pursuers would be turned back or drowned. According to the Exodus account, this is what happened.

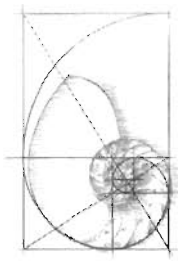
In Hollywood lore, the escape from Egypt was made through the "Red Sea" (following the popular mistranslation in various English versions). The very impressive movie footage showed the actors traveling between towering vertical walls of "water," which actually were masses of soft and apparently unstable gelatin, photographed as part of a double exposure procedure, using two widely different scales (that is, the actors were photographed on a set having neither walls nor other visible background, and the "walls of water" were photographed in a miniature set of wet gelatin, with no actors present; the two scenes were then superimposed). The famous result is precisely what many people have in mind when they refer to the subject, but this is Hollywood, not Exodus. The Bible does indeed state that the water appeared to the Israelites as "walls" of water on each side; and this seems to be an accurate rendition of their perception of matters. However, other details in the account, reviewed above, indicate that the crossing was made through Great Bitter Lake ("Sea of Reeds" or "Sea of Juncuses"). The movie footage did not include anything remotely like the rugged coral reefs that would have been in the way, and therefore—although it looked good on the silver screen—it did not actually represent what it purported to show (if "Red Sea" was to be followed strictly).

A number of printed commentaries (in English) include maps showing a hypothetical route across Great Bitter Lake (apparently correct), yet state in the text that the pertinent water body was the Red Sea. This contradiction apparently did not bother either writers or editors.

Conclusion

The thesis that the route of the Exodus crossed Great Bitter Lake, but not the Red Sea, was advanced many years ago, in part perhaps because of some of the constraints of distance and time that have been reviewed here, but perhaps largely because of the Hebrew and Greek words that are used in the various manuscripts.

One of the most interesting aspects of this discussion is not whether "Sea of Reeds" is correct (it is, as is easy to verify), but rather why translators continue to use "Red Sea," when the manuscripts provide a totally different identification, and when the additional details in the available sources require "Sea of Reeds" and do not permit "Red Sea." How is it that, in many versions, the correct rendition can be given in footnotes, but not in the main text? How does a scholar justify a deliberate switch? And how does the reader, who has no access to the ancient languages, know which version is correct? ✣



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Book Reviews

ON THE MORAL NATURE OF THE UNIVERSE by Nancey Murphy and George F. R. Ellis. Minneapolis: Fortress, 1996. 268 + xvi pages with index. Paperback; $20.00.

RECONCILING THEOLOGY AND SCIENCE: A Radical Reformation Perspective by Nancey Murphy. Kitchener, Ontario: Pandora, 1997. 103 + x pages with index. Paperback; $14.50.

Murphy of Fuller Seminary is a well-known participant in the science-theology dialogue, approaching it by means of the model of scientific methodology developed by Imre Lakatos. The arguments in her earlier *Theology in an Age of Scientific Reasoning*, that theological claims can constitute genuine knowledge to the same extent as those of the natural sciences, are echoed in the present volumes. Ellis, the co-author of the first book, is best known to scientists as a general relativist and collaborator with Steven Hawking in *The Large-Scale Structure of Space-Time*. A citizen of South Africa, he has been active in social causes in the recent tumultuous history of that country. Both are Christians in the radical reformation tradition—Ellis a Quaker and Murphy in the Church of the Brethren.

This background information is germane to the themes of these books, which seek to integrate Christian theology not only with the natural sciences but with the social sciences and the ethical issues they raise. The authors maintain that, especially because of the demand for an adequate moral stance, a theology developed within the radical reformation tradition can best provide this integration.

Each book is valuable and helpful for different audiences. *Reconciling Theology and Science* is a briefer and less technical treatment of important themes. It is useful for those looking for a clear and comprehensive overview of the dialogue. Murphy moves from the general issue of science-theology relationships to questions of cosmology and design, neuroscience and the soul, and evolution and creation, and concludes with the theology of the radical reformation in connection with the social sciences.

On the Moral Nature of the Universe provides the full scope and applications of the authors' arguments. In its first part, Murphy and Ellis work out relationships between the sciences in hierarchical form. The result is a "branching hierarchy of the sciences" (p. 86). Beginning at the bottom with physics, we ascend to chemistry and then biology, where the hierarchy branches. On the left the sequence runs from ecology and geology through astrophysics to cosmology. On the right, we continue through psychology, social and applied sciences, and motivational studies to ethics at the top.

The way in which this organization is developed means that the distinction between natural and human sciences is recognized without any implication that one is more "real science" than the other. Physics, chemistry, and other sciences are seen as foundational for levels above them, but the higher levels are not simply reducible to physics.

What will be most surprising to some people is that ethics is included. The argument of Murphy and Ellis is essentially that this inclusion is necessitated by the fact that the human sciences involve recognition of intentionality and goal seeking, and thus must deal with ethical questions about appropriate goals. But we then must consider the source of our ethics.

The authors reject the Enlightenment goal of a purely rational ethic. They have previously argued that a research program including a concept of divine creation receives "novel confirmation" from the apparent fine tuning of the universe, which has been the subject of extensive discussion in connection with anthropic principles. Detailed treatment of theology is delayed until chapter eight, in favor of a discussion of ethical issues, but the theologically motivated "hard core" of their ethical theory is set out on page 118: "Self-renunciation for the sake of others is humankind's highest goal." This kenotic principle will be traced to the Christology of Philippians 2:5–11, where Christ is said to have "emptied [*ekenosen*] himself" and taken the form of a slave.

This principle connects strongly with the tradition of the radical reformation and the Christian communities originating in the sixteenth and seventeenth centuries which renounced the church's claim to the power of the state. But Murphy and Ellis are by no means unconcerned with political and social issues. In setting out their theology, they make considerable use of the work of Mennonite theologian John Howard Yoder and his book, *The Politics of Jesus*.

There is much here that is congenial with Luther's theology of the cross in my own tradition, and I have some sympathy with critics who argue that Luther did not adequately carry this theology through into his social ethics. Furthermore, a kenotic understanding of divine action is attractive in connection with the natural sciences. It means that we should not be surprised at the fact that God is not "necessary" for scientific explanation, for God renounces any insistence upon overwhelming creatures with evidences of divine existence and power. Just as God supplies the necessities of life to both good and evil, God allows the universe to be understood by believers and unbelievers alike (pp. 209–11).

There are, however, problems with the kenotic approach, problems which do not invalidate it but which call for further consideration. A basic difficulty is the same one which has confronted attempts to develop a kenotic Christology in which the Incarnation involves renunciation of divine power: How could the universe continue to operate or even exist if the one in whom "all things hold together" gives up this power? Beyond specific understandings of

the Incarnation, this problem must be faced if indeed (as I think is quite correct) the kenosis which we see in the life of Jesus is revelatory of the divine character. Murphy and Ellis recognize that God does not simply take a deistic "hands off" attitude toward physical phenomena; there are levels at which divine influence is exercised (p. 215). But if this is consistent with God's character, why are not more stringent controls also consistent?

Questions about kenosis must also be raised on the ethical side of the hierarchy: Does the core requirement of self-renunciation for the sake of others mean that all violence must be eschewed? Nonviolence does work in many practical situations, and it is a goal to which Jesus calls us. Yet there are also situations in which we have a choice between the use of force and allowing force to be used, not against ourselves but against some innocent third party. Is refusal to use force then really "for the sake of others," or for the sake of our own moral purity?

Challenges to the social ethics of the radical reformation are not new. Murphy and Ellis discuss claims that the ordering of society requires use of coercion and violence, arguing that progress can be made toward nonviolent societies. How close that goal may be is another question.

Many participants in the modern science-theology dialogue have done valuable work from explicitly Roman, Lutheran, and Reformed standpoints. It is good to have these two works, introductory and more advanced, which make provocative contributions from the traditions of the radical reformation.

Reviewed by George L. Murphy, Pastor, St. Mark Lutheran Church, Tallmadge OH 44278.

RELIGION AND SCIENCE by Bertrand Russell, with a new introduction by Michael Ruse. New York: Oxford University Press, 1997. xxiii + 254 pages, index. Paperback; $12.95.

This is a new edition of Russell's well-known book that was originally published in 1935. This edition improves accessibility, of course, but also contains a new introduction by Michael Ruse, Professor of Philosophy and Zoology at the University of Guelph, Ontario, Canada. Ruse identifies four main positions that can be taken with respect to the relationship between science and religion: opposition, separation, dialogue, and integration. Russell argues as one who sees science and religion in opposition, with science winning the battle on all fronts.

The various chapters of the book deal with a series of topics: The Copernican Revolution, Evolution, Demonology and Medicine, Soul and Body, Determinism, Mysticism, Cosmic Purpose, and Science of Ethics. Russell's prose is very easy to read. He attacks the beliefs and behavior of the church in his discussion of each topic, and draws the conclusion that in each case science has shown a more accurate picture of the world as it is than the church had been willing initially—or ever—to accept.

The book itself is a classic and would be of interest to readers of this journal. But the introduction (eighteen pages) included in this edition is also of value. Ruse provides a helpful analysis of the various arguments in the book, together with his own assessment of their success. He ends by arguing that "Russell was a more complex and interesting figure than simply the blunt opponent of religion" seen in the book. Ruse draws attention to Russell's statement that Christianity and science have found ways to live harmoniously together, and to the fact that Russell as a person would not comfort himself with false gods. Ruse sees a similarity between Russell and orthodox theologians who take science and religion as different languages dealing with different questions. While Russell did not have faith, Ruse can see Russell's arguments in *Religion and Science* as a starting place for believers who take a different perspective than the one of opposition between science and religion from which Russell argues. Perhaps. But this requires a very sympathetic reading and a very open approach to using an argument that heads vigorously in one direction, and head it in another very different direction.

Reviewed by David T. Bernard, Professor of Computer Science and President, University of Regina, Regina, SK S4S 0A2 Canada.

BILLIONS AND BILLIONS: Thoughts on Life and Death at the Brink of the Millennium by Carl Sagan. New York: Random House, 1997. 244 pages, index. Hardcover; $24.00.

Sagan was the David Duncan Professor of Astronomy and Space Sciences and director of the Laboratory for Planetary Studies at Cornell University. He was the author of thirty books, and his novel *Contact* is now a major motion picture.

In this book, Sagan discusses a wide range of issues. Six chapters on "The Power and Beauty of Quantification" include discussions on world population growth and the possibility of life on Mars. Seven chapters tackle the question, "What Are Conservatives Conservating?" and the final six chapters on "Where Hearts and Minds Collide" include a description of his fight for his life against the rare disease myelodysplasia. Most chapters are old material previously published in *Parade* magazine. However, *Billions and Billions* is organized effectively, and the old and new material complement one another.

Sagan has many valid concerns. He is concerned about world population growth (p. 16) and the depletion of the ozone layer (p. 87). Most Christians would agree that many problems cited by Sagan should be addressed, but is more government regulation the only solution? Readers of *PSCF* are aware of this debate (see Richard Wright's article [June 95] and Edwin Olsen's article [June 96]).

Sagan provides some empirical evidence to back up his views, but this evidence is far from conclusive. Furthermore, some of Sagan's suggestions are those of an extreme alarmist. For instance, he suggests there "is a precipitous recent decline" in sperm counts—possibly

from chemicals and plastics that mimic the female sex hormones, and this could result in many men becoming sterile "by the middle twenty-first century" (p. 74). However, not all of Sagan's views should be dismissed. He correctly notes that politicians tend to be shortsighted at times (p. 118), and he gives some evangelicals credit for protecting the environment because they view it as an issue of stewardship before God (pp. 138, 141). Sagan does not believe in God, but he is glad that some Christians do not think they have dominion over everything so they can destroy those things at will.

"Abortion: Is it Possible to Be Both 'Pro-Life' and 'Pro-Choice'?" is probably the weakest chapter in the book. Sagan concludes: "If we are forced to choose a developmental criterion, then this is where we draw the line: when the beginning of characteristically human thinking becomes barely possible" (p. 176). He assumes this takes place in the fetus during the thirtieth week of pregnancy—near the beginning of the third trimester. It is amazing that Sagan can come to this arbitrary and reckless decision after making the following assertions: "In too many cases, we have lacked a moral compass" (p. 137). "If it is impermissible to abort a pregnancy in the ninth month, what about the eighth, seventh, sixth ... ?" (p. 165). "We recognize that specifying a precise moment will overlook individual differences. Therefore, if we must draw a line, it ought to be drawn conservatively—that is, on the early side" (p. 171). "A morality that depends on, and changes with, technology is a fragile morality ..." (p. 178).

It is Sagan who lacks a moral compass. He calls *Roe v. Wade* a "good and prudent decision" (p. 178), and like Justice Harry Blackmun he cites the fact that abortion "was common in ancient Greece and Rome" (p. 169). Roman law, however, permitted not only abortion but also infanticide. Sagan admits he is "on the slippery slope" (p. 176), but he fails to realize how far that slope goes down.

In the final chapter, "In the Valley of the Shadow," Sagan attempts to look at the logical conclusions to which his reductionist views lead. For instance, he states that because humankind is not unique, but one of the animals, to some degree humans find themselves in a "cold, immense, indifferent universe" (pp. 211–2). Furthermore, he admits that the marrow grafting that kept him alive would not have been possible without research and experiments on animals. This is a problem for Sagan because he has always held to the position that humans are basically the same as those animals around us (p. 211). Sagan observes: "I remain very conflicted on this issue. I would not be alive today if not for research on animals" (p. 219). Sagan acknowledges that if there were life after death then possibly he could satisfy his "deep curiosities and longings" (p. 215), but he dismisses this possibility as a pretty story "for which there's little good evidence" (p. 215).

Carl Sagan's last book, *Billions and Billions*, gives great insight into this gifted scientist and communicator. Readers of *PSCF* should take note of these last words of the best-known evolutionist of the twentieth century.

Reviewed by Everette Hatcher III, P.O. Box 23416, Little Rock, AR 72221.

HUNTING DOWN THE UNIVERSE: The Missing Mass, Primordial Black Holes, and Other Dark Matters by Michael Hawkins. Reading, MA: Helix Books/Addison-Wesley, 1997. 240 pages, glossary, bibliography, and index. Hardcover; $24.00.

Michael Hawkins (not to be confused with Stephen Hawking) is an astronomer at the Royal Observatory in Edinburgh, Scotland. He began his career in astronomy at age 25, following his service in the British Navy as a submarine navigator. After studying mathematics at Oxford, he received a Ph.D. in astronomy from Cambridge. According to the book jacket, he is one of very few people to survive both an airline crash and a lightning strike.

In the author's words, the main focus of this book is "to provide an interesting case study of the conception, birth and struggle for survival of a new scientific idea, the theory which I have put forward, that the material universe is almost entirely made up of small black holes." Hawkins attempts (I believe successfully) to demonstrate the essential simplicity and accessibility of what might seem like some of the most remote and intractable ideas at the cutting edge of cosmology. To place his own work in proper context, Hawkins uses the first nine of the book's thirteen chapters to review the great cosmological debates and the struggle between Steady State theory and Big Bang cosmology. Underlying this discussion is the conflict between rationalist and empirical approaches to science, so Hawkins uses a significant portion of his book to discuss the philosophy of science from his perspective. He maintains that understanding "the fundamental difference of opinion as to whether the route to truth is through the intellect or through experience, is crucial to an understanding of the scientific process." This conflict is explored in some detail in chapters four and seven.

Hawkins begins his story with the "cosmological and philosophical conflict between two titans of modern astronomy," Fred Hoyle and Martin Ryle, of the Steady State and Big Bang theories. The Big Bang follows the Judeo-Christian tradition of a universe created at a finite time out of nothing, while the Steady State results from the idea of a Platonic universe, eternal and perfect. The major weakness of the Big Bang cosmology is the necessary infinitesimally fine balance between the forces of expansion and the contractive force of gravity, which can only be accounted for by a metaphysical appeal to divine intervention. The Steady State theory has no need of a creator or the finely balanced initial conditions. Hawkins provides a very readable account of the two positions and then discusses "the solution to the problem with which most astronomers are very comfortable": the theory of Inflation conceived by Alan Guth (discussed in chapter six).

In chapter seven, "In the Land of the Blind," Hawkins explores the philosophical debate in more detail. He states that his thinking has been influenced by Karl Popper and Wittgenstein. To simplify the nature of the philosophical disagreement, Hawkins says: "At risk of oversimplifying, I think it can be summed up as a conflict between natural inductive, or common sense, reasoning and the artificial deductive reasoning of formal logic and mathematics."

Hawkins believes that unless you can test the validity of a statement by experimentation or observation, it has no scientific meaning. About the many universes hypothesis, he says: "To my mind, this many-worlds idea is a classic manifestation of the sort of nonsense that Wittgenstein warns us against."

Although I have focused on Hawkins' philosophical discussions, I do not want to minimize his presentation of the state of modern cosmology, the Hubble constant, the density parameter, the age of the universe, the Inflation model, the cosmological constant, and so on. Hawkins does a masterful job in making this material accessible to nearly everyone. In chapter nine, he introduces his own work with the idea that because of the Big Bang theory, at least 95% of the universe is made up of dark matter. The remainder of the book presents, in a very readable way, his seventeen years of effort to understand this dark matter and how gravitational lensing is used to find it. When he became convinced that the density parameter for the universe was significantly greater than the baryonic limit, he states:

> I had to face up to the fact that either my microlensing hypothesis was wrong or that at least two-thirds of the Universe is made up of nonbaryonic compact entities, a quite remarkable prospect ... By this stage I was becoming confident that the microlensing hypothesis was correct, especially since it had survived six months of the most rigorous peer review in my experience.

Hawkins makes his beliefs quite clear. In the first chapter, he states his basic assumptions of science which are unassailable and not open to debate. In addition he says, "as an orthodox scientist I have more faith in the scientific approach to understanding the Universe than in religion or philosophical methods ... I am suspicious of any ontological system that claims to deliver unchallengeable truths." I find it curious that Hawkins uncritically accepts and is strongly influenced by Richard Dawkins (*The Blind Watchmaker*). For example, he says: "Scientists are human, and along with all their activities, ideas and constructs, they are biological entities whose enormously complex existence can only be explained in terms of Darwinian evolution." Hawkins agrees with the idea that nature is mindless, incoherent, and chaotic and that while reality is evolving, it is not evolving toward anything.

If you would like an interesting and very readable accounting of modern cosmology, you will want to get this book.

Reviewed by Bernard J. Piersma, Distinguished Visiting Professor, USAF Academy, CO 80840 (on sabbatical from Houghton College, Dept. of Chemistry).

IS THERE A GOD? by Richard Swinburne. New York: Oxford University Press, 1996. 141 pages, index. Hardcover; $19.95.

Swinburne, Nolloth Professor of Philosophy at the University of Oxford, has a gift for writing a clear and readable English sentence, and has provided us with another book that grapples with hard questions about the existence of God and our understanding of the universe. In several of his previous books (for example, *The Coherence of Theism, The Existence of God, Faith and Reason*, and *The Concept of Miracle*), Swinburne discussed and debated questions related to a Christian belief in the existence of God at a very high intellectual level. In this book, he tries to make these arguments available to a larger and more popular audience.

Swinburne takes on those who, like Richard Dawkins and Stephen Hawking, try to argue that scientific understanding of the world excludes God. Such views are very open to criticism, and Swinburne provides it. His aim is stated in the introduction:

> The basic structure of my argument is this. Scientists, historians, and detectives observe data and proceed thence to some theory about what best explains the occurrence of these data. We can analyse the criteria which they use in reaching a conclusion that a certain theory is better supported by the data than a different theory—that is, is more likely, on the basis of those data, to be true. Using those same criteria, we find that the view that there is a God explains *everything* we observe, not just some narrow range of data. It explains the fact that there is a universe at all, that scientific laws operate within it, that it contains conscious animals and humans with very complex intricately organized bodies, that we have abundant opportunities for developing ourselves and the world, as well as the more particular data that humans report miracles and have religious experiences. In so far as scientific causes and laws explain some of these things (and in part they do), these very causes and laws need explaining, and God's action explains them. The very same criteria which scientists use to reach their own theories lead us to move beyond those theories to a creator God who sustains everything in existence (p. 2).

In chapter two, Swinburne provides a valuable discussion on the nature and justification of explanation for the student new to studies in philosophy or science. Next follow chapters on how the existence of God explains the world, its order, and the existence of humans. There is also a chapter on the problem of evil, and a final chapter on miracles and religious experience, which I found insightful because Swinburne interwove his discussion on personal experience with apposite references to the proper use of basic rules of rationality, credulity, and testimony.

The only problem I found was that to keep the discussions concise, some helpful elaboration and illustrations on certain points were missing, which might have made the given argument more powerful. However, this by no means detracts from the value of the book. There is much food for thought, and the reader who wants these arguments expressed more fully and more rigorously should consult Swinburne's other works. For those who aren't ready to read thousands of pages *Is There A God?* provides a helpful outline of the relevant issues and questions, and will be a valuable addition to the library of any college student, scientist, or clergy person who thinks and grapples with ultimate questions.

Reviewed by Mark Koonz, First Lutheran Church, Opheim, MT 59250.

CREATING GOD IN THE IMAGE OF MAN? The New Open View of God: Neotheism's Dangerous Drift by Norman L. Geisler. Minneapolis: Bethany House, 1997. 191 pages; indexes. Paperback; $12.00.

ASA member David F. Siemens wrote a letter (*PSCF* 49, no. 1 [1997]: 70) in which he notes the views of authors, such as Peacocke and Polkinghorne, who reject the ideas of divine omniscience and eternity. He quite interestingly qualifies their unorthodox attitude as making a god in their own image. This book is a refutation of these modern views, and its title reflects Siemens' thought of these unorthodox thinkers.

Geisler, an ASA member, is a philosopher who has written about fifty books, many of them on apologetics. He is currently dean of Southern Evangelical Seminary at Charlotte, NC. Geisler has previously written on the subject of worldviews in his *Worlds Apart* (Baker, 1989) and especially in his *Christian Apologetics* (Baker, 1976), where he unfolds his famous tests of unaffirmability and undeniability which are beyond the reach of postmodern criticisms.

In this book, Geisler exposes and refutes neotheism, the new, open view of God, which pictures a god with human limitations. This new view is a mixture of theism and panentheism (process theology). Its major proponents are Clark Pinnock, William Hasker, David Basinger, and Randall Basinger. Many evangelical thinkers and scientists have expressed sympathy for it, or endorsed different neotheist ideas. Neotheist ideas are also spread by some popular Christian best sellers, such as Gregory Boyd's *Letters From a Skeptic* (Victor, 1994).

Geisler briefly describes major worldviews. He then presents the distinctives and foundations of classical theism. The chapter on theism deals with abstract notions, but it clearly exposes the nature of God: his unchangeable knowledge, his will, and his relationship with the world. After this, Geisler contrasts theism with panentheism, describing and refuting the latter view. He then exposes neotheism, a fresh mixture of theism and panentheism. Geisler refutes the biblical arguments offered by neotheists. He shows how neotheism is incoherent, and how its theistic elements logically reduce to theism, and vice-versa with its panentheistic elements.

Geisler ends the book with the practical consequences of neotheism: the fallibility of prophecy and the Bible, and rejection of the biblical doctrines such as salvation, evil, and prayer. He points out that many prophecies contained in the Old Testament have been fulfilled and therefore falsify neotheism, which holds that God is temporal and cannot know the future.

Creating God in the Image of Man? is concise and contains several bibliographies. I think Geisler successfully refutes neotheism with clarity and logic. But will this book succeed in halting the growth of neotheism? I think it might have had more impact had it been published by a university press instead of an evangelical one. Although it is beyond the scope of the book, I would have been interested in a comparison between neotheism and ancient heresies. I find it noteworthy that there are some common features between the neotheist God and the two gods of Marcionism.

This book clarified my ideas about the nature, knowledge, and will of God, as well as his relationship with me. It removed some doubts, increased my awareness of his majesty, and deepened my worship. I think that it may be quite profitable reading for Christians who love God with their minds, and a valuable acquisition for those who are interested in orthodox Christianity.

Reviewed by Bruno D. Granger, Patent Examiner, European Patent Office, The Hague, The Netherlands.

SEARCHING FOR TRUTH: Lenten Meditations on Science and Faith by John Polkinghorne. New York: Crossroad Publishing Company, 1996. 156 pages. Paperback; $12.95.

Polkinghorne, former president of Queens' College, Cambridge University, England, is a Fellow of the Royal Society. Fifteen years ago, he resigned from his chair in Mathematical Physics at Cambridge to study for the Anglican priesthood. Since then, he has published many books relating science to religion, beginning with *The Way the World Is.*

This Lenten book consists of 47 short articles to meditate upon from Ash Wednesday to Easter Sunday. Beginning with an article on sin, the central problem of humanity, Polkinghorne explains that the root of sin is alienation from God. The author believes that the best way to begin Lent is to acknowledge our need of God.

For the second week, Polkinghorne writes on creation. He believes in the Big Bang theory, but he also believes that God created the universe and is continuing his creation process today. He thinks the evolutionary process was programmed by God for the development of the world, but he also believes that the human race is special. Polkinghorne thinks that the world is mathematically beautiful because it is created by a rational God. This thought should enlarge our vision of God's majesty and power to include the understanding of chance operating in the universe.

The theme for the third week is reality. Polkinghorne understands that the layers of reality consist of truth, goodness, and beauty. To Polkinghorne, theism makes more sense than atheism. However, theism must not be based on sterile natural theology, but on a personal encounter with God.

In week four, the meditation is on searching. The search to understand reality should not be limited to science alone. The ultimate question is: What is God like? He has made himself known through Jesus Christ. We encounter Christ through the church, the sacrament of the Eucharist, and through the poor and needy who daily

cross our paths. Most importantly we meet the Lord in Scripture. Biblical writers and scientists share a common pursuit: seeking to give an honest account of what happened through the narrative conventions of their time.

Next is a meditation on prayer followed by one on suffering. The meditation for the final week is related to Jesus' passion. The moment of darkness on the cross when God provided for salvation was followed by the triumphant resurrection of Jesus.

Overall this small book seeks to relate science and religion in a devotional way. Polkinghorne provides a summary of his writings in the form of daily meditations. This Lenten book can provide refreshing insights for both scientists and nonscientists alike. It is indeed a writing from a wise priest and gifted scientist.

Reviewed by T. Timothy Chen, National Institutes of Health, Bethesda, MD 20854.

ADAM, APES AND ANTHROPOLOGY: Finding the Soul of Fossil Man by Glenn R. Morton. Dallas: DMD Publishing Co., 1997. 195 pages, index. Paperback; $20.00.

How should an archaeologist decide whether hominid remains are human remains? In the debate between those who hold that the human race is no older than 40,000 years or so and those who attribute earlier origins to humans, the question of how you identify humans is crucial. In this book, Morton argues that, to identify humanness, one should look for evidence of activities typically associated with humans, including speech, religion, art, burial, decoration, toolmaking, planning, and care of the injured.

This book reports data from published literature showing that ancient hominids did many of the things we associate with humanity as long as 1.8 million years ago. Biblically, man is the image-bearer of God. The image of God does not fossilize, but fossil evidence that ancient hominids did things we consider uniquely human would suggest strongly that these individuals were human.

Speech, associated with brain regions called Broca's and Wernicke's areas, is a uniquely human activity. Animals such as monkeys have Broca's and Wernicke's areas, but do not use them for speech. A human's very large Broca's area makes a recognizable impression in the skull. This feature in a fossil skull indicates an individual with speech capability. Morton cites literature showing the presence of Broca's area in two-million-year-old *Homo habilis* skulls, as well as later *H. erectus* and Neanderthal skulls.

Ancient hominid technology provides further evidence of their humanity. For example, humans utilize space differently from animals, dividing living spaces into areas for functions, such as sleeping and food preparation. Neanderthal and other ancient hominids organized their living spaces as humans do, rather than the undifferentiated dens of animals. While no ancient hominid clothing has survived, plenty of indirect evidence exists, such as sewing needles and scrapers for cleaning hides. These evidences go back 26,000 years. Furthermore, there is evidence that *H. erectus* lived in Siberia and Germany 300,000–400,000 years ago and in Georgia 1.6 million years ago, and these locations require winter clothing.

While it might seem difficult to find evidence of a human's soul in the fossil record, some evidence is available if "soul" is defined as self-awareness. Morton studies evidence of planning depth and compassion for the injured by ancient hominids. Neanderthals' planning depth—the ability to plan ahead—extended to days or months, as evidenced by the distance they transported tool and weapon raw materials. Chimpanzees' planning depth runs, at most, to minutes. There is evidence Neanderthal and *H. erectus* treated their incapacitated with compassion more than 40,000 years ago and 1.7 million years ago respectively. Morton relates the story of KNM-ER 1808, a dying *H. erectus* woman whose remains were discovered in 1973. KNM-ER 1808 was cared for and protected by companions during her last days, approximately 1.7 million years ago in Kenya. The woman's remains were found with evidence of bone growth caused by hypervitaminosis A. This growth would have taken many days to form, during much of which she would have been incapacitated. Someone brought her food and water and protected her from predators. Morton notes that Jane Goodall's studies of chimpanzees' treatment of an injured tribe member show that such compassionate treatment is not common among apes.

When new evidence contradicts our understanding of Scripture, we can: (1) reject the evidence; (2) reject Scripture; (3) reinterpret Scripture to fit the evidence; or (4) search for an interpretation that honors both. Morton presents a strong argument for the fourth alternative, and a warning to evangelicals to avoid the damage to Christian credibility that results from the first. The careful logic and extensive references provide an excellent starting point for anyone wanting to investigate the humanity of fossil hominids.

Reviewed by William E. Hamilton, Jr., General Motors Research and Development Center, 30500 Mound Road, Warren, MI 48090-9055.

BEGINNING WITH THE END: God, Science, and Wolfhart Pannenberg by Carol Rausch Albright and Joe Haugen, Eds. Chicago: Open Court, 1997. xvii + 458 pages, index. Hardcover; $38.95. Paperback; $19.95.

Are you interested in formulating a satisfying philosophical solution to the perennial problem of the relationship between science and theology? If so, you will enjoy this volume of collected papers from a three-day symposium at the Lutheran School of Theology in Chicago (1988). A distinguished group of scientists, theologians, and philosophers met with Wolfhart Pannenberg and examined his effort to "lay theological claim to scientific understandings." Some papers were extensively revised before publication, one was written during the dialogue, and one was written after subsequent reflection.

The volume is organized in seven parts: (1) four of Pannenberg's previous essays, selected to provide background for those not conversant with his work; (2) analyses of the structure of Pannenberg's thought; (3) physics, cosmology, and the omega point; (4) contingency, field, and self-organizing systems; (5) DNA as an icon; (6) methodology; and (7) Pannenberg's response. Haugen has written an excellent introductory essay laying out the science-religion dialogue and Pannenberg's contribution to it. Albright has written introductory essays for each of the first six parts, summarizing and explicating the points and themes addressed and each author's contribution to them. In a work such as this, a glossary would have helped tremendously. Take "icon" as an example. The index gives several references to passages in several essays where it is discussed, but that doesn't meet the need for a concise, yet comprehensive, definition of "icon" in Pannenberg's thought.

Pannenberg maintains that "the existence and character of all reality is in some way determined by the all-determining reality ... (and) ought to contain some 'trace' of this" (p. 1). This "all-determining reality" is God. Since religious language is referential, we can assert that both scientific and religious language function "as assertions about an extra-subjective reality" (p. 2). Furthermore, these two versions of reality are not necessarily mutually exclusive. In fact, "scientific descriptions of reality must be accepted as 'simply a provisional version of objective reality' which needs to be 'expended and deepened' by the theological version" (p. 7). This is not to say that scientific methodology is somehow deficient or that theology has a knowledge base unavailable to science or is somehow beyond the criticism of science. Rather, theology aims at the most comprehensive description of reality possible while science intentionally limits itself to a partial description of reality (p. 7).

Pannenberg sees God as "the power of the future," which is, nevertheless, "ontologically prior to and is the condition of possibility for every present" (p. 12). Consequently, the present can exist only as it participates in the future, and he insists that "the reality of God be understood as that universal dynamic field that unifies all created reality and upon which all created reality is contingent" (p. 12). Although he defends an objective reality, Pannenberg recognizes that our knowledge of it is provisional. He avoids obliterating the distinction between subjectively determined knowledge and objective reality by maintaining that all appearance (and existence) anticipates the reality in the eschatological future that is nonetheless "ontologically prior, and therefore objectively existing." Because of the historical nature of reality, i.e., it is incomplete until it attains its eschatological goal, all claim to knowledge is limited and conditioned by its cultural and historical setting and is therefore necessarily provisional. "In other words, strictly speaking, we can have no direct knowledge of objective reality, but only provisional anticipations of objective reality" (p. 24).

All respondents, except possibly Wicken, support the idea that theology must function as a science to have any credibility, but several question whether Pannenberg has given an adequate explanation of what this means and whether he has adequately defended the scientific nature of theology. There was some support found in the new field of physical eschatology and in the ecological interpretation of evolution by Wicken for a theologically relevant dimension to scientific data, but Pannenberg's views on time, eternity, the "future wholeness of reality," and God as "the ontological prior source of meaning" occasioned serious questions. Will Pannenberg's scientific understandings really support his metaphysical claims? On the whole, Pannenberg has not received unqualified support, but neither has he received unqualified rejection. Rather, his proposals have caused serious philosophical discussion and an eager anticipation of further developments in the argumentation.

Reviewed by Eugene O. Bowser, Reference Librarian, James A. Michener Library, The University of Northern Colorado, Greeley, CO 80639.

EINSTEIN'S GOD: Albert Einstein's Quest as a Scientist and as a Jew to Replace a Forsaken God by Robert N. Goldman. Northvale/London: Jason Aronson, 1997. 166 pages. Paperback; $20.00.

Having something new to say about one of the best-known scientists of the century is a challenge. Goldman is obviously very familiar with Einstein's work and with his nonscientific writings. The thrust of the book is clearly conveyed by the subtitle: the author portrays Einstein's life as a spiritual quest. This book attempts to find the meaning behind Einstein's use of the word "God," and to find a connection between his study of physics and a spiritual dimension of human experience. The weakness of the book is that the reader can have difficulty understanding some of the author's statements in this area, and can easily wonder if the implication of motive or intent to Einstein is justified. An example of the first category is this: "To accept a theory of relativity is to believe that every moment in the past and future of conscious man is alive." Here is an example of the second: "Einstein saw the terrible tribulations of the world around him and longed to escape them in science and philosophical reflection. But when humanity's plight in Europe worsened with the rise of Hitler, the silent persistent urging of God would not let him."

While the subject is intriguing, the book successfully opens up areas of inquiry, but often leaves the queries without satisfactory answers.

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

DARWINIAN MYTHS: The Legends and Misuses of a Theory by Edward Caudill. Knoxville, TN: University of Tennessee Press, 1997. 143 pages. Hardcover.

Caudill, a professor of journalism in the College of Communications at the University of Tennessee, Knoxville, previously published *Darwinism in the Press: The Evolution of an Idea*.

In his introduction, Caudill suggests that Darwin's idea of natural selection was the most important scientific idea of the nineteenth century, an idea which stood at the center of the scientific debate over the purpose of science and the nature of evidence. Myth, for Caudill, means "that which has become more fecund than reality." Truth may be the literal facts of the story, or it may be what is conveyed by the story even though the story is not factual. Since Caudill's background appears to be literary and not scientific (although this is not indicated in information provided with the book), this book, as might be expected, is more journalistic and philosophical than scientific.

Part 1 includes three chapters. Chapter 1 documents the publicity campaign conducted by Charles Darwin for acceptance of *On the Origin of Species* and the roles played by Huxley and Hooker. Chapter 2 discusses the Huxley-Wilberforce debate of 1860 as a symbol of the triumph of modern science over religion. Chapter 3 considers the myth of Darwin's deathbed recantation of evolution. Caudill suggests that the rapid conversion of so many people to the radical idea of evolution was not achieved solely because of the scientific merits of natural selection. It involved a concerted campaign by a Darwinian publicity machine. Thomas Huxley, Darwin's bulldog, and Joseph Hooker were prominent in the campaign to promote evolution and Darwin's *Origin*. Huxley invented the term "agnostic" and Darwin readily adopted this label for himself. Caudill documents Darwin's willingness to manipulate others for his own purpose, and suggests that "at times Darwin bordered on intentional falsehood." *Origin* was used by Huxley and other scientists to widen the gap between science and theology. It appeared to me that Caudill was somewhat selective in using references that were generally favorable to Darwin and evolution.

Chapter 2 provides a good discussion of the available information (which turns out to be rather scanty) of the historic Huxley-Wilberforce debate. The myth that developed is that Huxley, the voice of science and reason, destroyed Wilberforce, the voice of religion and ignorance, and that science triumphed over theology. Caudill concludes that the question of who won the debate cannot be answered on the basis of the historical record which shows that Wilberforce and Huxley each believed he had won the debate. Some years later, Darwin's and Huxley's sons campaigned for the idea that Huxley had decisively won the debate, which led to the myth of the triumph of the scientific worldview.

Chapter 3 demonstrates how a story which has little or no support in fact, and which is "virtually nonexistent in the academic subculture of historians of science," has persisted within a certain segment of Christianity. Lady Hope's story of Darwin's deathbed recantation of evolution coincided with the establishment of modern creationism-fundamentalism and represented a Christian response to liberal theology and attempts to make Christianity and science compatible. For a much more extensive discussion of this myth, see *The Darwin Legend* by James Moore (Baker Books, 1994).

Part 2 comprises the bulk of the book and discusses four misuses of Darwinism in four chapters. Social Darwinism, primarily the result of Herbert Spencer's application of evolutionary concepts to human society, is analyzed in Chapter 4. Chapter 5 discusses the use of Social Darwinism to justify the Spanish-American War. The sad history of eugenics in this country and the incorporation of eugenics and Social Darwinism by Nazi Germany into Volk philosophy (chapters six and seven) finish the list of misuses.

Caudill ends with a summary of the *Myths and Misuses of Darwinism*, and concludes that ideas do have consequences, that "Darwin changed the course of Western thought, and his ideas even were perverted to justify murdering millions of people." I recommend the book for substance, although I would not say it is one of the better books which I have read.

Reviewed by Bernard J. Piersma, Distinguished Visiting Professor, USAF Academy, CO 80840 (on sabbatical leave from Houghton College, Dept. of Chemistry).

FAITH, REASON, AND EARTH HISTORY: A Paradigm of Earth and Biological Origins by Intelligent Design by Leonard Brand. Berrien Springs, MI: Andrews University Press, 1997. 332 and xii pages, glossary, bibliography, index. Paperback.

Brand is a biologist who deals with evolution facts. In his research, he found that "good evidence indicates this process of evolution does occur and produces new varieties and species" (p. 122). Brand develops the case for megaevolution and interventionism, choosing informed interventionism and rejecting megaevolution. Between microevolution and megaevolution he places speciation. He compares "Naturalistic Evolutionary Origin" and "Informed Intervention, Followed by Evolution Within Created Groups." Under the last heading he posits: "Limited macroevolution above the species level, within created groups; origin of at least new genera, and in some cases even origin of higher categories (for example some parasites)." He thinks interventionism is in harmony with most of science. Then he writes: "The areas of disagreement are the time scale for the history of life on earth and the concept that life can originate without intelligent input and can evolve into new life forms by mutation and natural selection or any similar process." To explain the geological processes he refers to the Genesis flood and catastrophism.

Brand reads the whole Bible in a literal way and counts the age of the earth in thousands of years, not in millions.

In the chapter entitled "Faith and Science, What is Their Relationship?" we read that several potential lines of evidence may help us evaluate the reliability of the Bible. Brand studied the book of Daniel and checked Daniel's predictions. Based on that and the internal consistency of the Bible, he accepts the reliability of the Bible.

I recommend this book for study, since it gives a clear description of an intelligent design position, combined with God's intervention at certain intervals to explain gaps existing in the evolutionary development.

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

PERILS OF A RESTLESS PLANET: Scientific Perspectives on Natural Disasters by Ernest Zebrowski, Jr. Cambridge, England: Cambridge University Press, 1997. 287 pages, index. Hardcover.

Zebrowski, a physics professor at Pennsylvania State University, has written a gem. This book combines observations on the ways of science, described in unusually lucid prose, with discussions on some events which excite our imaginations the most: natural disasters. The prose is free-flowing, clear, and a pleasure to read; the material is presented at college-level. One can hardly come away from the book without knowing that the author is a master teacher. The storytelling is "human," without being sensational.

Although the book does not touch directly on religious/scientific issues, it does provide data for them, and so is worthy of reading by ASA members and their students. A few excerpts will illustrate this.

"Engineering is a tougher business than science" (p. 56). I have my own ideas on this statement, having been in both professions, and I am sure you do, too! Consider an example Zebrowski discusses in defense of his thesis. In the Mexico City earthquake of September 19, 1985, reinforced concrete structures under six stories and over 15 stories in height generally survived; those in between sustained heavy damage or collapsed catastrophically. Why? The earthquake wave had a two-second period—and this is the natural vibrational period of buildings of this height! How could an engineer have foreseen this?

Here is another example. Compare the San Francisco earthquake in 1906 with that of the Messina earthquake in 1908. Seven hundred people died in San Francisco, over 100,000 in Messina. Why? San Francisco had more than double the population, and the earthquake there was five times as intense! Tsunamis were not a factor. San Francisco's fire was much more devastating. The residents of both cities were familiar with prior earthquakes. Geological science and fault mapping in the two areas were comparable. Why, then, was there over 100 times difference in loss of life? The answer, Zebrowski argues, is found in the type of building construction found in the two towns. Wood was predominant in San Francisco, masonry (which does not flex well) in Messina. Most of the deaths in Messina resulted when people were crushed to death by falling walls within their own houses!

There is much more to ponder in this book. For example, there is a very good discussion of the Easter Island disaster (human-caused, in this case) as well as discussions of tornados, hurricanes, epidemics, volcanos, and floods. I recommend this book to all ASA members as a challenging read.

Reviewed by John W. Burgeson, 6731 CR203, Durango, CO 81301.

WHERE GARDEN MEETS WILDERNESS: Evangelical Entry Into the Environmental Debate by E. Calvin Beisner. Grand Rapids, MI: Eerdmans and the Acton Institute for the Study of Religion and Liberty, 1997. 256 pages + xix, indexes. Paperback; $18.00.

Beisner is an economist serving as an associate professor of interdisciplinary studies at Covenant College. There was an exchange in *Perspectives on Science and Christian Faith* (December 1995) between the author and Richard Wright. This book lists twenty-five items on environmental matters, published or spoken from 1989–1995 by Beisner. Five of these are appendices in this book.

Where Garden Meets Wilderness has seven chapters. The first chapter is entitled "The Rise of Evangelical Environmentalism." Beisner does not refer to a 1971 book by John W. Klotz, a 1974 article in *Christianity Today*, nor, most importantly, Francis Schaeffer's 1970 book, *Pollution and the Death of Man*. Beisner's main interest is in criticizing recent and current evangelical thought. His statement that "Significant evangelical attention began to turn toward the environment in the 1980s" (p. 3), is an oversimplification, at best.

The second chapter is on the nature of an evangelical environmental worldview. Beisner relates a televised dialog with Ron Sider and analyzes *Earthkeeping in the Nineties* (Loren Wilkinson, Ed. [Grand Rapids, MI: Eerdmans Publishing Company, 1990]).

In the third chapter, Beisner warns of the dangers of developing an ethic of environmental stewardship. In particular, he analyses the suggestions for being better stewards which were in *Earthkeeping in the Nineties*. He agrees with some, but not all, of these suggestions unreservedly.

In chapter 4, he discusses the use of Scripture by evangelical environmentalists. Beisner specifies four Scriptures misused by more than half a dozen evangelical authors. Isaiah 5:8, he says, is about depriving others. Jeremiah 2:7–8 is not about what happens to God's people when they pollute the environment, but when they worship idols. Isaiah 24:4 tells that God will destroy the land, not that people have done so. The Law of Jubilee is not about equal distribution, but about retaining property rights. I believe Beisner is correct about all these passages. Then he points out scriptural ideas that relate to the environ-

ment but have not been used as such. The parable of the sower, he says, could be used to teach that we are supposed to cultivate the soil, because its natural state is not very useful. The parable of the wheat and the tares could be used to teach that not all plants are good. There is more, and it is not a repetition of anyone else's use of Scripture.

The fifth chapter is on environmental misinformation, in which he takes on the Christian Society of the Green Cross, and lists ten predictions about running out of petroleum, none of which came true. The sixth chapter is on some debating mistakes evangelical environmentalists have made, and the seventh on population matters. Beisner does not believe that an increasing population is a bad thing. We are created in the image of God, and thus should be able to make the earth a better and better place.

The first appendix is an attempt at a scriptural foundation for environmental ethics. The second is an attempt at a Christian perspective on biodiversity. This material was delivered to the South Carolina Division of the Society of American Foresters. (Too often Christians speak only to other Christians.) The third is a long critical review of Susan Power Bratton's *Six Billion and More* from *Stewardship Journal*. The fourth, originally published in *World*—which raised Wright's ire—is a critique of the *Evangelical Declaration on the Care of Creation* by the Evangelical Environmental Network. The fifth is Beisner's response to Wright.

I cannot imagine anyone reading this book without coming away with several favorable impressions. One is that Beisner takes Scripture seriously. In an index of scriptural references which is almost four pages long, he lists fifty of the Bible's sixty-six books, most of them several times. The second is that Beisner uses a lot of literature. In an author index, he lists over two hundred and fifty individuals. The book has over forty pages of notes. (But see comments on the first chapter, above.) The third is Beisner does not hide his opinions. The final sentence of his review of Bratton, for example, is: "In short, *Six Billion and More*, while an *important* contribution to debate, suffers such serious moral, theoretical and empirical flaws that it should not be embraced by thoughtful Christians as a truly *positive* contribution" (p. 159).

Beisner's main purpose is to criticize other evangelical Christians who have written about the environment. Is he merely a tool of insensitive industrialists, one of those Christians whom Lynn White said was responsible for our environmental troubles? Not exactly. He perceives environmental problems. He believes that we are to be responsible, under God, to take care of the environment. He perceives that our scriptural mandate is to turn the wilderness into a garden. He questions many of the received truths of the environmental movement. He is not sure that global warming, fluorocarbons in the atmosphere, and especially population growth are nearly as bad as many have stated. He is not sure that extinction is happening nearly as rapidly as some have written. He believes that economic development is mostly good, and that the environmental problems impacting the most people are low-tech things, such as smoke from cooking fires.

This is an important book, and deserves a careful reading by the members of this Affiliation. Beisner has performed a valuable service. We need to think about low-tech pollution affecting those least able to do something about it. We need to be careful about making statements about environmental problems that cannot be backed up with real data. We need to avoid jumping on bandwagons, and crying doom without very good reason. We need to examine the scriptural basis of our environmental ethics very carefully. We should not expect all Christians to agree about environmental priorities, or Christians to always agree with non-Christians. However, I am afraid that, whatever Beisner's intentions, some of those reading his book will be encouraged to neglect their stewardship responsibilities.

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ENVIRONMENTALLY SIGNIFICANT CONSUMPTION: Research Directions by Paul C. Stern, et al., Eds. Washington, DC: National Academy Press, 1997. 143 pages. Paperback; $34.00.

This is the final report of the Committee on Human Dimensions of Global Change Commission on Behavioral and Social Sciences and Education of the National Research Council. The twelve members of the Committee have backgrounds spanning history, political science, economics, anthropology, ecology, engineering, oceanography, geology, and sociology. The book was reviewed by many others as part of the formal process that all National Research Council reports experience in the course of their development. The result is a brief but highly reliable compendium of what we presently know and do not know about human effects on the environment which have their origins in human consumption within highly industrialized nations, as distinguished from other nonconsumption factors, such as global population growth or deforestation in the two-thirds world.

The opening chapter sets out the issue of consumption as a problem for environmental science and gives a historical description of how the problem has been approached to date. The second chapter focuses on the development of a working definition of what counts as consumption for purposes of environmental research and policy. The next chapter consists of a series of contributed papers focusing on tracking key flows of energy and materials in societies which engage in high rates of consumption. A parallel chapter looks at the driving forces behind these consumption patterns. In both chapters, the concern is to summarize data which bears on the issue, critique this data for its strengths and weaknesses, and suggest key research questions which remain outstanding. The final chapter focuses on strategies that can be employed to set research priorities for this important global issue.

The various charts, graphs, and tables are worth the price of the book. There is ample ground within this volume to engage the research energies of Christian scholars and to help frame Christian discussions about our own stance regarding consumption. One could not help but think of the contributions of Ronald Sider and Sojourners over many years, calling Christians' attention to issues around consumption patterns in America. As with all National Academy publications, there are ample references to key research sources upon which the analyses are based. Students, especially at junior-senior and graduate levels, can use these contributions as a jumping off point for a detailed look at particular issues as they relate to Christian responsibility in a stewardship framework. This is an important issue around an important topic. It remains for biblical scholars and theologians to address the religious dimensions of the issue of human consumption as expressed not only at the individual, but also at the societal level.

Reviewed by Dennis W. Cheek, Director, Office of Information Services & Research, Rhode Island Department of Education and Adjunct Professor of Education, University of Rhode Island, 255 Westminster Street, Providence, RI 02903.

THE TWO CITIES OF GOD: The Church's Responsibility for the Earthly City by Carl E. Braaten and Robert W. Jenson, Eds. Grand Rapids, MI: Eerdmans Publishing Company, 1997. 133 pages. Paperback; $18.00.

Most chapters in this book were first presented at two conferences sponsored by the Center for Catholic and Evangelical Theology. Martin Luther wrote about the two hands of God: the left hand administering the daily affairs of life and the right hand administering the Gospel and church. This book addresses the Augustinian question of the relationship between Jerusalem and Athens.

The co-editors of this book are directly associated with the Center for Catholic and Evangelical Theology in Northfield, Minnesota. Robert Jenson also is Professor of Religion at St. Olaf College. The other contributors come from six different religious or academic institutions.

A variety of specific issues are addressed by the various essays: the church's responsibility for the world, the relevance of Scripture to cultural engagement, natural law, politics, faith and the American academy, economics, and marriage. The co-editors' preface accurately summarizes the overall orientation of the volume:

> Christians claim that the church is the one community given knowledge of God's will for the world. However arrogant this sounds, the church that is no longer willing to sustain such a claim has arguably lost its reason for existence. The first task of the church, precisely in the modern secular city, is to be true to her own self as the Body of Christ in the world. By being nothing less than the community of God's love, the church confronts the city with the truth of the city's own nature and destiny. The church serves the city best by giving it the means to see itself truthfully (p. ii).

The essays are thoughtful and well written, although the discussions are brief. Only limited references to a much larger body of scholarly work that bears on each topic are included. However, there is sufficient diversity in viewpoints among the contributors to provoke a sustained discussion of the contents. The book could be required reading in a variety of courses in Christian colleges and universities, especially in social science disciplines. Religious studies departments could also use it in a course targeted to modern American culture. In both cases, students could be asked to write their own research paper around a topic either broached in the volume or related to its major themes.

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ENVIRONMENTAL ETHICS AND CHRISTIAN HUMANISM: Studies in Christian Ethics and Economic Life by Thomas Sieger Derr, with James A. Nash and Richard John Neuhaus. Nashville: Abingdon Press, 1996. 160 pages. Paperback; $17.95.

The comment on the back cover claims that Derr challenges current biocentric ethics from the perspective of Christian humanism. Knowing little of Christian humanism, I cannot attest to this boldness. I, however, can recommend this small volume as a readable, challenging book on several aspects of the current environmental debate from a Christian perspective.

My Christian perspective is probably more evangelical than that of the author of the lead essay, Derr, and that of the rejoinders to his essay, James A. Nash and Richard John Neuhaus. Derr's assessment of the ecofeminists is especially poignant yet balanced. For example: "The ecofeminist movement has many faults—what interesting movement does not?—but some seem particularly crippling or disabling." These include the assumption that all crises are "bound together by one theme of patriarchalism" and the implausibility of the "specific identification of women with nature as a unity, opposed to men."

Derr covers many topics in his essay (which is the bulk of the book) including animal rights, population, the greenhouse effect, the ozone layer, and the balance between the rights of the individual and the community.

The first response to Derr's essay is by Nash, who is described as a "liberal" Protestant. Well written, it questions some of the points raised concerning ecofeminism, nonhuman life, and other points.

Predictably, Neuhaus' retort is pithy and articulate. His conservatism is well known from his many writings and this essay is no exception. Many of his points resonated with me. I especially like his analogy of humans as the cantors and caretakers of the universe. What songs should be sung, Neuhaus asks? His answer: the song of

God's sovereignty, of our dignity derived from his caring for us, of God's delight in his creation, of reason's gift, of fellow-feeling with all that is, of wonder, of obedience to the command to care, and of redemptive note. On those strains, I commend this well-written, thought-provoking book!

Lytton John Musselman, Fulbright Professor, Department of Biological Sciences, University of Jordan, Amman 11954, Jordan.

SHAPING WORLD HISTORY: Breakthroughs in Ecology, Science, and Politics by Mary Kilbourne Matossian. Armonk, NY: M. E. Sharpe, 1997. 247 pages, index. Hardcover; $62.95. Paperback; $22.95.

Matossian is a retired professor of history from the University of Maryland at College Park. She received her Ph.D. in history from Stanford University and is a recognized expert on microtoxins in history. This book describes the four most important factors that she believes sparked human innovations in history: climatic change, change in communication and transportation technology, competition between political elites, and scientific discoveries. Whether she has picked the top four influential factors from what could be a very long list is immaterial as far as this reviewer is concerned. The book is an interesting read that traverses millennia and a very diverse set of topics in a basically chronological approach.

The first chapter makes the overall case about why she picked these four major causes of innovations. In some sense it is a precis of the entire book. Throughout the book, Matossian consistently weaves the threads of the four factors as chief drivers ("triggers" in the language of James Burke) within human systems that prompted various human responses (innovations). She plays out these ideas in various historical periods including hominid evolution; early agriculture; the birth of civilization; the Roman Empire; Han Empire; Chinese Millennium (A.D. 500 to 1500); Medieval Europe; Reformation; scientific revolution of the seventeenth century; the modern era of population explosions, social control, and industrialization; and recent developments in science and technology.

Informed readers will quibble with Matossian over many points. She, however, is to be complimented in attempting a very difficult task and helping others to begin to think more in depth about how basic forces in nature and society shape larger historical contexts in transparent and veiled ways. I was reminded both of Arnold Toynbee's sweeping narratives of world civilization and the writings emanating from the Annals school in France, e.g., Fernand Braudel. Everyone who reads this book will walk away with some new insights, some criticisms, and much food for thought.

The range of literature accessed and ideas expressed is a tribute to Matossian's wide-ranging interests and intellect. ASA members will certainly be amused that the significant role of religious belief in shaping human cultures and developments only surfaces in the most tangential manner. The reader can fruitfully compare her perspective, for example, with that of David Noble's newest book, *The Religion of Technology: The Divinity of Man and the Spirit of Invention* (New York: Alfred A. Knopf, 1997), which argues for a very central (and negative) role of Christianity in technological developments.

Reviewed by Dennis W. Cheek, Director, Office of Information Services & Research, RI Department of Education and Adjunct Professor of Education, University of Rhode Island, 255 Westminster Street, Providence, RI 02903.

PLAYING GOD: Dissecting Biomedical Ethics and Manipulating the Body by R. C. Sproul, Jr., Ed. Grand Rapids: Ligonier Ministries/Baker Books, 1997. 96 pages. Paperback; $8.99.

This book is not written by the highly regarded and widely known R. C. Sproul. It is an anthology gathered by his son, R. C. Sproul, Jr. The senior Sproul does contribute two essays of four pages each. This typifies the length of the fifteen gathered pieces. Each reads in an emphatic style indicative of their origin as columns in a newsletter called *Tabletalk*. The punchy selections, consistently decrying current trends in bioethics, could function well as discussion starters. At the end of the book, there is a list of four or five provocative questions for each brief chapter.

The book could be damaging if it is used in a group that does not have the needed expertise to balance unfounded assertions with relevant information and nuance. As an anthology, the degree of expertise varies. Thoughtful scholars such as Nigel M. de S. Cameron have a selection, but most of the contributions are not written at that level. For example, Andrew Kimbrell states: "Christians have always insisted that the human body is created in the image of God, giving extraordinary dignity and meaning to the body itself" (p. 71). On the contrary, while Genesis, of course, states that we are created in God's image, there is no implication that the image of God relates to the particular physical body.

On science, Michael Beates writes in *Can You Clone A Soul?* that "several dozen people with Parkinson's will undergo surgery, having their skulls opened for the implantation of tissue. But to see if there is a psychosomatic element in this procedure, only half will receive fetal tissue transplants. Such testing, manipulating the body with no intention of corrective measure, further diminishes the credibility of those engaged in such research" (p. 76).

Actually, with fully informed consent, double blind testing and other types of controls are often necessary to establish the efficacy of potentially corrective measures. In most cases, it would be not providing controls that would undermine the credibility of the engaged research results and their authors.

Reviewed by James C. Peterson, C. C. Dickson Professor of Ethics, Wingate University, Wingate, NC 28174.

THE CHRISTIAN CASE FOR VIRTUE ETHICS by Joseph J. Kotva, Jr. Washington, DC: Georgetown University Press, 1996. 184 pages, index. Hardcover; $55.00.

The review copy of the book contained little biographical information on the author. I gleaned from the introduction that he is serving as the "scholar-pastor" of the First Mennonite Church, Allentown, PA. No other relevant works by this author were mentioned. This book is apparently a modification of his Ph.D. dissertation.

The Christian Case for Virtue Ethics consists of seven chapters. The first, "The Return to Virtue Ethics," discusses many reasons we are hearing calls for a return to a virtue approach to ethics. Chapter two, "What is Virtue Ethics?" explains the teleological nature and tripartite structure of virtue theory. The third chapter, "Needed: A Christian Case for Virtue Ethics," answers "Why should Christians in particular, embrace virtue ethics?" Chapters four and five take up the specific task of making "Theological Links" and "Biblical Connections" between Christianity and virtue theory. The author examines sanctification, Christology, anthropology, in addition to the Gospel of Matthew and the Letters of Paul, for specific compatibility with a virtue approach. He also mentions the simplistic nature and directionlessness of the ever popular "situation ethics." Having established basic theological and biblical compatibility, Kotva deals in chapter six with "Theological and Biblical Objections" to virtue ethics, such as being self-centered, too aristocratic, or even sectarian. The seventh and final chapter is his "Conclusion: An Appeal for a Christian Virtue Ethic." There are extensive chapter endnotes with bibliographic citations and an index.

The book's main point is that St. Thomas Aquinas was right all along: Aristotle's virtue ethics are well suited to the Christian moral life. The author seeks to establish solid links between virtue theory, orthodox Christian theology, and Scripture itself. One of his primary considerations is that any ethic a Christian chooses to follow should ultimately lead to conformity to Christ. The focus of a virtue approach is on the development of internal Christian character, from which ethical actions will flow.

Virtue theory is not, however, accepted into the Christian fold without significant modification. Kotva points out that Christian virtue ethics must emphasize the indispensability of God's grace for our growth in virtue. We cannot simply lift ourselves by our ethical bootstraps into a state of "virtuosity." Likewise, the theory must be expanded to include such realities as the Christian hope of life after death, forgiveness, and justice.

Kotva has a clear, focused goal. He wants Christians to abandon some deontological and consequentialist approaches they have been taking, and look seriously at virtue ethics. He is direct, to the point, and makes his case convincingly. Digressions are taken up in extensive chapter endnotes. I would have liked the author to go further into defining the actual content of his proposed Christian virtue approach to ethics. What, specifically, are the virtues that every Christian should be cultivating in life? Are these virtues the same for every group? If they are not the same for everyone, on what basis do we choose specific virtues to pursue? Does God choose different virtues for each Christian? What role does the local church play in the demonstration of the virtues? Answers to these questions could profitably become the subject of a second volume.

The author's straightforward style allows for easy reading. He uses some technical theological and ethical language such as "kerygma" (which can be handled by consulting a standard dictionary). I see the book being used as a supplementary text in a Christian college/university undergraduate ethics class. If one is concerned about various ethical systems being promoted today, and how a Christian can justify embracing any of them, then reading this book will help one see the nice fit that Aquinas saw between Aristotle's virtue ethics and Christianity. This is a good book, but it is expensive. I would ask my university library to purchase it.

Reviewed by G.A. Ridgeway, 234 Saipan St., Parris Island, SC 29902.

GOD AND INSCRUTABLE EVIL: In Defense of Theism and Atheism by David O'Connor. New York: Rowman and Littlefield Publishers, Inc., 1998. 273 pages. Hardcover; $67.00.

This book is a reworking of several papers previously written on related topics. O'Connor, professor of philosophy at Seton Hall University, has produced a book which at first glance appears to be oxymoronic. How can a book defend both theism and atheism? Historically these have been viewed as mutually exclusive positions. O'Connor, however, defends the position that "relative to certain facts and capacities, theism can be justified for certain persons in certain circumstances, atheism for others in other circumstances." Both theories may be accepted by the same person in different circumstances. O'Connor seeks detente between "friendly" atheism and "friendly" theism. The detente rules out agnosticism which holds that, due to lack of knowledge, no one can be justified in believing either atheism or theism.

This book is not easy reading for the philosophical neophyte. For instance, O'Connor's acronyms are difficult to remember from chapter to chapter. Further, for some readers OT may suggest Old Testament, but to O'Connor it means orthodox theism (p. 7). This line will illustrate how disconcerting acronyms can be: "... thus that NERNP that seems to be NENP1 cannot be (God) justified as NEM" (p. 85).

This book will appeal to anyone who has ever asked why there seems to be so much unnecessary evil and suffering in the world. Careful reading is required for comprehension, even for those familiar with the subject matter. O'Connor is most lucid when he illustrates the points via concrete illustrations; fortunately, he does this frequently. *The Puzzle of Evil* by Peter Vardy, written on the same subject, is a good prolegomena to O'Connor's

book. O'Connor's book is written in a more abstract vein, and it will provide some intellectual delights for those so inclined.

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

THOUGHT CONTAGION: How Belief Spreads Through Society by Aaron Lynch. New York: Basic Books, 1996. 192 pages, bibliography, index. Hardcover.

The author makes a strenuous effort to demonstrate that ideas, beliefs, and taboos called "memes" become themselves entities separate from their hosts, that is, from individuals and communities. Taking on a life of their own, memes began to control people, rather than people controlling their own destinies; in other words, people do not accumulate ideas as much as memes accumulate people. Lynch contends further that recent research, which proposes to correlate the origin and movement of ideas within the same categories of genetic evolution, also requires a new science to explain more accurately how ideas spread through a population; thus, the birth of "memetics," the study of how ideas spread through populations. Lynch simplifies the term with his own construction of "thought contagion."

Stimulated by such works as Richard Dawkins' *The Selfish Gene*, in which the term meme was coined, Lynch follows a largely materialist evolutionary path to found the new science. Dawkins himself offers a promotional blurb for the book jacket: "When I get down to writing 'The Selfish Meme,' Aaron Lynch's admirable *Thought Contagion* will ... [provide] intriguing examples and penetrating analyses."

Lynch does indeed provide many intriguing examples but the analytical dimension is woefully lacking. He basically runs into the same problem that all have faced when they try to force human dynamics into the strictures and formulas of the natural sciences. There are, of course, some describable and even predictable patterns within human behavior that lend themselves to general scientific formulas, but when one presses this too far it quickly becomes something other than the consistency found in the natural sciences.

On the surface, Lynch has a lot going for him. Ideas, beliefs, and taboos are powerful and do appear to develop lives of their own. Many individuals and communities behave in certain consistent ways without being able to explain exactly why they behave that way. At times, they are willing to die in defense of, or kill to perpetuate, those very behaviors, or at least use less forceful measures to encourage conformity. There are also those phenomena of social behavior that run through a population like an infectious virus, such as the hula-hoop fad of the 1950s. Some of these phenomena will always defy precise scientific explanation, which, of course, does not bode well for memetics.

Undeterred, Lynch proposes many examples of "memetic science," such as the nonconformity of the Amish, who perpetuate this meme through having more children to maintain labor intensive farming without machines and to convince an ever-increasing posterity of the validity and necessity of such a perspective. His interpretation is that once the idea is spawned it takes a "natural evolutionary" course that determines behavior rather than individuals coming to a conscious choice.

Lynch pursues his objective to define memetics with some caution, noting that he can only propose certain outlines at this stage of its development. However, even in outline, there are critical flaws that will not get better with time or study. Once given totally to the proposition of naturalism, that is, molecular interaction is the ultimate cause of all existence, then memetics would make some sense. In fact, it would have to be the final explanation. On the other hand, his analysis is simply not persuasive; he never gets beyond describing behavior, though he is convinced that memetics is at work. However, his analysis of why it happens is unconvincing. This is clearly seen in his effort to put memetics into "scientific" categories (chaps. 3–9). The seven modes turn out to be so general, and often contradictory, that they have little meaningful explanatory content.

Perhaps the most blatant flaw is exposed in Lynch's feeble attempt to resolve the ultimate contradiction of the theory. If a meme takes on a life of its own, invading and infecting the host mind, then how can the host mind accurately analyze itself? In reality it cannot, since the infection, contagion, now controls the thought process. Lynch responds: "The point would be valid if the theory were the first and only example of itself, but the likelihood of that appears remote. As an example of itself, thought contagion theory should merely supply itself more data for analysis and predictions" (p. 177). He, of course, misses the critical point: no matter how much more data, the basic theory remains self-contradictory. His response: "But this is simply not true of memetics." Lynch may be in denial—tricked by a meme.

The relationship among chemistry, biology, and consciousness will always be intriguing, perplexing, and stimulating. It would be difficult to write a book that makes no contribution to the field. For that reason, Lynch does provide a very readable text on a popular level, but despite every effort to be "scientific," does not move out of the realm of "pop-science."

Reviewed by Wes Harrison, Alderson-Broaddus College, Philippi, WV 26416.

HAPPINESS IS A SERIOUS PROBLEM by Dennis Prager. New York: HarperCollins Publishers, 1998. 179 pages. Hardcover; $23.00.

Prager has been picked as one of Los Angeles' ten most powerful people. This celebrity status derives from his radio talk show, his newsletter, his books and tapes, and

his worldwide lectures. He has been described as "an amazingly gifted man and moralist" and "a true Renaissance man." This volume has received accolades from such writers as Harold Kushner *(When Bad Things Happen to Good People)* and William Bennett *(The Book of Virtues)*.

Of what interest would this book be to Christians and scientists? It should interest Christians because Prager believes that religious people are obligated by their faith to be happy. Although Prager's Jewish background has not led him to side with Christians in their conviction that happiness (or joy, if you prefer) comes via a proper relationship with God through Jesus Christ, he does believe that religious faith is a necessary ingredient in happiness. As for the scientific perspective on happiness, it is found less in this book than in *The Pursuit of Happiness* written by ASA member David G. Myers. Michael Argyle's book, *The Psychology of Happiness*, also deals with extensive sociological and psychological research. Prager's book has no footnotes and no bibliography. His conclusions seem to be based on his experience, buttressed by his philosophical, psychological, and theological background rather than on empirical analysis. Nevertheless, I think most Christians will find little in this book to quibble about and quite a bit to celebrate. For instance, Prager believes that unhappiness is widespread "because human nature is insatiable." To achieve a modicum of happiness, it is necessary to battle our insatiable natures, which means we must battle ourselves. The problem with contemporary Americans—the most affluent people in history—is that they are satisfied with nothing, fixated on what they do not have, and consumed by images of the unobtainable. This leads to a misguided search for wealth, beauty, fame, sex, pleasure, security, and excitement. With these thoughts, Prager echoes the words of Jesus and Paul (Luke 12:15; 1 Tim. 6:7).

Prager's premises are that happiness is a moral obligation, unhappiness is easy while happiness takes work, the mind plays the central role, and happiness is difficult to define. Major obstacles to happiness include comparing ourselves to others, the missing tile syndrome (searching for what is missing instead of reveling in what is not), equating happiness with fun or success, false expectations, and victimization. Major attitudes essential for happiness include seeing happiness as a by-product, cultivating a positive philosophy of life, and developing self-control. Anecdotes and humor are scattered throughout the discussion.

Some might take exception with Prager in his emphasis on happiness as a serious problem and something we should pursue. Christians might argue that life's quest should not be for happiness but for salvation and obedience. Prager's response to this would doubtless be that salvation and obedience should lead to happiness (or joy): "Unhappy, let alone angry, religious people provide more persuasive arguments for atheism and secularism than do all the arguments of atheism."

Happiness is a much written about topic. There are 1,226 books in print on the subject. However, probably none of them are more readable, succinct, and wise than this one. I think you will find it interesting, stimulating, and for the most part, psychologically and theologically sound. Finally, we might ask, "So, Dennis Prager, are you a happy man?" I suspect those who read this book will have no problem answering this question.

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

WHAT HAPPENS AFTER DEATH: Scientific and Personal Evidence for Survival by Migene González-Wippler. St. Paul, MN: Llewellyn Publications, 1997. 242 pages, index. Paperback; $7.95.

The author is a cultural anthropologist, lecturer, writer, and has experience as a science editor. In the second half of this book, a spiritual entity named Kirkudian has ostensibly channeled to the author the story of a number of his former existences, sometimes in another star, sometimes in a life on earth. Like many others who tell of reincarnation, Kirkudian is a name-dropper, claiming to have associated with the ballerina Anna Pavlova, and to have been incarnated as Alexander the Great and as Francis of Assisi. The scientific aspects of Kirkudian's astral adventures are quite unworldly, in which "tritium" is a red liquid, and the waters of a planet consist of mercury and liquid nitrogen! These stories may be of interest to the lovers of science fiction among our readers.

The first part of the book tries to be more serious: the author describes it as "an objective study of life after death" (p. xi). She occasionally observes a scientific caution. González-Wippler admits that an out-of-the-body experience might be "a brief hallucination" (p. 56). She also admits that none of the major prophecies of the psychic Edgar Cayce have come true. But for the most part, she provides an uncritical, accepting travel through the major highlights of spiritualism and unexplained phenomena, with little concern for skeptical criticism. For example, she suggests that the Fox sisters actually communicated with the spirits of departed people in Hydesville, New York in the mid 1800s. But the fact that Margaret Fox later confessed that it was all a fake, and publicly demonstrated that her spiritual "rappings" were the cracking of her toe joints, is not mentioned in this book.

In the four-page bibliography, the credulous are well represented, but the skeptical in this field are given scant representation. The teachings of a form of astral Hindu mysticism, in which there are many distinct planes of reality, are accepted without the batting of an eyelash.

How could the soul survive death? "Simple and well-known data" lead the author to the following conclusion: "The human mind is made of electromagnetic energy, and since energy cannot be destroyed, then it follows that the human mind cannot be destroyed either" (p. 11).

These samples convey the tenor of this book.

Reviewed by Lee A. Young, 144 Chestnut Circle, Lincoln, MA 01773.

REINCARNATION: A Critical Examination by Paul Edwards. Buffalo, NY: Prometheus Books, 1996.

To this reviewer's knowledge, this book is the first comprehensive and systematic evaluation of reincarnation and karma written by a skeptic. In the Introduction, Edwards states the reason for this critical evaluation: "It is well known that the main philosophical tenets of Christianity and Judaism—belief in God, life after death ... have been subjected to a devastatingly critical examination by a number of the greatest Western philosophers. No Western philosopher has offered a similarly detailed critique of reincarnation and the related doctrine of karma." In the past decades, beliefs in reincarnation and karma have been steadily gaining support in the West, and hence the author feels an "urgent need" to write the present volume "to fill this gap."

Edwards has tried to state all the main arguments offered in support of reincarnation and karma, and has concluded that this evidence is "worthless." The analysis, or "critical examination" as the author calls it, is done in seventeen chapters, starting with the definition of reincarnation and karma in the first chapter and comparing them to their counterpart in monotheism, resurrection. Though he finds both beliefs untenable under critical examination, he argues that reincarnation has several advantages over the belief in the resurrection of the body.

Unfortunately, Edwards makes his comparisons and analyses from the worldview of an ontological naturalist. As a thoroughgoing materialist, for whom death is the total annihilation of existence, he presents all his arguments based on nonduality, or at best "weak duality" of body and mind. In so doing, he is unable to include the demonic element present in many "empirical" arguments made by the proponents of reincarnation and the Law of Karma.

In this book, Edwards succinctly summarizes the content of each chapter. In Chapter 2, he presents the moral argument, namely the evidence of injustice in the world, used by supporters of reincarnation. In Chapter 3, he discusses the Law of Karma, followed by such empirical arguments as child prodigies, and déjà vu experiences. In Chapters 5 and 6, he discusses hypnotic regressions and analyzes famous cases, such as Bridey Murphy. He finds all these evidences wanting. Spontaneous memories are discussed in Chapters 7 and 16. In Chapter 8, he shows how the principle of conservation of "spiritual" energy logically leads to the reincarnation conclusion. Chapters 10–12 are devoted to the new immortality movement often used to support reincarnation, with Kubler-Ross and Moody as its chief protagonists. After thoroughly discrediting the near-death experiences of Kubler-Ross and Moody (always from a materialist's perspective), he takes apart the views of Grof, a Czech psychiatrist now living in the United States, and his ex-wife Halifax, who maintain that certain experiences of dying people who had been given LSD are evidence for reincarnation. In chapter 9, he evaluates the astral body notion and then discusses the "interregnum"—the realm in which human beings are said to reside between incarnations. The final chapter is devoted to the argument that human consciousness depends totally on the human brain; hence, when the brain dies, so does consciousness.

As a committed atheist, the author denies the possibility of a spiritual, immaterial existence and dismisses the concept of an immortal soul which is a basic tenet of all major world religions. In fact, the reader is encouraged to read Chapter 17 *first*, in order to appreciate the materialist presupposition on which the author bases *all* his arguments against reincarnation and the Law of Karma, and for that matter, against *all* belief in afterlife.

For ASA members interested in learning about the pervasive belief in reincarnation in the West (over 50% of Americans today believe in reincarnation) or the controversy surrounding near-death experiences, hypnotic regression, and astral projection, this book is a good compendium. Unfortunately, Edward's total rejection of the spiritual dimension in humans and the nonexistence of the spirit world, and even of good and evil, seriously weakens his otherwise perceptive critique of the belief in reincarnation and the Law of Karma. This book is a good reminder of C. S. Lewis' insightful statement that without special revelation from God, as recorded in the Bible, the natural inclination of man is toward pantheism, where reincarnation and the Law of Karma become the only consistent explanation of immortality. Without a loving, personal God, who has redeemed humankind through the death and resurrection of his Son, Jesus Christ, all that an individual is left with is reincarnation, which could be described as "a poor man's resurrection"!

Reviewed by Kenell J. Touryan, Chief Technology Analyst, National Renewable Energy Laboratory, Golden, CO 80454.

WILLIAM JAMES: The Center of His Vision by Daniel W. Bjork. Washington, DC: American Psychological Association, 1997. 360 pages, appendix. Paperback; $19.95.

Bjork is the author of several books and biographies including *B.F. Skinner: A Life; Victorian Flight: Russell Conwell and the Crisis of American Individualism;* and *The Compromised Scientist: William James in the Development of American Psychology.*

As the title indicates, the purpose of this biography on James is to determine the "center of his vision." This examination of James' fundamental focus provides an excellent account of his life and intellectual endeavors. The book chronicles his life beginning with his trips to Europe as one of the privileged sons of the wealthy Henry James, Sr., up to William's death from circulatory problems after ending his teaching affiliation with Harvard University.

Across the fifteen chapters which are used to cover his life from adolescence to death, James' beginnings as a student who takes an interest in contemporary French art provide the groundwork for his becoming one of the most influential figures in the history of American psychology. One fascinating aspect of this book is that the

author relies more on James' personal diaries, notebooks, and correspondence with those close to him than on published works as the basis for discovering James' personal focus. As a result, many of the quotes (which are in the writing style of the late 1800s and early 1900s) take some getting accustomed to.

The book moves from his interest in art, which he maintains throughout his life, to his search for an occupation as an adult. While deciding on medicine, his multiple interests become apparent with his search for adventure on the Amazon and the beginning of his many affiliations with preeminent philosophers of the day. His marriage and chronic neurasthenia provide the personal backdrop for his academic pursuit of the nature of reality. It becomes apparent that James' interests were constantly shifting due to his refusal to accept the boundaries of scientific and philosophical disciplines. To James, reality flows together and boundaries are arbitrary.

An excellent account of James' activities and accomplishments as Professor of Psychology at Harvard is provided. Woven throughout his correspondence with his wife, extended family, and professional acquaintances, James displays an uncanny breadth of knowledge and begins to shape the origins of his thinking on such psychological topics as "streams of consciousness," pragmatism, empiricism, and dualism. The personal diaries and notebooks, along with the correspondence with friends (both personal and professional), display the multiple hats that James wore, as well as his emotional responses. The author also provides a convincing argument for the emotional and intellectual dependence that James had on his wife, which is often underplayed or missing from other biographies.

Bjork's emphasis on the private James allows for a greater appreciation for the struggles that this pioneer of functionalism and introspection faced. This biography attempts to avoid focusing on the individual interests of James, as other biographers have done. The author believes that: "To breathe biological life into James one must take an imaginative leap into the way he saw reality as his creative life unfolded" (p. xv). Concerning the "center of his vision," Bjork concludes that "there was one preoccupation that guided his creative efforts ... his deepest involvement was the effort to describe how *his* mind encountered the world" (p. 264, author's italics). Overall, this book provides an original and in-depth overview of James' life, relationships, and intellectual contributions. This book is highly recommended to anyone seeking a concise and fresh perspective on America's best-known psychologist and revolutionary thinker.

Reviewed by William M. Struthers, Biopsychology doctoral student, Psychology Department, The University of Illinois at Chicago, Chicago, IL 60607.

Letters

Reply to Tanner

Dr. William Tanner's letter (*PSCF* 50, no. 2 (1998): 156) critical of my Dec. 1997 article raises a number of interesting issues. Dr. Tanner states:

> 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.

First, Tanner uses "round" numbers. There is no way that the crisis occurred as early as seven million years. The most recent dating of the Messinian Salinity Crisis places it between 5.9 and 5.5 million years ago.[1]

Tanner continues:

> 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.

As members of this forum are well aware, that is precisely what I am saying. It is the only thesis that fits the observational data of anthropology. To restrict Adam to the past 10,000 years ignores tremendous evidence of religious and other human behavior that exists prior to that time. Tanner is apparently unaware of the existence of this data, including:

- fire usage (back to 1.5 myr)[2]
- religious altars (400 kyr at Bilzingsleben, Germany)[3]
- idols (Israel 300 kyr)[4]
- art (1.6 myr)[5]
- hut-building (1.8 myr)[6]
- woodworking (1.5 myr)[7]
- Earliest wooden plank with polish (240–700 kyr)[8]
- Earliest ocean crossing (780 kyr)[9]

All of this took place long, long prior to 10,000 years that Tanner believes represents Adam. Tanner states:

> Part of Morton's article depends heavily on expressions such as "could have been" and "possibility" ... 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.

The use of "could" applies equally to any hypothesis that is advanced.

I would like to hear Tanner's explanation for the above facts. It would be nice if people who were so quick to criticise would actually spend the time to examine the anthropological literature and see that what they suggest is not tenable given today's anthropological database!

I will freely admit to a gap in data needed to support my thesis, but it is not the gap between 10,000 years and 5.5 million years. It is the gap in cultural information from 2.5 million years to 5.5 million years.

Notes

[1]Robert Riding, et al., "Mediterranean Messinian Salinity Crisis: Constraints from a Coeval Marginal Basin, Sorbas, Southeastern Spain," *Marine Geology* 146 (1998): 11.
[2]John A. J. Gowlett, *Ascent to Civilization* (New York: McGraw-Hill, Inc., 1993), 56–7.
[3]Rick Gore, "The First Europeans," *National Geographic* (July 1997): 110.
[4]R. G. Bednarik, "Comments," *Rock Art Research* 5, no. 2 (1988): 98.
[5]M. D. Leakey, *Olduvai Gorge 3 Excavations in Beds I and II, 1960–1693* (Cambridge: Cambridge University Press, 1971), 269.
[6]Richard Leakey, "Recent Fossil Finds from East Africa," in J. R. Durant, ed., *Human Origins* (Oxford: Clarendon Press, 1989), 60–1.
[7]Kathy D. Schick and Nicholas Toth, *Making Silent Stones Speak* (New York: Simon and Schuster, 1993), 160.
[8]S. Belitszky, et al., "A Middle Pleistocene Wooden Plank with Manmade Polish," *Journal of Human Evolution* 20 (1991): 349–53.
[9]M. J. Morwood, et al., "Fission-track Ages of Stone Tools and Fossils on the East Indonesian Island of Flores," *Nature* 392: 173–6, 174.

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On Pearson's Lament: Codes, Morals, and Ethics

I recall a colleague's plaint, "They've scheduled a lawyer to teach Real Estate Ethics. Only a philosopher can teach ethics." Pearson, Assistant Professor of History and Philosophy, reacts similarly when he observes that the codes of ethics are incomplete (*PSCF* [June 1998]: 85 f.). Both philosophers want the codes to represent, as a minimum, morality, if not ethics. But that is not their intent.

Teaching ethics, I probed the basis for moral behavior. Could it be Kant's Categorical Imperative or Mill's hedonistic utilitarianism? I asked about the behavior justified differently by the various systems. As a Christian, I can also ask how comprehensive a system is found in Scripture.

In contrast, the primary questions of a professional code of ethics are: What must I refrain from doing in order to keep my license, to avoid censure, or to retain my right to apply for a grant? What must I do to maintain good standing? While the general hope is that all codes will reflect moral principles, this is not fundamental. For example, truth and justice are basic to morality. But a lawyer whose client has confessed to him cannot tell the court, "My client pleads 'not guilty,' but he's confessed his guilt to me and should be punished for the crime." Instead, he has to do everything within the rules (more or less) to secure an acquittal. If he is successful, neither truth nor justice is upheld. But he would be disbarred for telling the whole truth.

Codes have more recently acquired another function. I recall a situation in which the message was: "We can't discipline him for that. It's not in the Student Code." Tacit assumptions were no longer an adequate defense against a lawsuit. The omission had to be corrected in the next code.

Codes have marked limitations. First, they provide lower limits, whereas morality deals with ideals. Second, their application involves a restricted group. The "ethics" of placebos in drug trials has no parallel among realtors. Third, however expanded, they are incomplete, for clever rascals keep finding ways to circumvent them.

How comprehensive should a code be? I don't know, beyond the need to meet perceived problems. Perhaps only in breakthrough areas with unknown perils should codes be more stringent, with relaxation possible as empirical data allows reevaluation. This last has moral underpinnings. But other provisions in codes and related documents may spring from such immoral sources as deliberate obfuscation, pride or greed. So evaluation is more important than expansion.

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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.

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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.

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

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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