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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Skeptics of internet discussion groups readily cite examples of boorish behavior, off the top of the head pontification, and a cluttering of valuable space by those who must have the last word. Our first year of experience with the ASA ListServ has seen each of these problems — yet the benefits far outweigh the liabilities. Participants (anyone may subscribe) ask questions, make announcements, and contribute to ongoing discussion topics.

I have suggested topics based on papers published in recent issues of *PSCF*. The first, a general discussion of Meredith G. Kline's "Space and Time in the Genesis Cosmogony" (March 1996) drew much attention and generated a debate between two list members on a related theme. The second suggestion involved papers by Richard Wright "Tearing Down the Green: Environmental Backlash in the Evangelical Sub-Culture" (June 1995), and Edwin A. Olson "A Response to Richard Wright's 'Tearing Down the Green'" (June 1996). Again the response has been excellent. In each case, we have offered the articles on the ASA web site for those who do not have access to *PSCF*. We will continue this practice as long as there is interest.

Academics and people in industry linked to an in-house computer have quick access to the internet. Those who use a commercial service via modem from home face cost issues which are exacerbated by high volume and lengthy communications. Our list supervisor, Terry Gray, has developed a means for previewing the subject line of the communications so that one can download only mail that is of interest. Information on joining the ListServ and visiting our World Wide Web site is found on page 187. The ASA ListServ offers instant access to a wide spectrum of information and people of like faith who may become good friends through this medium. Our web site offers great potential for students and others who seek information on science-Christianity issues.

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In This Issue

The values of technology have generally been viewed with an optimistic eye by pundits past and present. Philosopher Robert A. Wauzzinski takes a more realistic view in his "Technical Optimism, Evolving Optimism: An Overview." He suggests that the heart of optimism's problem is technicism — the exaggeration of the technical aspect of the rest of life.

Robert F. DeHaan then considers paradoxes arising in main-stream Darwinian theory. He offers a more encompassing macro-development approach which begins with "the original and major change agent in phyletic lineages; Darwinian mechanisms then take over to provide the finishing adaptive touches." In the closing paper Jerry Bergman focuses on the contribution of Darwin and other late nineteenth century interpreters of evolution to sexual differentiation and the notion of female inferiority.

The Communications of Thaddeus Trenn and Cal DeWitt speak to fundamental issues of style and substance in our considerations of science and Christian faith. In Dialogue, Fred Suppe and Richard Bube offer responses to the June *PSCF*'s Editorial question, "Are evangelical scientists practical atheists?" Further essays on this topic will appear in forthcoming issues.

Don DeGraaf's Essay Review of Del Ratzsch's *The Battle of Beginnings: Why Neither Side is Winning the Creation-Evolution Debate* leads an extensive book review section. We close this issue with a selection of letters.

Technological Optimism

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Technological optimists believe in the religiously autonomous use of Reason for the domination of nature to the end of "progress." Complete human betterment is thought to come through technical innovation. After a brief overview of the history of optimism, we will focus upon the representative thought of Julian Simon and R. Buckminster Fuller. We will conclude this article with an attempt to discern the strengths and weaknesses of technological optimism from a biblical view.

Evolving Optimism: An Overview

Technological optimists believe that all forms of perennial human problems always can be corrected with technical solutions, given enough time and resources. The major concepts we will address include religion, the unity-diversity of life, autonomy, progress, Reason-rationality, nature domination, and, of course, technology.

Human life is diverse, like the liberal arts curriculum, in the sense that there are many different ways of functioning or being in life. While diverse, life manifests a basic wholeness. One may liken this diversity to rooms in a house that are different in character. It is the love of a family, however, that unifies mere architectural diversity, making it a home.[1] When the apostle Paul confesses in Col. 1:17 that creation coheres in Christ, he is speaking about the wholeness of reality. Therefore, we may conclude that however much academics necessarily separate reality into disciplines, an underlying wholeness roots creation in Christ. Because life is diverse yet rooted, we may talk about the *place* or *room* technology is allotted to by the optimists. Their basic *religious* or *root* convictions give answer to the place or importance allotted to technology.

To speak of life being rooted is to talk about the depths of life. Something or someone anchors life in a real or a pretended way: Christ or an idol is the religious way of speaking. So to the spatial metaphor depth we add ultimate to signify that which is believed to be of paramount importance for life.[2]

Optimists are ultimately committed to human autonomy — self-law — as the root of technological activity in particular and life more generally. "Man is the measure of all things" is their credo. Optimists turn to Reason[3] as the authority source for science and technology. They used Reason to free humanity from the "self-inflicted nonage" or legalized period of immaturity inflicted upon the West by the Church. Secular thinkers inspired to some extent by the Renaissance (1300-1600) and considerably by the Enlightenment (1700-1800) turned from divine revelation to Reason for authority.[4]

Neither pride nor experience would allow the mere confession of autonomy to substitute for the substance of remaking culture after the image of Humanity. Nature had to be remade so that the autonomous personality could bend nature to serve Reason. Science was the program, practical technology the fruit. Nature, mechanistically conceived, was to be systematically separated into countable atomistic bits to the end of manipulation and control. This rationally inspired, empirically directed eighteenth century attempt was bent on the subjugation of nature.[5] Domination meant freedom from the forces that long have controlled us: economic want, disease, natural laws, and ignorance.

Technological events prior to the eighteenth century blazed the trail for freedom so conceived. The introduction of the lateen or triangular sail, swinging rudder, deeper hulls, and the advent of the compass enabled fourteenth century Europeans to increase

trade while expanding their literal world view. Increased material abundance and navigational mastery resulted, while traveling stress diminished. Technological optimism drew inspiration from these navigational improvements that contributed, circa 1400, to the Renaissance or "rebirth." We will return to this rebirth in a moment.

Most technological optimists during the seventeenth and eighteenth centuries increasingly turned to a mechanistic view of reality. *Interpretations* of Sir Isaac Newton's universal gravitational laws reinforced an ethos that led to the nineteenth century Industrial Revolution. Older views, like those of Reformation theologian John Calvin that called nature a "symphony of service," gave way to the majority voice of philosopher-mathematician Rene Descartes. He called nature a "great machine made by the hand of God" whose laws were supposed to be as predictable as those of the machine. The human body functioned similarly. These laws, like freedom, were believed to function autonomously.

Therefore, belief in a Deistic God followed. The Christian God who providentially — personally and omnipotently — rules over the universe was believed to be irrelevant for a mechanistic autonomous universe. A "Clockmaker" was needed that would leave us alone to remake reality *for ourselves*. Thus, Descartes' arrogant religious candor states:

> ...it is possible to arrive at knowledge which is most useful in life, and that instead of speculative philosophy taught in the schools, a practical philosophy can be taught by which, knowing the effects of fire, water, air, the stars, the heavens, and all other bodies that surround us, as distinctly as we know the truths of mathematics, we might put them in the same way to all uses for which they are appropriate, and thereby make ourselves, as it were, masters and processors of nature.[6]

Such statements portray the secularization, possibly even the bastardization, of humankind's stewardly role as caretaker. The "cultural mandate" or God's command in Genesis 1 and 2 given to humanity through Adam and Eve to cultivate the earth *to the glory and service of the Lord* is transformed into a means of proud domination. If laws could be known, then they could be manipulated. They *had* to be manipulated; our freedom demanded it. This demand for freedom led, in turn, to the *technological imperative:* everything that can be done *should* be done as quickly as possible.

Much was at stake, not the least of which was "progress." *Total social and human betterment* became equated with improvements in science and technology. If science was the method of progress and technology the tool of progress, then increased economic abundance was the reward of progress. Economic rewards were known, literally, as bits of utility or *happiness.* The Industrial Revolution was supposed to be the complete cultural realization of this kingdom of happy, autonomous humanity.[7] "May technology be praised."[8] Therefore, in the rational scientific subjugation of nature through the practical tool of technology with the rewards being economic pleasure, we can locate the optimists' confidence in technology to produce a better life.

The American character was readily attracted to optimism during our national infancy. Abundance was worshiped and the oceanic boundaries were secured under the aegis of the thinly veiled secular call to a "manifest destiny," an American version of nature subjugation.[9] As our nation struggled for unity and identity, we turned to celebrated technological projects that in turn became our common religion. Thus, in 1839 the Reverend James T. Austin echoed the sentiments of a nation when he spoke of the hopes for steam power:

> It is to bring mankind into a common brotherhood; annihilate space and time in the intercourse of human life; increase social relations; draw close ties between philanthropy and benevolence; multiply common benefits ... and religion into an empire which they have all but nominally possessed in the conduct of mankind ... [10]

Robert A. Wauzzinski has served in an endowed chair that focused on the philosophy and ethics of technology and as a senior scholar for a project on the study of the interplay between religion and culture in Indianapolis, IN. He is currently the Visiting Professor of Philosophy and Religion at Ball State University. His disciplines include the philosophy of technology and of economics. He is the author of, Between God and Gold: Protestant Evangelicalism and the Industrial Revolution, 1820-1914, *that explores the roots of the Industrial Revolution. This article on technological optimism will be included as a chapter in the forth-coming book,* Discerning Prometheus: Placing Technology Within the Human Experience.

The thought that sin effects all that we do apparently did not occur to Reverend Austin until after the carnage of the Civil War. This blithe ignorance would return after the uncivil war only to be emasculated in the trenches of World War I. Indeed, beliefs die hard.

The nineteenth century was an age of optimistic swagger. Technical and economic betterment became increasingly equated with *total* human betterment and was accepted as an article of faith.[11] Want, ignorance, superstition, and poverty were supposed to regress as we progressed. We say "supposed" because the norm of progress functioned as a secular ethical imperative. The hope and the practical realities of improved roads, production, transportation, communication, and steam power pulled us into the stream of grand expectations in the nineteenth century. Gears exceeded muscles, mass-production outraced crafts, and science proved superstition to be incorrect: these were all evidences of progress for the human condition. Technology was thought to be conquering perennial human problems. Of course, all of this optimism came in the absence of a biblical and realistic view of sin that affects all that we touch. Perhaps the technological display in the Civil War, World War I, and World War II are God's exclamation points for our naiveté and futile trust in our babbling towers.

The nineteenth century was an age of optimistic swagger. Technical and economic betterment became increasingly equated with* total *human betterment and was accepted as an article of faith.

Historical and literary regression may clarify our thinking by placing this notion of progress in sharp relief. The ancient civilizations of Egypt, Greece, and Rome lacked at least one practice and two beliefs requisite for acceptance of the idea of progress. There was neither systematic, empirical investigation nor manipulation of nature. Certainly there were grand projects, like the pyramids, but these were the exceptions rather than the scientific rule. Further, the concepts of economic "happiness" and democracy were not universally applied. This is especially the case for the slave, upon whose shoulders these civilizations rested. Thus, widespread technology was not possible.

Life was subject to fate or moria. Especially in Greece, this notion of ironclad historical determinism applied to people and to the gods. Our destiny, or at least intellectual focus, lay beyond the world of the senses. A focus on the world of the forms — fixed, immutable intellectual constructs — served to undercut attention to the world of the senses. Indeed technical skills were known as the *adulterine arts*. The term adulterine comes from the root word adultery which means to pollute or to defile. When applied to the technical arts, it meant that participation in these arts soiled or corrupted the soul because the intellectual focus shifted away from the world of the forms — The Good, The True, and The Beautiful — to the corruptible, changing world of the senses.[12]

The reader must note two points. First, ancient cultures generally maintained a *verticalism*. That is, their focus upward to an intellectually abstract world came at the expense of a *systematic* understanding of our world. Corrupted Rome was the exception through her grand civil engineering projects like the Colosseum. Further, the Greek focus was upon the world of the forms: the products of their minds.

Second, the *Horizontalism* of the Enlightenment, or a focus primarily upon this world, afforded a secular alternative to the pagan one just outlined. Accordingly, human technological and scientific Reason attempted to bring salvation or human betterment. We secularly mimic in science, technology, and economics what Christ promised only to his disciples: abundant life. Note that abundant life, as defined by horizontalism, is equated with increasing amounts of economic and technological goodies. Could this be what our Lord called Mammon? Horizontalism roots its salvation in Reason; finds its task in technology; realizes its hope in economics.

Medieval Christianity advanced our view of technology, up to a point. From biblical religion they took a view of the creation as "very good" and a view of labor as created with dignity. Technology was one way to "be fruitful and multiply." And so professor Lynn White, noted historian of medieval technology, is correct when he says that the technical arts advanced because of medieval monasteries.

Yet there is much White misses. This world was not the final goal for the monk; heaven was. Just as the cathedrals pointed upward, the eye and mind looked upward beyond this world to the next. Technology developed but mostly in service to the church, the center of the Middle Ages. Biblical, not secular themes, dominated stained-glass windows.

Clearly secular — literally meaning outside the church — means were to serve sacred or church ends. One may conclude that in this milieu, progress in a more holistic, multidimensional sense, is pursued ambivalently.[13] Ambivalence starts when technically competent monks nevertheless undercut their efforts, because an eschatologically redeemed earth is not in their world view. Further, Aristotelian views of the relative unworth of the body and its associated activities keep the pious person more attentive to the rational, immortal soul and its otherworld destination. Further, the kingdom of God — the reign of God over all creation — was truncated by the focus upon the institutional church. The message is clear: technology takes a backseat to church activities. Nowhere do the Scriptures require the church to mediate the coming of the kingdom, nor us to aspire to heaven *apart* from a redeemed earth. This synthesis of the Christian religion with Greek thought frustrated biblically directed technological development.

Autonomy, material abundance, nature domination, Reason, and faith in the human personality to achieve secular salvation are the claims and the activities of optimism.

We must return to the Renaissance and the Enlightenment. The "rebirth" of classical learning and a nurtured optimism gave birth to a belief in the value and the dignity of the individual. To the extent that the individual prospered, it was thought all of society prospered. This meant individual technical achievements and persons were hailed as harbingers of progress. In 1540, Vanoccio Biringuccio wrote *Pirotechnia* or *Work on Fire*. This scholarly but highly readable book vaulted him into immediate prominence and became the basis for modern mass production.[14]

Sometimes the lust for freedom turns violent. Such was the case for the French Revolution of 1789. The French Encyclopediasts added another element to our collective belief in progress. Intellect, morals, and our bodies could be perfected. The chief impediments to perfectibility were the fetters of history. All external restraint, even the calendar and *our gender differences* must be removed, then progress would be ensured. Schools for educators, bureaucracies for reformers, and material abundance for the masses were to be the means and the masters respectively for the dawn of a new era. Manipulation and control of persons and society — technique — became for the first time in the latter part of the eighteenth century a universally agreed upon means for achieving progress. Thus, the eighteenth century only increased the mechanistic view, this time in the name of freedom! The success of the French and less violent but no less autonomous, American revolutions enshrined the norm of progress for modernity because America became the chief symbol of "First (therefore most desired) World" technology. Consequently, optimism promotes an ecumenical and cosmopolitan standard:

> Studies conducted by Soviet specialists and experts from various international organizations show that nuclear energy is now the only reliable type of energy that can satisfy our energy-hungry world.[15]

This hubris was exposed *two months later* when Chernobyl erupted.

Nor is the former "evil empire" the only nation gripped by optimism. Naiveté is, as we said, ecumenical. The Challenger tragedy and suffering resulted from flippant NASA attitudes. When warned that faulty O-ring construction might lead to disaster, NASA shrugged. Highly regarded Dr. Richard P. Feynaman was a member of the President's Commission on the Challenger disaster. He argued that NASA and Morton-Thiokol managers exaggerated the shuttle's reliability "to the point of fantasy."[16] The issue common to both Capitalism and Communism in their misuse of technology is hubris.

Autonomy, material abundance, nature domination, Reason, and faith in the human personality to achieve secular salvation are the claims and the activities of optimism. Analyzing the thought of contemporary figures will add depth and hue to our analysis.

Julian Simon: Secular Optimist

The thought of author-scientist Julian Simon provides a striking example of the modern evolution of technological optimism. For him humans are "the ultimate resource."[17] Simon roots this analysis in the notion of linear progress. Accordingly, improvements in technological areas must translate into total social and human betterment — *over time*. That is, given enough time — hence the term linear — any problem like hunger or overpopulation or pollution can be *solved* because humans have a nearly limitless

capacity for resourcefulness. Humans are infinitely creative.

Short-run problems like air pollution from automobiles may seem perplexing. In the short run, any city's smog may be a problem. In the long run, however, the very number of people causing the problem becomes the source to mine for solutions since people are the *ultimate resource.*

Is the globe facing long-term economic scarcity of natural resources? "No," argues Simon. Data, which we shall soon see, indicates that the cultivation of natural resources will increase, thus *reducing* scarcity.

Are food shortages and famine increasing? Again argues Simon, "No." Per capita food availability has been improving for the last three decades. Further, the incidences of famine have *decreased* over the last century.[18]

The availability of usable land for agriculture is also not diminishing. Because the yields per acre continue to climb, the number of acres under cultivation has continued to drop. These and other nondeveloped acres have been converted or used for human recreation or wildlife habitat. Consequently, life for all is *believed* to be enhanced. This claim will occupy us in the final section.

Simon, in summary, says the ratio of newly applied technologies to rising population increases the solution to longstanding problems. Thus,

> As I studied the economics of population and worked my way to the view I now hold — that population growth, along with lengthening of human life, is a moral and material triumph — my outlook for myself and for my family and for the future of humanity became increasingly more optimistic.[19]

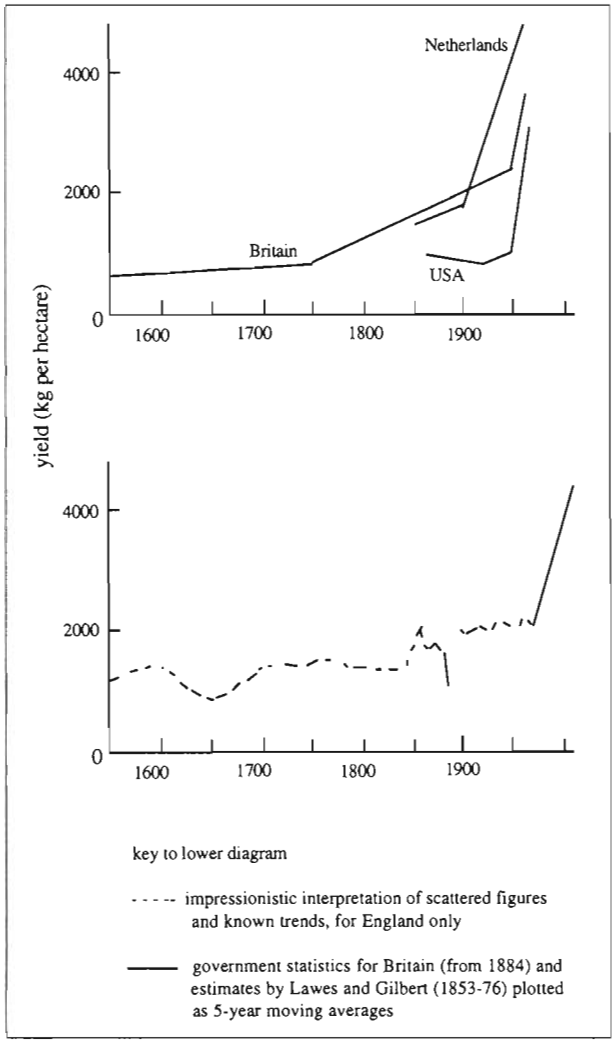
Simon links his optimism with a Capitalistic faith in the market. Mass production lowers per unit costs. This suggests a solution to the perennial problem of want. Thus,

> The fall in the cost of natural resources decade after decade, and century after century, should free us from the idea that scarcity *must* increase sometime. Instead it should point us to trying to understand the way that technological changes are induced by the demand for the resources and for the services they provide, and the way that such changes reduce scarcity in the past.[20]

Simon quotes technological futurist and optimist Herbert Kahn. Kahn uses studies of base metals for projected production potentials. He and colleagues at Hudson Institute find the store of metals to be "clearly inexhaustible."[21]

Although not taken directly from the work of Simon, the graphs below capture Simon's views. They show the "progress" of agricultural development measured by kilogram yield per hectare from years 0 to 2,000 A.D.

Four points pertaining to these graphs need to be noted. First, the top graph is represented as the real, accomplished grain yields. The slope gives the clear impression of a noninterrupted linear progress. In reality, the bottom graph represents more accurate data for the trends that did occur. Note the dotted lines representing *probable* grain yields, with certainty being low because of poor recording. Thus, the top graph represents not so much a description



Used with permission from ***Culture of Technology*** (Cambridge, Massachusetts: MIT Press, 1984), 15.

as an improperly supported *interpretation* of grain yields.

Second, beliefs affect our view of the future as well. Simon draws the conclusion from such graphs that because we have "progressed," we *must* necessarily do so in the future. But evidence is growing that suggests that heavy mechanization, chemical fertilizers, pesticides, and new hybrid crop strains may be depleting long-term soil viability.

Third, we note how belief affects science. *Hope*, *trust*, and *confidence* in the inevitability of progress hues data collection and interpretation. Belief fills in the literal blanks. When data is lacking, then belief about the inevitability of progress is the substitute. Pacey recognizes this by labeling the chapter "Beliefs about Progress."[22]

Finally, technological progress *automatically* is believed to mean economic progress or material gain. This is thought to occur despite missing data, damage done to other areas of life, and even moral *regress*. The consequences of this position lead us to believe that rich people are more moral, more *refined*, because they are rich: *reductio ad absurdum*.

In sum and in transition, the following conclusion seems evident. Optimists are not naive; they see the mistakes and the problems associated with technology. They believe (and this determines their character) that a technical solution can solve any technically related problem. If cars are polluting, then catalytic converters can clean up the mess. To technology is added more technology. Accordingly faith is demonstrated and augmented.[23]

The Work of R. Buckminister Fuller

We move on to consider the work of Fuller. His work encapsulates much of the interdisciplinary bent of this article. He uses philosophy, religion (traditionally understood), mathematics, engineering, economics, politics, and especially literature in his construction and promotion of technical projects. Fuller is best known for his geodesic dome: a tetrahedronic sphere whose strength per unit volume provided space and access to light at a low per unit weight and cost.

Fuller concluded from such projects that Reason could dominate nature and eventually culture. This rationality is practical or *instrumental* in character. Instrumental reason develops technical *means* to the proximate *ends* of successful engineering, control, and problem solving. The term "problem solving" adds a pragmatic element to his philosophy. Dominating his thought is the notion of the control that ideas give us. Ideas give us control. Control signals mastery. Mastery signals progress.

The following poem portrays his view of instrumental rationality and his ultimate commitment to his god,

I think of such of the aviator and sailor as
are in command of their faculties
on both sides of the moment.
Though you have been out in
a froth — spitting squall
on Long Island Sound or
in an ocean liner on a burgeoning sea
you have but a childlike hint of
what a nineteen-year-old's reaction is
to the pitch black shrieking dark out there
in the very cold northern elements
of unloosing spring
off Norway's coast tonight
15,000 feet up, or
fifty under, or worse
in the smashing face of it — and
here I see God.

I see God in
the instruments and in the mechanisms that work
reliably,
more reliably than the limited sensory departments of
the human mechanism.

And he who is befuddled by self or
by habit, or by what others say,
by fear, by sheer chaos of unbelief in
God or in God's fundamental orderliness,
ticking along on those dials,
will perish
and he who unerringly
interprets those dials
will come through.[24]

Fuller's message, written after the outbreak of fighting near Oslo, Norway during World War II, seems clear. Instrumental rationality can be trusted above all to deliver us. Reason makes the instruments that mirror the nature of God and, therefore, delivers us. It delivers us from the elements of chaos inherent in the universe. Thus, humanity brings a fundamental law and progressive orderliness to the universe. This orderliness brings peace, harmony, and, of course, progress to all of reality.[25] Surely this is secular providence: proud humanity attempts to order the universe though instrumental rationality. Instrumental rationality forms all the creation.

We close this section with his credo to humanity and to technology.

... tonight vividly (as tacitly always)
God is articulating
through his universally reliable laws.
Laws pigeonholed by all of us
under topics starkly "scientific"—
behavioral laws graphically maintained in performance
of impersonal instruments and mechanics
pulsing in super sensorial frequencies
which may serve yellow, black
red, white, or pink
with equal fidelity.
And I see conscious man alone
and mechanically fallible
and progressively less reliable
in personal articulation
of God's ever swifter word,
which was indeed in the beginning.
Only the mind-over-matterist,
as philosopher, scientist,
and informed technician
impersonally and universally preoccupied
is man infallible.[26]

Before we attempt some discernment, we must pause to reflect upon the consequences of this view for technology's place within our lives. Technology *should* dominate our lives fully, so concludes the optimist. If we are primarily rational-technical beings, if instrumental rationality brings salvation, if there is no creational order apart from the order man brings, if perennial human problems are to be overcome by technology, and if technical Reason is infallible, then technology *must* occupy increasing amounts of our time, energy, and resources. Through becoming increasingly technical, we are becoming more human because we are realizing more of our essential nature. In much the same way that theologians think that sanctification serves to fulfill and develop that which is truly human, optimists think that ever-expanding amounts of technology enhances life.

There is an imperative flavor to much of this thinking. We *must* become more technical because that is the way to freedom and order. This fact explains the technological imperative mentioned earlier. We *must* place on-line — willy nilly — the latest and greatest technology because our natures and salvation are believed to be dependant upon it. The consequences, if negative, be damned; we can technically fix it later. Such is the spurious reasoning behind the advent of "peaceful" nuclear energy in this country.

But does optimism encourage an overabundance of technology? Does the optimistic exaggeration of the salvific effects of technology lead to a lessening of other areas of life? Most important, we may ask if the nature of God and the nature of humanity are adequately represented by this view of life?

Optimism Discerned

Discernment, again, is the attempt at wise, collective, ongoing evaluation of the strengths and weaknesses of optimism. This we will attempt using a variety of biblical principles. Discussed first are the strengths.

The development of technology has been aided by optimism. The "cultural mandate" of Genesis 1 and 2 explicitly states that in developing culture through the subduing or the harnessing of nature, we fulfill our humanity. Our nature is elevated because we were supposed to become, *Coram Deo*, co-creators *under* God. Technical means are clearly part of subduing, as is made clear in Genesis 11. Technology and by extension scientific thought were given as "very good" gifts by our creator God. Their use is *not* the problem; their *misuse* is. That optimism has aided the task of subduing seems beyond doubt.

Further, there is a technical side or aspect to every problem. Because life is whole, we may conclude that technical reality impinges upon all aspects or problems. To work as if technology is universally present is to presuppose wholeness. Optimists do this, though with great exaggeration.

Because optimists find their remedies for all of life's problems in technology, they must create, then saturate culture, with technical objects.

Sadly, the entire creation, including technology, is corrupted because of sin. The idolatry of technology is known as *technicism*. Technicism is the exaggeration of the technical aspect at the expense of the rest of life. Technicism is the attempt to locate technical solutions to nontechnological problems. Future tragedies like those of Chernobyl and Challenger can be stopped when *humility* reduces the scope of technology, not by *adding* new systems. Because optimists find their remedies for all of life's problems in technology, they must create, then saturate culture, with technical objects. We live, therefore, in a technologically saturated society.[27] The problem of hunger cannot be addressed primarily with better tractors and crop strains, as the "Green Revolution" of the 1960s – 1970s attempted to do.

Solutions involve matters of economics and politics which ultimately find their root in the human heart: the religious center that predisposes one to caring or to hoarding.

We locate the heart of optimism's problem in technicism. Noted philosopher of technology professor Egbert Schuurman laments:

> In short, technicism, or the implicit ideology of technology, is the dominant expression of the humanistic groundmotive. Technicism entails the pretension of the autonomous man to control the whole of reality: man the master seeks victory over the future. He is to have everything his way. He is to solve problems old and new, including problems caused by technicism, so as to guarantee an abundance of material progress.[28]

Instrumentalism is related to technicism, as idolatrous tools are related to an exaggerated claim. Instrumental rationality is the tool or the means to carry out the program of technicism. Technicism wanted to tame nature in the name of human freedom. The subjugation of nature was accomplished by Reason, in this case instrumental in nature. The course of events had to be pursued because it was believed that humanity was essentially rational in nature. Further, after the Scientific Revolution we believed that reality was essentially mechanical in nature. Synonymous with mechanical is "predictably lawful." If we could predict an event, then we could control that event through rational-technical mastery of the law in question. Thus, the entire world view was rationalistic: Humanity, nature, our method, even the Deist's god was cast in a rational-mechanical mold. That believers in Christ have not recognized this as a two hundred-year-old idolatry is painful.

To equate total human betterment with technical progress, as optimism does, is sheer reductionism. Life with its many options and joys is reduced to technical solutions.

Technicism often leads to social and human *regression*. While it cannot be denied that we have made significant *technical* strides forward, our social and human walk has too often gone backwards. Because of our technical advances, many areas of life have been damaged or obscured. Military technology has greatly advanced — so too has the destruction of life. Industrial technology has expanded production, but our natural environment suffers more now than one hundred years ago. Even a relatively benign technology like television seemingly is retarding social, emotional, and moral health, if the growing national consensus is correct.

Further, technical advances actually can deplete nontechnical aspects of life as often happens with too much of industrial agriculture. Mechanized tractors and chemical-intensive farming have depleted the soil and thus reduced potential yields. Agricultural progress involves more than bigger tractors. It involves political justice and economic stewardship to change distributional patterns. These patterns ultimately are rooted in the human heart, as we have argued. To equate total human betterment with technical progress, as optimism does, is sheer reductionism. Life with its many options and joys is reduced to technical solutions.

Non, supra, even technical problems must be treated in concert. Wholeness is an accurate synonym for salvation, especially so in the New Testament. Holistic solutions are the opposites of reductionistic ones. If optimism had placed technical solutions *alongside* other aspectual needs of life, like justice, then life could be more abundant. If they placed technical requirements *in harmony with* other aspectual needs, then a song of doxology would flow from my lips because salvation, literally, would have come. As it is, optimism leaves me (and you, I hope) with the false bravado of babbling towers. Discerning solutions for pressing problems involve, among other things, placing technical solutions *in partnership* with other areas and specialties in life. Perhaps this hope should guide our next prayer when we ask that our sins be forgiven and that his kingdom "will come on Earth as it has in heaven."

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Notes

[1]The notion of the unity and the diversity of life is taken from the reformed Christian philosophy of Herman Dooyeweerd. See his *Roots of Western Culture: Pagan, Secular, and Christian* (Toronto: Wedge Publishing Foundation, 1979). The diversity of life, according to Dooyeweerd, is built into the creation by the Creator God when he repeatedly says in Genesis 1 that things are made "after their kind." Dooyeweerd philosophically accounts for this truth by claiming that there are fifteen "modes" or ways of being in life. Among these modes are the mathematical, biological, aesthetic, logical, juridical, economic, "ethical," and, of course, the technical. These modes are inviolable in the sense that no mode or sphere of life can be denied or ignored with impunity. Thus, diversity is maintained in spite of the grip of idolatry or the tendency to reduce then focus upon one or a few areas of reality.

[2]See Chapters One and Two of my *Between God and Gold: Protestant Evangelicalism and the Industrial Revolution, 1820-1914* (New Jersey: Fairleigh Dickinson University Press, 1993) for a more thorough definition of religion and how it applies to the optimistic glow that attempted to found the economics of American industrialism and the advent of industrial technology.

[3]For a provocative discussion of the origin and development of technical Reason, including its capitalization, see the highly regarded work of Frederick Klemm, *A History of Western Technology*, translated by Dorothy W. Singer (Massachusetts: MIT Press, 1964), 231-266. We capitalize Reason because its religiousness has functioned as an unquestioned, dogmatically accepted source of revelation.

[4]I am speaking here of the philosophical movement known as German Idealism and its profound impact upon Western technological thought and practice. This movement stresses the centrality of the mind or "the spirit" over reality, itself the product of a concept. If humans *and* reality are essentially rational, then through the use of our understanding we must not only penetrate to the depths of human nature, but to the depths of all of reality. Penetration here does not mean mere abstract viewing. It means rearranging reality to fit our conceptual models constructed for the *systematic reconstruction of reality*. This analysis chiefly applies to George W. F. Hegel and also to Immanuel Kant and Rene Descartes, as well as to the realistic Idealism of John Locke, and the subjective Idealism of David Hume. See Klemm, *History*, 231-234.

[5]I am obviously arguing that Lynn White's charge that medieval Christianity is the source for the modern environmental problem is only partially correct. The Enlightenment and the Renaissance are also to blame. See Bob Goudzwaard, *Capitalism and Progress*, (Grand Rapids, MI: William B. Eerdmans, 1979), 36-54. For the view of key scientists and their view of nature see Loren Wilkenson, editor, *Earth Keeping: Christian Stewardship of Natural Resources* (Grand Rapids, MI: William B. Eerdmans), 124-134.

[6]Rene Descartes, *Discourse on Method and the Meditations*, trans. by F. E. Sutcliffe (Harmondworth, U.K.: Penguin Press, 1979), 78.

[7]For a penetrating analysis of the religious, social, and intellectual roots of the mechanistic philosophy, and its scientific antecedents, which fueled the Industrial Revolution see Margaret C. Jacob, *The Cultural Meaning of the Scientific Revolution* (New York; Alfred A. Knopf, 1988), 52-54 and 232-45. See also Lewis Mumford, *Technics and Civilization* (New York: Harcourt and Brace Company, 1934), 46-48 and passim.

[8]The doxology to technology is courtesy of noted engineer Samuel C. Floreman, in, "In Praise of Technology," in *Technology and Change*, edited by John Burke and Marshall Eakin, (San Francisco, CA: Boyd and Fraiser Company, 1979), 21. In fairness to Floreman it must be said that in his more recent works he repudiates optimism.

[9]See, therefore, Clarence E. Ayers, "The Industrial Way of Life," in *Change*, 425f.

[10]Hugo A. Meir, "Technology and Democracy, in 1800-1860," in *Change*, 212.

[11]See Bob Goudzwaard, *Progress*, xxii, and 161 for the religious foundation for the secular notion of progress.

[12]For a detailed view of the Greco-Roman view of technology, and its historical roots, see Friedreich Klemm, *History*, 52-150. Klemm is especially good at showing how Plato's view of the relationship of forms to matter affected not only the ancient but the medieval world as well.

[13]See therefore David H. Hooper, *Technology, Theology, and the Idea of Progress* (Louisville, KY: John Knox Press, 1991).

[14]Klemm, *History*, 135-150.

[15]Valleri Legasov, Leo Feoklistov, and Igor Kusmin, "Nuclear Power Engineering and International Security," in *Soviet Life* (February, 1986): No: 2 (353), 14.

[16]Hooper, *Ideas of Progress*, 24 as quoting *The New York Times*, June 11, 1986, B 6:1.

[17]The phrase and subsequent analysis are taken from Julian Simon, *The Ultimate Resource* (New Jersey: Princeton University Press, 1981).

[18]Simon, *Ultimate Resource*, 3-5.

[19]Ibid., 9.

[20]Ibid., 23. Emphasis in original.

[21]Simon, ibid., 38, quoting Herman Kahn, William Brown, Leon Martel, et al., *The Next Two Hundred Years: A Scenario for America and the World* (New York: Morrow Publishing Company, 1976), 101.

[22]Arnold Pacey, *The Culture of Technology* (MA: The MIT Press, 1984), 15. Pacey quotes the authoritative works on agricultural study done by W. G. Hoskins, "Harvest Fluctuations and English Economic History," in *Agricultural Review*, 16 (1968), 15-45; and Susan Fairlie, "The Corn Laws and British Wheat Production," in *Economic History Review*, ser. 2, 22, (1969), 109-16. For further information see Pacey, ibid., 181f.

[23]This article is taken from a pending book. At this point in the chapter on optimism I deal with the philosopher Karl Marx and his technological optimism. Much to my surprise, I found out that while Marx was dire about Capitalism's ability to sustain a just economy, he was a blinded optimist about technology's ability to provide a miraculous future, complete with an unparalleled level of material abundance lavished upon the successful worker, after the coming revolution when wilting Capitalism will be overcome.

[24]Frederick Ferre, *Philosophy of Technology* (New Jersey: Prentice Hall, 1988), 60 quoting R. Buckminster Fuller, *No More Secondhand God and Other Writings* (Garden City, NJ: Doubleday, 1963, Anchor Books, editor, 1971), x.

[25]Ferre, ibid., 61, quoting Fuller, ibid., vii.

[26]Ferre, ibid., 60, quoting, Fuller, ibid., 17. The more advanced reader may want to read more about optimism. See, then, Egbert Schuurman, *Technology and the Future: A Philosophical Challenge* (Toronto: Wedge Publishing Company, 1980), 177-312 for his section on the "positivists."

[27]I use the word saturated because I do not agree with Jacques Ellul's analysis that our society is *dominated and defined* by technique. He grants technique a sovereign, although evil, reign and then can only juxtapose an equally exaggerated notion of human freedom to idolatrous technique. See my article in *PSCF*, June 1994.

[28]Egbert Schuurman, "The Technological Culture Between the Times: A Philosophical Assessment of Contemporary Society," 6 (n.p., n.d.). I received this soon to be published paper from Professor Schuurman while recently visiting the Netherlands.

By "groundmotive" Schuurman means to say that there are basic religious themes that run throughout the entire course of Western Civilization. See Dooyeweerd, *Roots of Western Culture* on the "nature/freedom" groundmotive.

I must disagree somewhat with Professor Schuurman. I have argued in my *Between God and Gold* that Mammon or economism is the primary idolatry of the West. This is certainly true for the way people live their daily lives.

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Paradoxes in Darwinian Theory Resolved by a Theory of Macro-Development

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Darwinian theory suffers from many paradoxes — unexplained and contradictory facts. This article identifies and explains twelve of them with regard to the history of organic life in the last 530 million years. It addresses the paradoxes with a more comprehensive theory of development, called macro-development, by adding a historical, ancestral dimension to individual development; and shows how this new and more complete developmental framework not only resolves the paradoxes but also offers a fresh perspective on the history of life of higher animals. Ancestral development becomes the original and major change agent in phyletic lineages; Darwinian mechanisms make later, adaptive changes.

It is well known that Darwinian evolutionary theory reveals many paradoxes, relevant facts that contradict or are unexplained by the theory.[1] What has not been fully recognized, however, is that the paradoxes are not randomly distributed. They fall into a distinct pattern. The pattern suggests that the paradoxes may be interrelated, and that there may be a latent conceptual framework, *macro-development*, that not only explains them, but also offers an alternative — even a more compelling — view of organic life than that given by Darwinian evolution.

First to be delineated will be the version of evolutionary theory that will form the focus of this discussion. Paleontological and biological facts that contradict the theory will then be presented. The pattern of paradoxes and a unifying conceptual framework underlying the pattern will be explicated and enlarged to form an alternative explanation of the history of organic life since the Cambrian explosion, 530 million years ago.

Darwinian Evolution

The following statements constitute the version of evolution that will be used in this discussion.

*ASA Member

Natural selection. The heart of Darwinian evolution is natural selection. It is a two-step process consisting first, of mutations and rearrangements of the germ-line that are random with respect to the future of the organism and species; and second, sorting and selecting by the environment of the most adaptive organisms produced by the mutations. The heart of the concept has remained essentially the same as formulated by Darwin.[2]

Slow, gradual process. Because mutations must be beneficial and small, natural selection is a slow and gradual process, requiring long periods of time to accomplish adaptive change. Punctuated equilibrium refers to rapid speciation that sometimes occurs in small, isolated populations following long periods of stasis. The overall pace of evolution is slow even with punctuated equilibrium.

Natural selection begins with species. Evolution begins at the bottom, with varieties and species, which become modified into other species and eventually into higher categories of organisms by means of natural selection.

Blind automatic process. Natural selection is a blind, automatic process; it has no long-range purpose or plan in mind. "Evolution is random and

undirected," according to a popular high school biology textbook.[3]

Change. Change is a universal characteristic of the organic world. To many evolutionary authors the ubiquity of change provides sufficient evidence that evolution has occurred.

Continuity of life forms. According to evolutionary authors the reality of evolution is demonstrated by continuous descent with modification from the first single, living cell to the multitudinous forms of life that exist today and ever have existed.

More than a scientific theory. It is now recognized that the theory of evolution constitutes more than a scientific theory or paradigm. It has become the philosophical foundation of the naturalistic view of the universe that has replaced the Judeo-Christian worldview which once dominated western culture.

The interpretation of Darwinian evolution given above will form the focus of this article.

Paradoxes in Darwinian Evolution

The pattern of paradoxes begins with the "Cambrian explosion" that occurred about 530 million years ago. The explosion refers to the outburst of complex, higher animals. The event is unique in the history of life on this planet; nothing like it happened before or since. Paleontologists are unusually profuse in their expressions of wonder at the biological fireworks set off during the early Cambrian.[4] Gould summarized the explosion as follows:

> The Cambrian explosion is the key event in the history of multicellular animal life. The more we study the episode, the more we are impressed by its uniqueness and of its determining effect on the subsequent pattern of life's history. These basic anatomies that arose during the Cambrian explosion have dominated life ever since, with no major additions. ... The pattern of life's history has followed from the origins and successes of this great initiating episode.[5]

The sheer magnitude of the Cambrian explosion is difficult to appreciate. Consider the following summary of observations that suggests its scope and complexity. In what may be considered (1) a geological "instant" (2) approximately 50 animals with (3) body plans that were (4) novel, (5) disparate, (6) complex, and (7) of stable modern design (8) appeared roughly synchronously in the Lower Cambrian. Each descriptive adjective or phrase suggests a paradox in Darwinian theory.

Paradoxical fact #1: *Rapid origin of Cambrian animals.* Stem animals of the Cambrian came into existence with rapid speed in a geological instant. The rapidity of their formation has recently been confirmed. It is now judged that the Cambrian explosion lasted at most 10 million years, and as little as 5 million, beginning 530 million years ago.[6] Valentine estimated that for brachiopods the time may "have been well under 5 million years, probably under 1 million years, and perhaps significantly less in some cases."[7] He even hinted at a time span of only "hundreds of thousands of years or less."[8] Bowring said, "It has long been inferred that the Cambrian explosion was fast; now we have some idea of just what fast means."[9]

> **The paradox.** Darwinian mechanisms work slowly and gradually, requiring extensive periods of geological time to bring about change.[10] It is difficult to see how gradualistic natural selection, even punctuated equilibrium, could have been a significant causal factor in the extremely rapid formation of body plans in the Cambrian explosion.

Paradoxical fact #2: *Body plan.* The body plan of the stem animals is the central, most significant biological structure formed in the Cambrian explosion. The body plan — also called Bauplan, phylum, and class — refers to the most fundamental morpho-

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logical and structural characteristics of the stem animals of the Cambrian. It refers to the basic architecture which defines the lineages founded by the stem animals; it is shared in common by all the subsequent descendants of the lineage. This is one of the most fundamental designs in the organic world. Lewin equated the term Bauplan with phylum, the highest taxonomic level of classification.[11] Characteristics of the body plan are thus used to classify large groups of animals (phyla) founded by the stem animals of the Cambrian.

The paradox. Animal lineages started with body plans at the highest taxonomic level of phyla. This observation challenges a central tenet of Darwinian theory, namely, that evolution starts at the lowest level, with varieties and species[12] and works upward into higher taxa. Some evolutionary authors have countered this paradox with the dubious argument that higher taxonomic categories are artificial and unrelated to real events in the organic world. Such authors and others, however, freely use these same taxonomic categories when it suits their purposes and where the use of them does not challenge evolutionary theory. The paradoxical evidence remains firm: Animals lineages originated as phyletic body plans of Cambrian animals, not as varieties and species.

Paradoxical fact #3: *Fifty body plans.* This is a staggering number of biological inventions. The variety of unique animal forms in the Cambrian is astounding, especially when compared with the relative uninventiveness and lack of diversity of the long previous Precambrian period.

The paradox. This flood of unique body plans further calls into question natural selection as the agent of change in the Cambrian. The probability of random mutations supplying the genetic variability for so many unique and novel animals seems remote, even though small initial genetic changes may result in large genetic morphological outcomes. There is no evidence, moreover, that environmental factors could select for so many unique forms.

Paradoxical fact #4: *Novel body plans.* Cambrian animals have few known or confirmed morphological antecedents from the earlier Precambrian period. This is an extraordinary discontinuity. It is estimated that only 5 percent or less of them show validated evidence of Precambrian parentage.[13] Erwin, et al., said: "Most classes and orders of durably skeletonized marine animals also appear abruptly, without obvious linkage to their durably skeletonized antecedents."[14] Miklos noted that "some *bona fide* metazoans ... literally pop out of the blue above the Precambrian/Cambrian boundary at approximately 530 mya."[15] "Evolutionary biology's deepest paradox concerns this strange discontinuity," observed Levinton.[16]

The paradox. A morphological discontinuity between Cambrian animals and the Precambrian biota is strongly implied by the paucity of confirmed, architectural antecedents. This hiatus challenges the principle of continuity of all life forms, a major doctrine of evolutionary theory.

Whether Cambrian animals had Precambrian ancestors that were too small, too flimsy, and unmineralized to leave fossils has yet to be demonstrated, and is being actively debated.[17] Two alternative positions have been put forth. The first is that the fossil evidence of a Cambrian explosion should be taken at face value, that the animals indeed developed almost instantaneously, sans Precambrian antecedents; and the second, that Cambrian animals have a long but *invisible* Precambrian history. Since it is unlikely that Cambrian animals sprang into existence without any antecedents whatsoever, it is probable that some precursors may eventually be found.[18] This would not detract from the discontinuity between Precambrian and Cambrian biota.

Paradoxical fact #5: *Disparate body plans.* With few exceptions, the body plans of the Cambrian animals were architecturally different from each other and were novel and discontinuous from the Precambrian fauna. Gould used the new term, disparity, to designate the immense chasms separating most body plans from each other; whereas he used the conventional term, diversity to indicate the minuscule differences among species.[19] Early in the Cambrian, phyletic disparity was high; species diversity was low.

Arguing from geometric principles, D'Arcy Thompson concluded that "the breach between vertebrate and invertebrate, worm and coelenterate, coelenterate and protozoan, is in each case of another order, and is so wide that we cannot see across the intervening gap at all."[20] Conway Morris wrote, "The morphological gaps, that by definition, separate phyla remain invioloate."[21] Writing about body plans of sea urchins Miklos noted that "They were of course, not convertible into body plans of other marine phyla."[22]

The paradox. The disparity and inconvertibility among the body plans of the Cambrian stem animals further challenges the essential evolution-

ary principle of continuity of all life forms. This principle is difficult to maintain in the face of morphological discontinuities among many of the Cambrian stem animals themselves, to say nothing of the probable hiatus between the Cambrian and Precambrian biota.

As might be expected some evolutionary writers disagree with the concept of morphological disparity and discontinuity among groups of Cambrian animals. Conway Morris, for one, said, "I argue that ... the apparent absence of intermediate forms between major groups is an artifact."[23] Valentine, on the other hand, argued that "The missing intermediates [of some invertebrates] may be regarded as data,"[24] which may be taken to mean that lack of data provisionally constitutes data. That there were few, if any, intermediary architectural forms is the primary conclusion supported by the fossil record, and should be held unless it is contradicted by newly discovered, confirmed intermediate forms.

Paradoxical fact #6: *Dearth of species.* There were many body plans or phyla but few species in the early Cambrian. Specific diversity was low. The higher taxonomic forms were present, but the lower forms, the species, were largely absent. This observation is most astounding and of profound significance.

The paradox. Gould called the observed dearth of species a central paradox of early life.[25] Many more species than phyla should have appeared, since a fundamental principle of Darwinian theory is that a large group of higher animals (phylum) has its origin in a long train of species. The paradox, however, lies not with early life; but with the incorrect evolutionary interpretation of it. Again, the logical conclusion is that ancestral lineages did not begin with varieties and species.

Paradoxical fact #7: *Synchronous appearance of body plans.* The fact that this large cohort of animals appeared approximately synchronously within roughly a 5-10 million year period deepens the mystery of the Cambrian explosion. Few Cambrian animals are the confirmed antecedent of another.

The paradox. The probability seems extremely low that natural selection could fully account for the synchronous appearance of 50 or so disparate body plans, in such a short time, in an environment presumably approximately common to all, as shown by the Burgess Shale. The synchronous appearance of Cambrian body plans is paradoxical to the Darwinian concept of natural selection.

Paradoxical fact #8: *Stability of body plans.* The body plans of the Cambrian stem animals that survived are extremely stable. They have remained essentially unchanged for more than 500 million years, to the present time, with no modernization or upgrading;[26] (but with some "reconfiguring" of sea urchin body plans.[27]) The Cambrian body plans exist today in our modern phyla and appear in an early embryonic stage in all members of a given phylum. Every descendant of the Cambrian stem animals shares in common the stable body plan of the original stem animal.

The paradox. Change is practically synonymous with evolution, according to some evolutionary authors.[28] Yet the unchangeableness of body plans challenges this meaning. If body plans had been formed by natural selection, why would they not have continued to evolve over the past 530 million years? Yet they did not. This suggests that some other process has been at work to form and maintain the stability of phyletic body plans.

Paradoxical fact #9: *Top-down direction of change in phyla.* One of the most important phyletic patterns in the fossil record is the general-to-specific or top-down direction of change or modification in phyletic lineages. General, or higher taxonomic levels (phyla, classes, orders), of a given phyletic lineage appeared in the fossil record before specific, lower-level taxa (families, genera, species). Abundant fossil data from the Cambrian and later periods support the generalization that with few exceptions the order of appearance in the history of phyletic lineages works from general to specific taxa, from phyla clear down to species. Erwin et al., stated,

> The fossil record suggests that the major pulse of diversification of phyla occurs before that of classes, classes before that of orders, orders before that of families ... most higher taxa were built from the top down, rather than from the bottom up.[29]

This top-down pattern is also found in trilobites;[30] amphibians, reptiles, mammals;[31] and in birds.[32]

The paradox. The top-down direction of phyletic change clearly challenges the central concept of Darwinian evolution, namely, that evolution proceeds from the bottom up. Darwinian theory holds that varieties become species, which are modified until they can be considered genera, which become families, etc., through the process of natural selection. This doctrine was introduced

by Darwin through his only diagram in *Origin of Species*, and has since been held without exception by evolutionary authors since his day.

Evolutionary writers such as Simpson and Mayr acknowledged that higher taxonomic forms appeared before lower forms in the fossil record, but went on to deny the biological reality of higher taxonomic categories. Their position is beginning to crumble, however, under the undeniable biological reality of the body plans of the Cambrian animals which are considered the equivalent of phyla. The paradox remains. Phyletic lineages develop from the top down, not from the bottom up.

Paradoxical fact #10: *The rise and fall of ancestral lineages.* Evidence from the fossil record, demonstrates that ancestral lineages start with a few small organisms, which subsequently rise to a maximum on many dimensions, such as size, complexity, population density, and which eventually decline on these and other variables. This pattern of increase to a maximum followed by decline is found in fishes, amphibians, reptiles[33] and in many other lineages. For example, brachiopods declined systematically;[34] as did corals.[35] The decrease is especially significant. Young, for instance, said, "Mammals are at present at their peak of development, perhaps they are already declining."[36] The decline of lineages is supported by paleontological, biological evidence, and by the logic that if a lineage increases, it must eventually decline. The fact remains: Decline is as ubiquitous as increase in phyletic lineages.

The paradox. The paradox is this: If *increase* in size, complexity, etc., in a lineage is adaptive, as evolutionists hold,[37] how can later *decrease* in these dimensions also be adaptive? Decline itself is rarely adaptive. It is not regularly correlated with changes in the environment. The paradoxical decline in lineages is explained away by major evolutionary authors who hold that declining lineages are actually adapting to their environment.[38] Of course! Declining lineages continue to adapt as best they can, even to the very end. But let that not hide the fact that they do decline, and that decline in lineages is paradoxical to Darwinian theory.

Paradoxical fact #11: *Finality of body plans.* The body plans of the Cambrian constitute the first and last manifestation of such an unprecedented scale of biological inventiveness on earth. After the Cambrian explosion not a single new, major group or phylum of animals has come into existence. This is especially significant in view of the relative openness of the environment after the great Permian extinction, 250 million years ago, which exterminated up to 80 percent of marine species leaving the environment about as empty as it had been at the Vendian-Cambrian boundary. Dry land, moreover, was a whole new habitat, a completely novel, vast and varied ecological niche. Yet no new phyla-level body plans developed when vertebrates and invertebrates invaded it 400-360 million years ago.[39] In spite of this open invitation for innovation, no new classes or phyla appeared. Indeed, the history of life since the Cambrian shows a dramatic loss of major groups of animals that originated in the Cambrian explosion.

The paradox. The finality of Cambrian body plans is inexplicable in evolutionary terms. If evolution is the creative force in the organic world, why have no new body plans evolved? The next section extends the paradox.

Paradoxical fact #12: *Multiplicity of species since the Permian.* A further astounding fact is that species have multiplied almost beyond count, starting 250 million years or so ago, and accelerating in the last 65 million years to the present.[40] Natural selection seems to have "kicked in" to produce abundant speciation after phyletic lineages passed their peak and began to run out of steam.

The paradox. If species are the evolutionary precursors of higher level taxa, and such a deluge of them has been occurring throughout the recent past, why have no new higher taxa been formed? With so many species emerging, this should be the age of new higher taxa. The reason it is not is that species evolve into other species, rarely if ever into higher level taxa. The present age is thus the age of new species. Rather than being the start-up mechanism for new major groups of animals, natural selection and speciation may more realistically be seen as the closeout process of phyletic lineages. They put the finishing touches on ancestral lineages. This obviously goes against the thrust of Darwinian evolution.

There may be a deeper significance to this recent exuberant speciation than is at first apparent. Since species result from natural selection, and are so numerous, it can be concluded that natural selection has been increasingly vigorous for the last 65 million years or so. Mutations, moreover, have presumably also been occurring in record numbers during this recent time span, since they are the first step in natural selection. What are the implications of this presumed increase in mutations?

Mutations have a bright and a dark side. They are essential to natural selection because they provide genetic variability which results in new phenotypes for the environment to sort out, the bountiful speciation presently observed, and the minor variations that embellish the basic design of lineages. The function of natural selection, as van Inwagen states, "is to insure that species possess sufficient diachronic flexibility that they aren't just automatically wiped out by the first environmental change that comes along."[41] Vertebrate species last only several million years or so.

Most mutations, however, are deleterious rather than beneficial to the future of a lineage. One would expect, therefore, to observe many detrimental effects of deleterious mutations, as indeed, one does in the decline and aging of lineages, accompanied by bizarre forms and inadaptive trends in some lineages. The bright and dark sides of mutations thus combine to simultaneously extend and diminish lineages that are in the process of dying out.

In what is considered a geological instant, approximately 50 animals with body plans that were novel, disparate, complex, and of stable modern design appeared roughly synchronously in the Lower Cambrian.

In summary, evidence from the fossil record shows the following patterns. Phyletic lineages originated rapidly, starting with stable body plans of Cambrian animals, differentiating downward taxonomically from general features of the lineage found in the body plan to the specific characteristics found in lower taxonomic levels, clear down to species. Phyletic lineages rise and fall, in some case with clear regularity. No new phyla have appeared since the Cambrian. Many phyla that originated in the Cambrian have disappeared. Although there was a dearth of species in the Cambrian, there has been an increasing abundance of them starting in the Permian. Mutations, the first essential step in natural selection, have presumably also been increasing, accounting both for the expanded speciation and for the deterioration and decline of lineages. Natural selection became increasingly operative late in the history of higher animal life to put the finishing touches on phyletic lineages and to prolong the life of the lineage.

Is There a Process that Explains the Pattern in the Paradoxes?

There is one process in the biological world that can explain the pattern of paradoxes presented above. Surprisingly, it is the process of development/growth. The process of development/growth is one of the most important processes in the biological world. It occurs universally among modern, higher, multicellular, complex animals. It has a similar profile across the whole range of higher animals and plants. It produces biological design. It arguably outperforms evolution on a day-to-day basis in producing change in the biological world.

Development is often equated with evolution. That is a mistake. The two processes are radically different from each other, as acknowledged by informed Darwinian authors. Development is genomic, hierarchically regulated, end-directed, and holistically organized; in stark contrast to the basically unpredictable, mindless, environmentally-directed process of Darwinian evolution.

The mystery is why development has been ignored for so long in discussions of the history of organic life. One need not look far for the reason. Natural selection has so dominated the thinking of Darwinists and others that they see no need to look for an alternate explanation for changes in organic life. According to some Darwinian authors, development contributes little to evolution.

A comprehensive theory of development, unfortunately, is totally lacking. Developmental theory is confined to the embryonic period of individual organisms, as dictated by current scientific fashion. This restriction is entirely unwarranted. Individual development needs a historical dimension to make it a more complete, comprehensive theory. The broad, historical theory of development proposed herein is predicated on the assumption that principles of development apply to large animal groups, existing over geologic time, as well as to individual animals. Such large-scale development will be called *macro-development*.

The focus in this discussion will be on principles of development applied to large groups of animals over geologic time. Below are five features of macro-development that qualify it to serve as an alternate explanatory framework for Darwinian mechanisms.

1. The sequence of morphological change in individual development is similar to changes in large-scale development. That is, they are *isomorphic* to each other. Their "profiles" match up beautifully. Principles of development can be used as readily to describe the origin and historical trends in large animal groups as they can the embryological and subsequent lifespans of individual organisms.

2. Development of large groups of animals over geologic time is governed by genetic mechanisms in the phyletic germ line, just as individual development is controlled largely by the individual somatic genome.

3. Macro-development provides a smooth, seamless, inherited continuity between phyletic development on the one hand and individual development on the other. This continuity thus resolves a major, unresolvable problem — the theoretical gap between evolution and individual development — that most Darwinists seem unaware of or fail to acknowledge.

4. Macro-development defines a new role for Darwinian mechanisms in the history of organic life since the Cambrian. These mechanisms produce adaptive variations on major innovative themes created by macro-development. Development may be seen as the "author"; Darwinian mechanisms, the "editor" of the history of organic life.

5. Macro-development is the major instrument of morphological design in the organic world.

The striking similarities between the features of development of individual animals and the pattern of paradoxes found in the fossil record presented above invite comparisons. Below is a summary of the resemblances.

Both individuals and phyletic lineages begin with a general body plan. The body plan is among the first structures to appear in individual embryological development. The earliest and defining feature of the Cambrian animals was their basic body plan.

Both individuals and phyletic lineages develop very rapidly at the start. Early development in the embryo is extremely rapid. In human beings all systems and morphological features are in place in slightly more than three months after conception.[42] The formation of body plans in the Cambrian occurred with extreme rapidity, geologically speaking — paralleling the very rapid formation of the body plan early in individual embryonic development and growth.

Body plans are extremely stable. Individual body plans are extremely stable in embryonic development. Early stages of development are remarkably resistant to adaptive, evolutionary change. Only later-appearing, superficial features of the animal, such as coloration, are subject to adaptive change. Young summarized the situation well.

> The basic construction of an organism (Bauplan) limits the possibilities of adaptive change. ... An organism must adapt to its surroundings as best it can with its given Bauplan. ... This is particularly obvious during the early stages of development, which are remarkably resistant to evolutionary change. ... Mutants affecting early embryological stages survive only in the laboratory. Adaptational changes mostly come relatively late in ontogeny.[43]

Thomson and Waddington made the same point.[44] All three authors acknowledge that early morphological and anatomical patterns are untouched by evolution. Adaptational changes occur later in development. Evolution thus does not change the body plan and other early-appearing features of the embryo. It affects the more peripheral, external morphological features that appear later in the developmental process.

It is not surprising then that phyletic body plans have not changed in more than 500 million years.

Development proceeds in characteristic time sequences.[45] One of the most fundamental principles of development is that the general features, which the embryo shares in common with all members of its phylum, appear before more specific features; and that specific features emerge out of general ones, according to basic laws of development formulated by von Baer almost two centuries ago.[46] This is the top-down direction of development.

After the Cambrian explosion, phyletic lineages differentiated from the top down — from the few, most general taxonomic features (such as the body plan) held in common by all members of the lineage, to the most specific and diverse features distributed among its multitudinous species. The top-down direction of both individual and phyletic development represents a realistic link between individual and large-scale development.[47]

The shape of the life span is curvilinear. The entire life span of individual animals is a manifestation of development. All organisms start small and

simple at conception, rise rapidly through the prenatal and juvenile stages, grow large and complex, reach a rounded maximum on many variables in maturity, decline in old age, and eventually die. The rise and subsequent decline is an invariant characteristic of lifelong individual development.

The broad, historical theory of development proposed herein is predicated on the assumption that principles of development apply to large animal groups, existing over geologic time, as well as to individual animals. Such large-scale development will be called macro-development.

There is also an unvarying succession of changes in ancestral lineages, starting with a few, small, insignificant animals, that increase in size, complexity, population density, and on many other dimensions; reach a rounded maximum, and then decline to fewer, smaller, less robust groups. This orderly sequence is isomorphic to development in the individual life span.

Eventual decline. All individual organisms show signs of senescence if they live long enough. Phyletic lineages of higher, complex animals begin to show signs of decline and aging after they reach and pass their maximum growth and development, and will eventually die if they do not first become extinct.

In short, the overall "shape" of individual development and the general "shape" of ancestral lineages are remarkably similar. The only major difference between them is the time scale — enormous for the historical lineages, insignificantly short for individual organisms. The resemblance between large-scale sequence of changes covering millions of years and the sequence of changes in early embryonic and lifelong development of individual organisms is quite astounding. It cannot be a meaningless coincidence that so many phyletic patterns of change in the fossil record are found to resemble patterns of development found in individual organisms. These similarities are surely not trivial or merely coincidental. On the contrary, they point to a deep unity between the overarching historical processes, called macro-development, and small-scale individual development. Patterns in the fossil record are sufficiently similar to patterns in development of individual organisms that those in the fossil record can provisionally be considered the results of development on a large historical scale.

In summary, a proposed theory of macro-development and growth as large-scale historical processes holds that the principles of development and growth apply to all biological systems, regardless of their size, temporal duration, or the number of generations they span. Development and growth are primarily determined, internally and hierarchically regulated processes which result in determinate temporal sequences and patterns of morphological changes which are found (1) in all individual higher, complex, multicellular organisms throughout their entire life spans, and (2) in all ancestral lineages of higher organisms, throughout their entire phyletic histories. The terms *phyletic, historical, ancestral, large-scale,* and *macro-development* can be used interchangeably in this definition.

Genetic mechanisms of macro-development and the intergenerational overlap of individual developmental mechanisms need to be explicated. Space limitations, unfortunately, prevent a full discussion of them here. Suffice it to say that the phyletic germ line is the primary source of developmental changes inherited by the individual somatic genome and expressed in the individual organism. The mechanisms of individual development, moreover, span two generations, originating in the parent and continuing through the death of their offspring.[48] The intergenerational feature of development supports the historical dimension of development.

An Additional Theoretical Bonus

There is a theoretical gap between evolution and individual development that needs to be resolved but cannot be closed as long as Darwinian mechanisms are considered the major force for change in the biological world. The problem is how development as a hierarchical, highly ordered, intrinsically directed process can be produced by the basically linear, unpredictable, externally directed process of Darwinian evolution. The bonus is that an expanded concept of development as a historical as well as an individual process offers a new solution to this intractable problem.

Darwinian authors have failed to provide a logical and empirical bridge between these two fundamental but irreconcilable biological processes — one of the most profound unresolved problems in biology. The difference between the two processes was em-

phatically expressed by Mayr, a major architect of the New Synthesis. He stated,

> There is a fundamental difference between end-directed behavioral activities or developmental processes of an individual or a system, which are controlled by a program, and the steady improvement of the genetically coded program. This genetic improvement is evolutionary adaptation controlled by natural selection.[49]

Thomson said: "Some kind of connection between evolution and development seems obvious, but at the same time remains as elusive as a butterfly."[50] Gould concurred. "That some connection exists cannot be denied."[51]

From [the Cambrian explosion] on, lineages began their long journey of phyletic development, with each individual progeny inheriting its developmental processes from the major morphological features of the ancestral lineage.

A fundamental recognition is emerging, moreover, that the theoretical disjunction between development and evolution cannot be allowed to continue. It must be addressed. Both must be articulated in one complete, coherent theory in order for both to be complete. Thomson said:

> J. Maynard Smith (1983) has written that "although we have a clear and highly articulated theory of evolution, we have no comparable theory of development." I would turn this statement around somewhat and say that until we have a general theory of development we are unlikely to derive a complete theory of evolution.[52]

To start with evolution as the major force and then try to insert individual development into it — as evolutionary authors do — is to encounter the insurmountable problem of explaining logically and biologically how the essentially unordered, unpredictable process of mutational variation, directed by opportunistic extrinsic environmental conditions, can produce the fundamentally autonomous embryo, exquisitely regulated and intrinsically ordered.

The developmental perspective solves the problem by making individual development continuous with and inherited from large-scale, historic development. This view provides a seamless continuity between large scale lineal changes and individual development. Both individual and macro-development originated in the Cambrian explosion. From that point on lineages began their long journey of phyletic development, with each individual progeny inheriting its developmental processes from the major morphological features of the ancestral lineage. Large-scale historical development, not Darwinian mechanisms, is the source of individual development, and individual development reflects significant aspects of the large scale process.

The developmental perspective is compatible with creative activity of an intelligent designer. The concept of body plan itself connotes planning and design. Body plans could also be called body *designs*. The determined, intrinsically regulated processes of phyletic development on the large scale, matched by individual development on the small scale, also hint at intelligent design.

Conclusions and Implications

Macro-development is proposed in this article as the major force for the origination of major groups of animals and for large-scale change in the history of these groups in the past 530 million. The events surrounding and following the Cambrian explosion show unmistakable characteristics of development that, in addition, challenge Darwinian theory.

Darwinian mechanisms become a major force in the organic world primarily after the fires of macro-development begin to burn low, specifically in the past 250 million years, and provide adaptive embellishments that enhance the survivability of species. They put the finishing adaptive touches on phyletic lineages and produce a plethora of species as a hedge against phyletic decline and impending termination. ✣

Notes

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The History of Evolution's Teaching of Women's Inferiority

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A review of the most prominent late nineteenth century evolutionist writings, focusing on Charles Darwin, reveals that a major plank of evolution theory was the belief of intellectual and physical inferiority of women. This belief resulted from a logical deduction of the natural selection world view: men were exposed to far greater selective pressures than women, especially in war and competition for mates, food, and clothing. Therefore, they evolved further. Conversely, women were protected from evolutionary selection by historical norms which dictated that men were to provide for and protect women and children. Natural selection would consequently operate far more actively on males, producing male superiority in virtually all skill areas. Although culture was also influential, beliefs have often been more important than fossil and other evidence in the specifics of evolutionary theory. The implications of this history for Christianity are also discussed.

A key aspect of Darwinism is survival of the fittest, requiring group differences from which nature can select. The inferior groups were more likely to become extinct; the superior groups thrived and left more offspring.[1] The biological racism that resulted from naturalistic evolution theory has now been both well documented and widely publicized. Especially influential in the development of biological racism, and the tragedy that it brought civilization, was the theory of eugenics developed by Charles Darwin's cousin, Francis Galton.[2] Less widely known is that many evolutionists, including Darwin, taught that women were biologically and intellectually inferior to men. The intelligence gap that Darwinists believed existed between men and women was so significant that some evolutionists classified men and women into two distinct psychological species: males were *homo frontalis*, females *homo parietalis*.[3]

Male superiority was so critical for evolution that George states: "The male rivalry component of sexual selection was *the key*, Darwin believed, to the evolution of man: of all the causes which have led to the differences ... between the races of man, and to a certain extent between man and the lower animals, sexual selection has been the most efficient."[4] Natural selection struggles exist between groups, but it is "even more intense among members of the same species, which have similar needs and rely upon the same territory to provide them with food and mates."[5] Evolution theorists once commonly taught that the intense struggle for mates within the same species was a major factor in producing male superiority. Further, Darwin's ideas as elucidated in his writing had a major impact on society and science. Richards concluded that Darwin's views of women's nature fed into his evolutionary theorizing, "thereby nourishing several generations of scientific sexism."[6] Morgan notes that Darwin motivated men to work out a set of reasons why women were "manifestly inferior and irreversibly subordinant" using biology, ethnology, and primatology.[7] The reasons for this goal are complex, but one factor was the major influence of evolutionary suppositions, especially natural and sexual selection, on scientists and their world view. The extent of the effect can be gauged by the fact that this conclusion about

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the evolutionary inferiority of women greatly influenced theorists from Sigmund Freud to Havelock Ellis.[8] As eloquently argued by Durant, racism and sexism were central to evolution:

> Darwin introduced his discussion of psychology in the *Descent* by reasserting his commitment to the principle of continuity: "My object ... is solely to shew that there is no fundamental difference between man and the higher mammals in their mental faculties." ... Darwin rested his case upon a judicious blend of zoomorphic and anthropomorphic arguments. Savages, who were said to possess smaller brains and more prehensile limbs than the higher races, and whose lives were said to be dominated more by instinct and less by reason ... were placed in an intermediate position between nature and man; and Darwin extended this placement by analogy to include not only children and congenital idiots but also women, some of whose powers of intuition, of rapid perception, and perhaps of imitation were "characteristic of the lower races, and therefore of a past and lower state of civilization."[9]

These beliefs were often reflected in Darwin's personal attitude toward women and non-Caucasian races. Darwin was once concerned that his son, Erasmus, might marry a young lady named Martineau and wrote:

> ... he shall be not much better than her "nigger." Imagine poor Erasmus a nigger to so philosophical and energetic a lady ... Martineau had just returned from a whirlwind tour of America, and was full of married women's property rights ... Perfect equality of rights is part of her doctrine ... We must pray for our poor "nigger." ... Martineau didn't become a Darwin.[10]

Among the more telling indications of Darwin's attitudes toward women are the statements he penned as a young man, which listed what he saw as the advantages of marrying. These include:

> children — (if it pleased God) — constant companion, (friend in old age) who will feel interested in one, *object to be beloved and played with — better than a dog anyhow* — Home, and someone to take care of house — Charms of music and female chit-chat. These things good for one's health (emphasis mine).[11]

Darwin then listed his negative concerns which included losing freedom to travel, being "forced to visit relatives, and to bend in every trifle," and

> loss of time — cannot read in the evenings — fatness and idleness — anxiety and responsibility — less money for books, etc., — if many children, forced to gain one's bread ... perhaps my wife won't like London; then the sentence is banishment and degradation with indolent idle fool.[12]

Other conflicts that Darwin perceived marriage would cause included "how should I manage all my business if obligated to go everyday walking with my wife — Ehau!" and that as a married man he would be a "poor slave ... worse than a Negro" but then reminisces that, "one cannot live the solitary life, with groggy old age, friendless and cold and childless staring in one's face ..." Darwin concluded his discussion on the philosophical note "there is many a happy slave" and shortly thereafter in 1839 married his cousin, Emma Wedgewood.[13] To Brent, these words show that Darwin had a low view of women: "It would be hard to conceive of a more self-indulgent, almost contemptuous, view of the subservience of women to men."[14] Richards analysis of Darwin's thoughts is as follows:

> From the onset he [Darwin] embarked on the married state with clearly defined opinions on woman's intellectual inferiority and her subservient status. A wife did not aspire to be her husband's intellectual companion, but rather to amuse his leisure hours ... and look after his person and his house, freeing and refreshing him for more important things. These views are encapsulated in the notes the then young and ambitious naturalist jotted not long before he found his "nice soft wife on a sofa"... (although throughout their life together it was Charles who monopolized the sofa, not Emma).[15]

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The major intellectual justification Darwin offered for his belief in women's inferiority, Kevles notes, is found in *The Descent of Man*. Here Darwin concluded the "*young* of both sexes resembled the *adult female* in most species" and from this and other evidence "Darwin reasoned that males are more evolutionarily advanced than females."[16] This view of women and evolution rapidly spread to scientists contemporary with Darwin. Anthropologist Allan concluded that "woman preserves the infantile type ... physically, mentally and morally, woman is a kind of adult child ... in the domain of pure intellect it is doubtful if women have contributed one profound original idea of the slightest permanent value to the world."[17]

Carl Vogt, professor of natural history at the University of Geneva, accepted many of "the conclusions of England's great modern naturalist, Charles Darwin," arguing "the child, the female, and the senile white" all had the intellectual features and personality of the "grown up Negro"[18] and that the female is similar in intellect and personality to both infants and the "lower" races.[19] Vogt concluded that human females are closer to the lower animals than males; and "hence we should discover a greater [apelike] resemblance if we were to take a female as our standard."[20] Because her evolution stopped earlier, a woman was "a stunted man."[21] Vogt even concluded that the gap between males and females increases with civilization's progress, and is greatest in the advanced societies of Europe.[22] Darwin was "impressed by Vogt's work and proud to number him among his advocates."[23] Other followers of Darwin who accepted this reasoning, especially the power of sexual selection, included

> ... George John Romanes, a younger evolutionist and physiologist. Shortly before his death, Darwin handed over to Romanes a great deal of data he had not had time to sort out ... according to Romanes, as the sexes moved toward more divergent roles ... *females became increasingly less cerebral and more emotional.* Romanes ... *shared Darwin's view that females were less highly evolved than males — ideas which he articulated in several books and many articles that influenced a generation of biologists* ... At the University of Pennsylvania, the influential American paleontologist Edward Drinker Cope wrote that male animals play a more active part in the struggle for existence ... both Romanes and Cope ... included human beings in their generalizations (emphasis mine).[24]

Darwin taught that the differences between men and women were due largely to sexual selection. To pass his genes on, a male must prove himself physically and intellectually superior to other men in the competition for females, whereas a woman must only be superior in sexual attraction. Darwin concluded that "sexual selection depended on two different intraspecific activities: the male struggle with males for possession of females; and female choice of mate."[25] In Darwin's words, evolution depends on "a struggle of individuals of one sex, generally males, for the possession of the other sex ..."[26]

Darwin taught that the differences between men and women were due largely to sexual selection.

In support of this conclusion, Darwin used the example of Australian "savage" women, who "are the constant cause of war both between members of the same tribe and distinct tribes, producing sexual selection" due to sexual competition.[27] He also cites the North American Indian custom which requires the husband to wrestle with male competitors to retain his wive; "the strongest party always carries off the prize."[28] The result is, Darwin concluded, "a weak man ... is seldom permitted to keep a wife that a stronger man thinks worth his notice. This custom prevails throughout all of the tribes" in North America. It is not clear how common these practices were then, but they were not common in Europe and Asia.[29]

Darwin used several other examples to illustrate the evolutionary forces which he believed produced men of superior physical and intellectual strength, and docile, sexually coy women. Since humans evolved from animals and "no one disputes that the bull differs in disposition from the cow, the wild-boar from the sow, the stallion from the mare, and, as is well known through the keepers of menageries, the males of the larger apes from the females," Darwin argued that similar differences existed among humans.[30] Consequently, he concluded that men are "more courageous, pugnacious and energetic than woman, and have more inventive genius."[31]

A major problem with applying observations from the animal kingdom to humans was that scientists were "now prepared to debate the most complex problems of economic reforms not in terms of the will of God, but in terms of the sexual behavioral patterns of the cichlid fish."[32] Nonetheless, as a result of Darwinism, most evolutionists concluded that women differed considerably from men in mental disposition and intelligence, as did females and males of other species. Further, many female traits

"are characteristic of the lower races, and therefore of a past and lower state of civilization."[33] In summary, Darwin concluded that

> the chief distinction in the intellectual powers of the two sexes is shown by man's attaining to a higher eminence, in whatever he takes up, than can women — whether requiring deep thought, reason, or imagination, or merely the use of the senses and hands. If two lists were made of the most eminent men and women in poetry, painting, sculpture, music, ... history, science, and philosophy ... the two lists would not bear comparison. We may also infer, from the law of the deviation from averages, so well illustrated by Mr. Galton, in his work on "Hereditary Genius" that if men are capable of a decided preeminence over women in many subjects, the average of mental power in man must be above that of women.[34]

Throughout his life, Darwin held these views about "male supremacy," which he believed were critical in evolution.[35] Obviously, Darwin almost totally ignored the major influences of culture, the environment, constraining social roles, and the relatively few occupational and intellectual opportunities that existed in his day and historically for both sexes.[36] He believed, as do many sociobiologists today, that biology rather than the environment was the primary source of behavior, morals, and all mental qualities.[37] Shortly before his death, Darwin said he agreed with Galton "in believing that education and environment produce only small effects on the mind of any one, and that most of our qualities are innate."[38]

As a result of Darwinism, most evolutionists concluded that women differed considerably from men in mental disposition and intelligence, as did females and males of other species.

Further, Darwin attributed most female traits to male sexual selection, but only a few male traits to female selection. He felt that females were not fussy about their mate's physical appearance.[39] Therefore, males were not only "more powerful in body and mind than women" but had even "gained the power of selection" — evolution was in the males' hands, and females were largely passive.[40] Women, consequently, were less evolved and more primitive; this is why instinct and emotions dominated women, a fact which was her "greatest weakness."[41]

There are major problems with a sexual selection hypothesis. Marriages in many societies are arranged by relatives for pragmatic considerations, such as to become part of a certain family, to obtain a dowry, or simply so the parents no longer must support an offspring. Darwin also argued that

> ... the intellectual powers in man were normally developed before the reproductive age and their heritable component would not be affected by the environment. Intellectual superiority of the human male was innate but how had it come about? By sexual selection, said Darwin, not by female choice. Man's beard might be the result of female choice ... but, considering the condition of women in barbarous tribes — where men kept women "in a far more abject state of bondage than does the male of any animal" — it was probably the male that chose. Different standards of beauty selected by the male might, thus, account for some of the differentiation of tribes.[42]

Darwin concluded that some traits were due to sexual selection. These included hairlessness on the human torso and limbs, and the numerous other secondary sexual characteristics which differentiate humans from all other animals. What remains unanswered is why males or females would select certain traits in a mate when they had been successfully mating without them for eons and when most primates did not prefer these traits. Unfortunately, in this case, "Darwin, as usual, looked for a single cause to explain all of the facts."[43] If sexual selection caused the development of a male beard and its lack on females, why do so many women prefer shaven males? Obviously, culture is critical in what is considered sexually attractive. These standards change greatly, precluding the long term sexual selection needed to develop them biologically.[44]

Because males allegedly varied to a greater degree than females in *all* traits, they were felt to be superior.[45] This was important because

> variations from the norm was already accepted as the mechanism of evolutionary progress (survival and transmission of adaptive variations) and because it seems that the male was the more variable sex, it soon was universally concluded that the male is the progressive element in the species ... Once deviation from the norm became legitimized by evolutionary theory, the hypothesis of greater male variability became a convenient explanation for a number of observed sex differences, among them the greater frequency with which men achieve "eminence."[46]

Proponents who supported the inferiority of women position pointed out that a higher percent

of both the mentally deficient and mentally gifted are male. Its opponents argued that since selection operates to a greater degree on men, the weaker males would be more rigorously eliminated. Thus, women would manifest a *higher* degree of variation. Further, the weaker females would be preserved by norms that protected them. Hollingworth's work was especially important in discrediting the variability hypothesis. She found that feeble-minded women were better able to survive outside an institutional setting partly as a function of the female role; thus, institutional surveys would find fewer females. Further, sex-linked diseases as well as social factors influenced the higher number of males judged feeble-minded.[47] These debates revealed not only the weak empirical evidence for the female inferiority theory, but also many problems with both natural and sexual selection theories.

Few women were defined as eminent because their social role often confined them to housekeeping and child rearing. Also, constraints placed on their education and employment by both law and custom rendered comparisons between males and females of little interpretive value relative to abilities. Consequently, it is naive to attempt to extrapolate measures of intelligence, feeble-mindedness, eminence, and occupational success to biology, let alone evolutionary history. This argument, which once seemed well supported (and consequently was accepted by many theorists) was later viewed as having little validity.[48]

The Influence of Darwin on Society

The theory of the origin of behavior via natural and sexual selection was to have major consequences on society almost as soon as Darwin completed his first major work on evolution. In Shields' words "the leitmotif of evolutionary theory as it came to be applied to the social sciences was the evolutionary supremacy of the Caucasian male."[49] Leading evolutionist Joseph Le Conte concluded that "the fundamental differences between male and female resulting from organic evolution must also apply to distinct societal roles for each sex."[50] Consequently, Le Conte concluded that "women were incapable of dealing rationally with political and other problems which required emotional detachment and clear logic" and therefore he opposed women's suffrage.[51] Key to the innate inferiority belief were biological determinism and the primacy of nature over nurture. After reviewing the once widely-accepted *tabula rasa* theory which teaches that the environment is responsible for personality, Fisher discussed the radical change in society caused by Darwinism:

> ... the year in which Darwin finished the first unpublished version of his theory of natural selection [1842], Herbert Spencer began to publish essays on human nature. Spencer was a British political philosopher and social scientist who believed that human social order was the result of evolution. The mechanism by which social order arose was "survival of the fittest" a term he, not Darwin, introduced. In 1850, Spencer wrote *Social Statics*, a treatise in which he ... opposed welfare systems, compulsory sanitation, free public schools, mandatory vaccinations, and any form of "poor law." Why? Because social order had evolved by survival of the fittest. The rich were rich because they were more fit; certain nations dominated others because these people were naturally superior; certain racial types subjugated others because they were smarter. Evolution, another word he popularized, had produced superior classes, nations, and races.[52]

Fisher added that the early evolutionist's teaching included not only the idea of superior races, but also the idea that a superior sex — the male sex — was to dominate and control females by virtue of evolution. Because males had to protect both themselves and their females, they were thought superior. In the words of nineteenth century evolutionist Topinard, males have "all of the responsibility and the cares of tomorrow, [and are] ... constantly active in combating the environment and human rivals, [and thus need] ... more brains than the woman who he must protect and nourish ... the sedentary women, lacking any interior occupations, whose role is to raise children, love, and be passive."[53]

Males were also subjected to many selection pressures that women were not. They were required to hunt. Hunting can be a dangerous activity: one could become lost or injured, not to mention the hunter could sometimes become the hunted and be injured or killed. The stronger and quicker males were more apt to survive a hunt and bring back food. Therefore, natural selection would impact them to a greater degree than females. In short, male superiority was due to the "inheritance from his half-human male ancestors ... the long ages of man's savagery, by the success of the strongest and boldest men, both in the general struggle for life and in their contest for wives; a success which would have ensured their leaving a more numerous progeny then their less favored brethren."[54] Women, on the other hand, have historically not hunted but instead have taken care of domestic, often menial repetitive tasks, and were thus far less affected by selection pressures. Since long-term selection prunes out the weak, all factors which help to save the weak allow them to pass their inferior genes to their offspring, consequently, working against evolution.

The long tradition has been for males to protect women: only men went to battle, and the norms of war forbid deliberately killing women. Women were sometimes killed, kidnaped, or raped, but they were not often formally involved in war as were the male combat troops. Dyer concluded combat is exclusively a male occupation because

> men were more suited to it by their greater physical strength and their freedom from the burden of childbearing ... almost every living male for thousands of generations has imbibed some of the warrior mystique ... and men were specialized in the hunting and warrior functions for the same physical reasons long before civilized war was invented.[55]

Williams discusses the problem of male inferiority, especially as it relates to the greater mortality rates in males compared to females, and concluded that

> at every moment in ... life the masculine sex is playing for higher stakes. Its possible winnings, either in immediate reproduction or in an ultimate empire of wives and kin, are greater. So are the possibilities for immediate bankruptcy (death) or permanent insolvency from an involuntary but unavoidable celibacy ... a male's developmental program must gamble against odds in an effort to obtain the upper tail of the fitness distribution. A female's need merely canalizes against malfunctions. Female mortality will be found to exceed male, not in species with female heterogamety, but in those with female masculinity.[56]

Many evolutionists concluded that skill plays a far greater role in hunting and fighting than in domestic work carried out by women. Consequently, "because women's activities typically require less skill than men's activities ... [and] available evidence suggests that men vary much more in hunting abilities than women do in gathering abilities, hence, as with violence, *selection acts far more intensely among males than among females*" (emphasis mine).[57] In Williams' words, "at every moment in its game of life the masculine sex is playing for higher stakes."[58] The following statement by George demonstrates just how critical women's inferiority doctrine was for evolution:

> The chief difference between men and women, however, lay in their intellectual power, "man attaining to a higher eminence, in whatever he takes up, than can woman — whether requiring deep thought, reason or imagination or merely the uses of the senses and hands." Those striking differences, Darwin argued, could not have been the result of use and disuse, of the inheritance of acquired characters; for hard work and the development of muscles was not the prerogative of man: "in barbarian societies women work as hard or harder." ... Intellectual superiority of the human male was innate but how had it come about? By sexual selection, said Darwin, not by female choice.[59]

Sexual selection was at the core of evolution, and female inferiority was its major proof and its chief witness. Males, Darwin concluded, were like animal breeders, shaping women to their liking just as animal breeders do.[60] Men were the hunting specialists and women "specialized in the 'gathering' part of the primitive economy."[61] War pruned the weaker men, and only the strong survived to come home and reproduce.

The inferiority-of-women doctrine was a major proof of evolution by natural selection taken for granted by most scientists in the late 1800s.

Further, the inferiority-of-women doctrine was a major proof of evolution by natural selection taken for granted by most scientists in the late 1800s. Gould claims that there were then "few egalitarian scientists" — almost all believed that Blacks, women, and other groups were intellectually inferior and closer to the lower animals.[62] Nor were these scientists simply repeating prejudices without extensive work and thought about evolution theory. They attempted to *prove* scientifically that women were inferior by completing reams of empirical research. Even today, some evolutionary scientists still accept many of these conclusions.[63] Gibbons notes that many evolutionists conclude that sexual differences in thinking "have roots in strong evolutionary pressures on the sexes during prehistory when the brain was expanding rapidly."[64]

The conclusion that women are evolutionarily inferior to men was a core aspect of, and unassailable evidence for, evolutionary theory, especially of Darwin's major contributions: natural and sexual selection. The teaching also had clear social policy implications:

> For Darwin, the intellectual differences between the sexes, like their physical differences, were entirely predictable on the basis of a consideration of the long-continued action of natural and sexual selection ... Male intelligence would have been consistently sharpened through the struggle for possession of the females (that is, sexual selection) and through hunting and other male activities such

> as the defense of the females and young (that is, natural selection). According to Darwin's notions ... "man has ultimately become superior to woman." On this basis, he argued in *The Descent* that the higher education of women, which was being furiously contested in Victorian England, could have no long-term impact on this evolutionary trend to ever-increasing male intelligence. ... male intelligence would be constantly enhanced by the severe competitive struggle males necessarily underwent in order to maintain themselves and their families, and "this will tend to keep up or even increase their mental powers, and, as a consequence, the present inequality between the sexes.[65]

Darwin was not simply giving biological reasons to support a view that was long believed in history. Tavris concluded that it was widely believed among scientists for centuries "that most of men's and women's body parts were perfectly interchangeable, and that the parts that were not — those interesting reproductive organs — were nevertheless analogous: women's organs were the same as men's, 'turned outside in.'"[66] With the coming of Darwin, a drastic change took place:

> In the nineteenth century, however, scientists in all fields began to attack this premise, and to emphasize instead the chasm between masculine and feminine natures, physical and mental. They concluded that the differences between male and female bodies were correspondingly vast, because female development had been arrested at a lower stage of evolution. Women, they said, could be placed on the evolutionary ladder along with children, apes, and "primitive" people. Even illustrations of female skeletons reflected this belief in female inferiority. Female skeletons were drawn with tiny skulls and ample pelvises, to emphasize the idea that women were intellectually weak and suited mainly for reproductive functions.[67]

To show that females were as a whole inferior to males, scientists set out to "prove" that the females' *brain capacity* was smaller. They first tried to demonstrate smaller female cranial capacity by skull measurements, which could easily be done; and then prove that brain capacity was causally related to intelligence, a far more difficult task.[68] The justification for this approach to proving inferiority was explained by Darwin:

> As the various mental faculties gradually developed themselves the brain would almost certainly become larger. ... the large proportion which the size of man's brain bears to his body, compared to the same proportion in the gorilla or orang, is closely connected with his higher mental powers ... that there exists in man some close relation between the size of the brain and the development of the intellectual faculties is supported by the comparison of the skulls of savage and civilized races, of ancient and modern people, and by the analogy of the whole vertebrate series.[69]

One of the most eminent of the numerous early researchers that used craniology to prove the intellectual inferiority of women was Paul Broca (1824-1880), a professor of surgery at the Paris faculty of medicine and "one of Europe's most prestigious anthropologists." He was a leader in the development of physical anthropology as a science, and in 1859 founded the prestigious Anthropological Society.[70] A major preoccupation of this society was measuring various human traits including skulls to "delineate human groups and assess their relative worth."[71] Broca concluded that

> in general the brain is larger in mature adults than in the elderly, in men than in women, in eminent men than in men of mediocre talent, in superior races than in inferior races ... other things equal, there is a remarkable relationship between the development of intelligence and the volume of the brain.[72]

Broca's research was not superficial, but thorough and extensive. As Gould states, "one cannot read Broca without gaining enormous respect for his care in generating data."[73] Broca was especially interested in the intellectual and cranial comparisons of women with men: "of all his comparisons between groups, Broca collected the greatest amount of information on the brains of women vs. men ... "[74] He concluded that "the relatively small size of the female brain depends in part upon her ... intellectual inferiority."[75] Broca also concluded that the disparity between men and women's brains was, even in his day, becoming greater. The increasing difference was "a result of differing evolutionary pressures upon dominant men and passive women."[76]

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In an extensive study of Broca's work, Gould concluded that his conclusions were "the shared assumptions of most successful white males during his time — themselves on top ... and women, Blacks, and poor people below."[77] How did Broca arrive at these conclusions? Gould answers that "his facts

were reliable ... but they were gathered selectively and then manipulated unconsciously in the service of prior conclusions,"[78] namely that, as evolution predicted ... women were intellectually and otherwise demonstratively inferior to men. Broca's own research and the changing social climate, though, later caused him to modify his views, concluding that culture was more important than he had first assumed.[79]

The Views of Other Darwinists

Other evolutionists were convinced that many differences between the brains of males and females included the frontal lobes. In females, they were less developed; the neurons were different; and the "cerebral fibre" was softer, longer, and more slender. The males' frontal lobes were "in every way" more extensively developed than females, a sex difference that even existed in the unborn fetus.[80] Other differences that indicated males were superior included the complexity and the conformation of the gyri and the sulci, differences in the corpus callosum, and the fetus cortex development rate.[81]

These views were expounded by many of the most prominent scientists of Darwin's generation. Gustave Le Bon (1841-1931), a founder of the social psychology scientific discipline, and a pioneer in the collective behavior field whose classic study of mob behavior, *The Crowd* (1895), is familiar to every social science student, wrote:

> in the most intelligent races ... are a large number of women whose brains are closer in size to those of gorillas than to the most developed male brains. This inferiority is so obvious that no one can contest it for a moment; only its degree is worth discussion. ... Women ... represent the most inferior forms of human evolution and ... are closer to children and savages than to an adult, civilized man. They excel in fickleness, inconsistency, absence of thought and logic, and incapacity to reason. Without a doubt there exist some distinguished women ... but they are as exceptional as the birth of any monstrosity, as, for example, of a gorilla with two heads; consequently, we may neglect them entirely.[82]

The measurement of brain size was of critical importance in proving women's inferiority because of assumed correlations with size and intelligence, and

> such a correlation is considered quite important from a biological and evolutionary standpoint ... there has been a direct causal effect, through natural selection in the course of human evolution, between intelligence and brain size. The evolutionary selective advantage of greater brain size was the greater capacity for more complex intellectual functioning. "Natural selection on intelligence at a current estimated intensity suffices to explain the rapid rate of increase of brain size in human evolution."[83]

A modern study by Van Valen, which Jensen concluded was the "most thorough and methodologically sophisticated recent review of all the evidence relative to human brain size and intelligence," found that the best estimate of the within-sex correlation between brain size and I.Q. "may be as high as 0.3."[84] Unfortunately for early evolutionists, a correlation of 0.3% accounts for only 9% of the variance between the sexes, a difference that may be more evidence for test bias and culture than biological inferiority. Schluter even argues that in comparing the heights of men and women with brain size, "women have much larger brains than men."[85]

The Overturning of Women's Inferiority Doctrine

Although the inferiority of women doctrine was long believed, it was increasingly scientifically investigated from the 1970s on as never before.[86] Modern critics of the conclusion that females were less intelligent because the female brain was smaller were often motivated by the women's movement. These critiques demonstrated major flaws in the evidence that "proved" women's inferiority, and indirectly, of major aspects of evolution theory itself.[87] For example, Fisher argues that the whole theory of natural selection is questionable, quoting Chomsky's words that

> the process by which the human mind achieved its present state of complexity ... [is] a total mystery ... It is perfectly safe to attribute this development to "natural selection," so long as we realize that there is no substance to this assertion, that it amounts to nothing more than a belief that there is some naturalistic explanation for these phenomena.[88]

She also argues that modern genetic research has undermined several major aspects of Darwin's hypothesis — especially his sexual selection theory. In contrast to the requirement for Darwin's theory, "genes are not inherited along sexual lines" because, aside from the genes which are on the Y chromosome; "a male offspring receives genes from both mother and father."[89] Even if natural selection was to operate differentially on males and females, males would pass on many of their superior genes to *both* their sons and daughters. Darwin and his contemporaries had almost no knowledge of genetics, but this did not stop them from making sweeping conclusions about evolution. Darwin even made the ir-

responsible claim that "the characteristics of a species acquired by sexual selection are usually confined to one sex."[90] Yet, Darwin elsewhere recognized that women can "transmit most of their characters, including some beauty, to their offspring of both sexes," a fact he ignored in much of his writing.[91] He even claimed that many traits, such as genius and the higher powers of imagination and reason are "transmitted more fully to the male than the female offspring."[92]

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Because Darwin believed the pangenesis theory that certain acquired characteristics could be inherited, he could accept his superiority-of-the-male-sex view. Darwin did not reject this belief even when many other naturalists realized the theory was untenable.[93] The decisive blow to both the theory of pangenesis and all other forms of Lamarckism was the work of August Weismann, who found that the reproductive cells of animals were "distinct, identifiable and differentiated at an early stage of development in both males and females [and] there was no way in which the body's cells could affect the germ cells."[94] The final blow was the Mendelian and De Vriesian theories of inheritance which proved that the mother and father both contributed genetic information to their male and female offspring. Ironically, this major blow to the male superiority theory that rendered it largely untenable did not cause any major widespread repudiation of it. It took the civil rights movement to force a reevaluation of attitudes which were highly ingrained in both scientific theory and the cultural norms of society.

Genetics does not totally negate the reasons which were used to conclude that females were evolutionarily inferior because some sex-linked traits would still normally be inherited only by males on the Y chromosome. Because women inherit two X chromosomes, many recessive deleterious chromosomes on one X chromosome would likely be masked by the dominant non-deleterious chromosome on her other X. Males would not have this advantage: many traits which would be masked for a female are expressed because the Y or male chromosome does not contain many X alleles. Being much shorter than the X, it has far fewer genes compared to the X chromosome. This argues for the genetic superiority of women and is why many genetic diseases such as color blindness and hemophilia are far higher among males than females. These traits, though, are often inherited by males through their mother and expressed only through sons.[95]

The Contribution of Darwin to Sexism

Even though Darwin's theory gave birth to biologically based racism and sexism, some argue that he would not approve of, and could not be faulted for, the results of his theory. It is true that many researchers went far beyond Darwin — especially his cousin, Galton, who concluded from his life long study of the topic that "women tend in all their capacities to be inferior to men."[96] In an extensive review of this view, Richards concluded that "recent scholarship has emphasized the central role played by economic and political factors in the reception of evolutionary theory," but Darwinism provided "the intellectual underpinnings of imperialism, war, monopoly, capitalism, militant eugenics and racism" and sexism, and that "Darwin's own part in this was not insignificant as has been so often asserted."[97] After noting that Darwin believed that the now infamous social Darwinist Spencer was "by far the greatest living philosopher in England ... ," Fisher concluded that the evidence for the negative effects of evolution teaching on history are unassailable:

> Europeans were spreading out to Africa, Asia, and America, gobbling up land, subduing the natives and even massacring them. But any guilt they harbored now vanished. Spencer's evolutionary theories vindicated them ... Darwin's *Origin of Species*, published in 1859, delivered the *coup de grace*. Not only racial, class, and national differences, but every single human emotion was the adaptive end product of evolution, selection, and survival of the fittest."[98]

These conclusions of Darwinian biology about females "squared with other mainstream scholarly conclusions of the day. From anthropology to neurology, science has demonstrated that the female Victorian virtues of passivity, domesticity, and greater morality (... less sexual activity) were rooted in female biology."[99] Consequently, many concluded that "evolutionary history has endowed women with domestic and nurturing genes and men with professional ones."[100] Steinem added that

> similarly, the passive, dependent, and childlike qualities of the "darker races" (then still called the "white man's burden") were part of their biological destinies. Evolutionists also chimed in with a reason

> for all this: men who are not Caucasian and women of all races were lower on the evolutionary scale. In the case of race, this was due to simple evolutionary time ... in the case of Caucasian women — who obviously had been evolving as long as their male counterparts — there was another rationale. The less complex nervous systems and lower intelligences of females were evolutionary adaptations to the pain of childbirth, repetitive domestic work, and other physical, non-intellectual tasks. Naturally, females of "lower" races were also ... inferior to their male counterparts.[101]

This conclusion about the evolutionary inferiority of women was so ingrained in biology that Morgan concludes that the intellectuals and thinkers in this area tended to "sheer away from the whole subject of biology and origins" hoping that they could ignore it and "concentrate on ensuring that in the future things will be different."[102] Women writing on the topic also largely ignored the Darwinian inferiority theory.[103] Morgan stresses that we simply cannot ignore evolutionary biology, though, because the belief of the "jungle heritage and the evolution of man as a hunting carnivore has taken root in man's mind as firmly as Genesis ever did" and that man has "built a beautiful theoretical construction, with himself on top of it, buttressed with a formidable array of scientifically authenticated facts." She argues that these "facts" must be reevaluated and that scientists have "sometimes gone astray" not purely because of prejudice, but also because of philosophical proscriptions.[104] The prominent evolutionary view that women are biologically inferior to men, she argues, must be challenged. In her book and scores of other works, researchers have adroitly overturned the conclusion that women are in general biologically inferior to males.

Many nineteenth century biologists argued for women's inferiority because they strongly believed that "unchecked female militancy threatened to produce a perturbance of the races and to divert the orderly process of evolution."[105] Other researchers took the approach that collectivists' social organization of the last century and other factors were slowly reducing the existing biological sex inequalities.[106]

The Influence of Culture on Evolution's Views of Women

Culture was of major importance in shaping Darwin's theory. Victorian middle-class views about men were clearly included in *The Descent of Man* and the other writings of evolutionists. As argued by Richards:

> Victorian assumptions of the inevitability and rightness of ... woman's role of domestic moral preceptor and nurturer and man's role of free-ranging aggressive provider and jealous patriarch — [were] enshrined in Darwin's reconstruction of human evolution. Our female progenitors ... were maternal, sexually shy, tender and altruistic, while our male ancestors were "naturally" competitive, ambitious and selfish, not unlike Darwin himself who ... wrote in *The Descent*: "Man is the rival of other men; he delights in competition ... " It was ... the natural order of things, just as man was "naturally" more intelligent than woman, as Darwin demonstrated to his satisfaction through the dearth of eminent women intellectuals and professionals: "The chief distinction in the intellectual powers of the two sexes is shown by man's attaining to a higher eminence in whatever he takes up, than can women — whether requiring deep thought, reason, or imagination, or merely the use of the senses or hands." [107]

Although Darwinism beliefs did much to impede human rights, many other forces existed which influenced the women's inferiority belief:

> Long before Darwin, earlier "evolutionists" had likewise relegated women to a role of subjugation and inferiority in both atheistic and pantheistic religious cultures (consider the common image of the "caveman" dragging his mate by the hair, as well as the subservient role of women in practically all pagan and ethnic religions).[108]

The Darwinian concepts of male superiority also served to increase the secularization of society and make more palatable the acceptance of the view that humans were created by natural law rather than divine direction.[109] The importance of naturalism in developing the women's inferiority doctrine was emphasized by Richards:

> Darwin's consideration of human sexual differences in *The Descent* was not motivated by the contemporary wave of anti-feminism ... but was central to his naturalistic explanation of human evolution. It was his theoretically directed contention that human mental and moral characteristics had arisen by natural evolutionary processes which predisposed him to ground these characteristics in nature rather than nurture — to insist on the biological basis of mental and moral differences ... [110]

A major method used to attack the evolutionary conclusion of female inferiority is to attack the evidence for Darwinism itself. Fisher, for example, noted that it is difficult to postulate

> theories about human origins on the actual brain organization of our presumed fossil ancestors, with only a few limestone impregnated skulls — most of them bashed, shattered, and otherwise altered

> by the passage of millions of years [and to arrive at any valid conclusions on the basis of this] ... evidence, would seem to be astronomical.[111]

Hubbard adds, "Darwin's sexual stereotypes are doing well also in the contemporary literature on human evolution. This is a field in which facts are few and specimens are separated by hundreds of thousands of years so that maximum leeway exists for investigator bias."[112] She then discusses our "overwhelming ignorance" about human evolution and claims that many beliefs which are currently "accepted" are pure speculation.

Many of the attempts to disprove the evolutionary view that women are intellectually inferior attack the core of evolutionary theory itself. Human group inferiority must exist in order for natural selection to have something from which to select. A good example is Shepherd, who in evaluating the evolution female inferiority theory, produced an incisive well-reasoned critique of both sexual and natural selection and Darwinism as a whole.[113]

Although Darwinism beliefs did much to impede human rights, many other forces existed which influenced the women's inferiority belief.

Evolution can be used to argue for male superiority, but it can also be used to build a case for the opposite. The evolutionary evidence "left considerable scope for individual interpretation" to the degree that some feminist authors and others have read the data as showing the evolutionary superiority of *women* using "the same evolutionary story to draw precisely the opposite conclusion."[114] One notable example is Montagu's classic book, *The Natural Superiority of Women*.[115] Some female biologists have even argued for a gynaecocentric theory of evolution, concluding that woman is the trunk of evolution history, and man is but a branch on the tree, a grafted scion.[116] Others have "tried to integrate reform Darwinist evolutionary knowledge with contemporary feminist ideals."[117] Hapgood even concludes that the evolutionary purpose of males is to serve females, arguing that "masculinity did not evolve in a vacuum but because it was selected." He notes that there are many species that live without males, and the fact that they do not live genderlessly or sexlessly shows that "males are unnecessary" in certain environments.[118] It is the woman that reproduces, and survival is important in evolution only to the degree that it promotes reproduction. Consequently, Hapgood argues, evolution theory would conclude that males were evolved only to serve females in all aspects of child production and nurturing. This includes both to insure that the female becomes pregnant and that the progeny are taken care of.

Another revisionist theory is that women were at one time in history not only superior, but dominant. This view argues that society was once primarily matriarchical and patriarchal domination was caused by factors which occurred relatively recently.[119] Of course, the theories that postulate the evolutionary inferiority of males suffer from many of the same problems as those that postulate women's inferiority.

The Use of Darwinism To Justify Behavior In Conflict With Christianity

Some argue that many of these views that Darwin developed should again be perpetuated to justify a moral system, using evolutionism as support.[120] For example, Ford stated,

> the idea that we have to defeat sexism is ... erroneous ... the much attacked gender differentiation we see in our societies is actually ... a necessary consequence of the constraints exerted by our evolution. There are clear factors which really do make men the more aggressive sex, for instance ... [121]

Eberhard notes physical aggressiveness of males is justified by sexual selection, noting that: "males are more aggressive than females in the sexual activities proceeding mating (discussed at length by Darwin 1871 and confirmed many times since ...)."[122] Further, the conclusion "now widely accepted ... that males of most species are less selective and coy in courtship because they make smaller investments in offspring" is used to justify male sexual promiscuity.[123] Male promiscuity is, in other words, genetically determined because "males profit, evolutionarily speaking, from frequent mating, and females do not."[124] The more females a male mates with, the more offspring he produces — whereas a female need only mate with one male to become pregnant. Evolution would progress only if she selected the most fit male, which is what Darwin's theory of sexual selection predicted. For this reason, males have "an undiscriminating eagerness" to mate, females "a discriminating passivity."[125] Fox even argues that high pregnancy rates among unmarried teenage girls is due to our "evolutionary legacy" which drives young girls to get pregnant.[126] Con-

sequently, cultural and religious prohibitions against unmarried teen pregnancy are doomed to fail.

After concluding that female inferiority is a result of natural selection, it is often implied that what natural selection produces is natural, thus proper, or at least it gives a "certain dignity" to behaviors that we might "otherwise consider aberrant or animalistic."[127] For example, evolutionary success is defined as leaving more offspring; consequently, human males are promiscuous. This explanation is used to justify both male promiscuity and irresponsibility, and trying to change "nature's grand design" is futile. Endeavoring to alter the "natural order" of female inferiority is also contrary to "nature's grand design." Symons argues that many attitude and behavioral differences between the sexes are innate, and identical rearing of males and females cannot eliminate them.[128]

Ghiselin concludes that many sexual behavioral differences are a result of evolution and therefore an unalterable part of our biology. Evolution evolved females to be loyal and males to be disloyal, females to lack justice, and males to be just — and changing these evolved biological differences is fraught with difficulties.[129] In response to these conclusions, Richards stated:

> It has been left to feminist scholars who are concerned with disputing evolutionary arguments like Ghiselin's, to explore the social dimensions of Darwin's writings on the biological and social evolution of women. They are unanimous in their categorization of them as ... supporting a prejudiced and discriminatory view of women's abilities and potential ... The small section of the appropriately named *Descent of Man*, where Darwin deduced the natural and innate inferiority of women from his theory of evolution by natural and sexual selection, is fast becoming notorious in feminist literature.[130]

Conclusions and Implications for Christianity

The Darwinian conclusion that women are inferior has had major unfortunate social consequences. Darwin hypothesized that sexual selection, an important evolutionary method, along with the data he and his followers gathered supporting their view of the inferiority of women, were major evidences of natural selection.[131] Consequently, the disproof of women's inferiority means that a major mechanism which was originally hypothesized to account for evolutionary advancement had to be modified. The data, although more complete today, are similar to those that Darwin used to develop his theory, yet we have forged radically different conclusions. This vividly demonstrates how important both preconceived ideas as well as theory were in interpreting the data. The women's evolutionary inferiority conclusion developed because, in Fee's words:

> Measurement was glorified as the essential basis of science: both anatomists and psychologists wanted above everything else to be "scientific." ... Earlier psychological theory had been concerned with those mental operations common to the human race: the men of the nineteenth century were more concerned to describe human differences.[132]

These human differences were not researched to understand and help society overcome them, but to support and justify a theory postulated to support naturalism and also a set of social beliefs. The results that history teaches were tragic, especially in the area of racism:

> it makes for poor history of science to ignore the role of such baggage in Darwin's science. The timeworn image of the detached and objective observer and theoretician of Down House, remote from the social and political concerns of his fellow Victorians who misappropriated his scientific concepts to rationalize *their* imperialism, *laissez-faire* economics, racism and sexism, must now give way before the emerging historical man, whose writings were in many ways so congruent with his social and cultural milieu.[133]

Hubbard goes further and calls Darwin guilty of "blatant sexism" and places a major responsibility for scientific sexism and its mate, social Darwinism, squarely at Darwin's door.[134] Advancing knowledge has shown many of his ideas were not only wrong, but tragically harmful, and many still adversely affect society. In Richards' words, Hubbard concluded that Darwin "provided the theoretical framework within which anthropologists and biologists have ever since been able to endorse the social inequality of the sexes." [135] Consequently, "it is important to expose Darwin's androcentrism, and not only for historical reasons, but because it remains an integral and unquestioned part of contemporary biological theories."[136]

A critical reason for Darwin's conclusion was his rejection of the biblical account that taught man and woman were specific creations of God, made not to dominate, but to complement each other. In Richards' words, "For Darwin, the human races were the equivalent of the varieties of plants and animals which formed the materials of evolution in the organic world generally" and the means that formed the sexes and races were the same struggles that

Darwin concluded animals underwent to both survive and mate.[137] Having disregarded the Creator, Darwin needed to replace him with another — and the one he selected was the struggle between males for possession of females and food. This replaced the goal of ideal harmony that resulted from the compatibility doctrine with disharmony that resulted from his competition theory — the conclusion was that evolution favors the most vigorous and sexually aggressive males because they usually leave more progeny.[138]

Advancing knowledge has shown many of [Darwin's] ideas were not only wrong, but tragically harmful, and many still adversely affect society.

Darwin's theory did not result from personal conflicts with women, but more from his efforts to explain creation without an intelligent creator. A person's negative attitude toward the other sex commonly results from poor experiences with that sex. In Darwin's case, from all information available from Darwin, his wife, and children and others, his marriage was exemplary. Their only major difference was in the area of religion, and this caused mostly minor problems: their devotion to each other is classic in the history of marriages of famous people. Further, as far as is known, he had an excellent relationship with all of the women in his life. His children too, especially his daughters, thought highly of Darwin and later when they felt free to talk about their home life, none of the scandals, about abusive parents or ignoring fathers that are so common today, surfaced. When Anna, their oldest daughter, died in 1851 at the age of ten, Charles was devastated and many attribute much of his hostility toward religion and God to this loss and the death of his mother when Darwin was much younger. Immediately after his daughter's death, Darwin

> lay agonized in bed for hours, his stomach churning. He stopped crying long enough to see Dr. Gulley ... But when writing to Emma, he broke down again. Annie had gone "to her final sleep ... " Towards six o'clock Fanny ... found Charles still crying bitterly ... but there was something else tormenting him now. He longed to be with Emma, yet how could he go until his beloved child was buried? [139]

Although his critics have tried to critically scrutinize every aspect of his life, they never have found evidence that belies the conclusion that he was devoted to his wife and children, and they to him.

The Christian teaching of the equality of the sexes before God and the lack of support for female biological inferiority stand in considerable contrast to the conclusions derived by evolutionary biology in the middle and late 1800s. In this author's judgment, the history of these teachings is a clear illustration of the excesses that naturalistic thinking can lead to. It also forces the Christian community to evaluate the role of women in the church, something that is now vigorously proceeding. The Scriptures used to justify an inferior position for women in the church do not, when scrutinized, teach, and in no way justify, most of the conclusions used to support the women's inferiority doctrine. ✤

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Books Received and Available for Review

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

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Communications

Caring for Science under Friendly Fire**

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"Have nothing to do with stupid, senseless controversies" (2 Tim. 2:23-25), Paul admonished the youthful Timothy, cautioning vigilance, for there will ever be those "craving for controversies and for disputes about words" (1 Tim. 6:4). Yet if you must correct opponents, he added, then "do so in a spirit of gentleness." (2 Tim. 2:25).

For many people today, it would appear that science and religion are either in combat or incommensurable. Science purportedly has displaced any use for religion or God. One well-meaning corrective offered in a variety of forms is to replace the naturalistic metaphysics normally associated with natural science with an alternative metaphysic more in tune with theistic belief. Presumably this would save science from itself in some redemptive fashion. Many related issues have contentiously arisen of late that require attention, for misunderstanding abounds presenting a blockage to belief: a scandalous impasse to believers and unbelievers alike. Typically part of the difficulty is terminology. But there are also deeper sources of divisiveness that lurk beneath the surface, since we are dealing here with matters that involve the heart, will, and spirit of every person. It is precisely because this situation transcends mere academic concern that I have felt compelled to attempt to exercise the Pauline formula. Caring for science to me is an issue of deep pastoral care. Yet all I can offer are some insights gained over years of experience and academic learning — perhaps "like a bridge over troubled waters" as Paul Simon would sing — to reach the heart, the hub of this vexed matter.

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Many, if not all, of the contending voices share concern for establishing claims for Divine authority in both creation and Scripture. I share these concerns. I also share concern for the facile dismissal of God as irrelevant, so prevalent in the world today. I did not always have this conviction, but learned the hard Pauline way. Of course, we need to help place God back into people's minds, hearts, and souls. But to do this requires far more in the way of prayer and patience and far, far less in the way of intellectual agility and altercation. While I strongly sympathize with those who see signs of intelligent design in the universe, it is simply not good enough to lord it over those who, for one reason or another, fail as yet to see things in this way. The head and the heart are *very* far apart. It has been said by sages of old, as well as today, that "The Fool has said in his heart that there is no God" (Ps. 14:1). In my own agnostic days, although I could not, of course, grasp the deep meaning of it all with my head, I too was never a proactive "heart-fool." So, although I share common cause with much of the general thrust and sentiment voiced in various quarters, I feel obliged gently to expose some points of confusion permeating this complex area of interaction. For the resulting contention, to Satan's glee, is quite counterproductive.

Let me highlight just a few of the points which are presented here in a generic way without designating names or schools of thought.

1. Science is inherently opposed to religion. It carries with it a presumption of agnosticism or

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even atheism. One implication of this would be that most scientists are closet atheists.

2. Science espouses a naturalistic metaphysic which only exacerbates the first point.

3. Science presumably could be corrected, improved (redeemed as it were) if it were to replace this naturalistic (allegedly atheistic) metaphysics with one more attuned to theism.

These three represent just a few of the minefields for contention. Even a cursory reading of the current literature reveals vying positions concerning intelligent design, creation and evolution, and many other issues that are directly related. The July 1995 ASA meeting confronted, once again, the vexed special issue of "missing" intermediate forms and other complaints about evolution. I urge us all to transcend these details and contentious alternatives, important as these may be in their own right, to regain a sense of perspective. There is infinitely more at stake here than being in the right about intelligent design and related matters.

This is a highly complex topic. Let me merely try to set out aphoristically what I see as some salient points requiring attention. Then let us hone in on why the entire matter is of such serious concern.

Aphorisms

Evidence is *not* self-evident or faith-neutral, but it is subject to interpretation according to the belief patterns of the individual or group.

The issues are explicitly *not* to be construed in terms of science versus faith, but to be explained by assessing the underlying faith-type presuppositions operative in every case — whether theistic or *non*-theistic.

Choosing between design and lack of design is a matter of belief, *not* of scientific knowledge or fact. Yet what we choose to believe *may* miss the mark.

Natural science and its methodology must be distinguished from what can be called "forensic science" which is more appropriate for the art of persuasion and judicial interpretation of evidence. Natural science, which deals with the *general* case, involves a style of thinking incompatible with concern for the particular instance and special cases as might typically be found in a court of law. Put succinctly, scientists and lawyers don't share a common mentality.

Science deals with high probabilities. and so it ought properly to abstain from conclusions involving accumulations or congeries of improbabilities.

"Grace" has been defined by Peck as a "pattern of highly improbable events with a beneficial outcome."

Some mysteries must remain forever beyond explanation.

Reasons for Serious Concern

To give a sense of overall direction, let me remind you of what I mentioned about the road from the head to the heart. At the center of it all is the difference between the God of creation and God as Redeemer. As Christians, we might espouse the distinction primarily in terms of understanding and awareness. Everyone, however, is not a Christian; many are not believers in any god. Yet as Christians we believe that God created every person in his own image and likeness. This has profound implications, it seems to me, for how one is to discover from where he or she came. Whatever conclusions one may draw with the aid of the intellect and reason, these will ultimately pale into insignificance in the face of redemptive love. The fundamental level which *ultimately* counts concerns potential encounters between each created person and his or her Creator.

The crucial point is succinctly and most poignantly stated by Simone Weil with her characteristic simplicity:

> Until God has taken possession of him, no human being can have faith, but only simple belief; and it hardly matters whether or not he has such a belief, because he will arrive at faith equally well through disbelief.

Encounters with the Creator God as God the Redeemer are available to each person whether a scientist or not, whether religiously inclined or not. Yet it is here that we discover just why we ought to care so deeply about science, just as it is. The sense of awe which the findings of genuine science proclaim clearly lends itself to the deeper encounter, whatever formal belief state may be operative in a person at some particular time. We are all groping for God, and science happens to be for some a handy and effective way to grope! It is this view of science,

as stepping stones along the path to God that is so crucial, by which persons using their God-given reason and intelligence may seek to enhance the innate sense of belief that they have in their heart of hearts *whatever* they may profess outwardly.

The ranks of science are filled, I'd wager, with closet Christians and believers of diverse sorts. Many a scientist has had his or her own "foxhole" experience. Sadly, professional norms may exact a price for those who forthrightly state their own heart position as a matter of true witnessing. This, of course, in no way means that such a one should turn around and encumber their science either methodologically or metaphysically with what they have come to understand. A scientist who is a Christian is a scientist with a wider perspective about the findings of science, as British Charles Coulson pointed out. Such a one does not engage in a different kind of science from his colleagues.

Instead of attempting to introduce an alternative metaphysic into science — as if one first had to be converted even to do proper science — it would be more beneficial to reflect again upon the model of Coulson. It is the *scientist* as a person who gains the wider perspective in virtue of his conversion. It is *not* science as a discipline that requires some sort of redemption. To elevate, as it were, science to some ethereal realm would *ipso facto* deprive sincere individuals of science as their principal means by which to grope for God. If such a strategy were effective, many who are as yet unable to switch over into such a belief mode would be disenfranchised from even getting started on the quest. Again, it is the scientist as believer who can see more and deeper into the very same phenomena available to all scientists. It is this heightened sense of awareness made possible by the personal response of the individual to God the Creator now experienced as the God of Redemption that brings this about.

On a related point, it would not be helpful to pursue a sort of hierarchy of science, as if the "regular" naturalistic science were somehow inferior to a theistic science. This would do injustice to the discipline and jeopardize its essential communal character. It is entirely understandable that one theistically inclined would wish to share these insights with nonbelievers. But the effort to be helpful is fraught with danger, for again it removes from the unbeliever the very means available for groping. This is a variation of the problem of conversion. Once a person has "arrived" and has begun truly to believe, his highest wish is that his friends should benefit and learn to share this perspective. One wishes to be helpful so that others may see in this new and better way. However, it is not helpful to try and force things. What is required is a great deal of patience and humility to realize that God calls all persons to himself according to *his* ways and timing.

There is yet another aspect of construing science, with its inherent methodological naturalism, as somehow inferior or opprobrious. Things are not always what they seem. The conclusions drawn by science on one level common for all to understand do not necessarily rule out a deeper sense of reality. By this I do not mean simply a game of hidden variables. Rather, it is simply that God has created and is creating in his own time and in his own ways. We are not privy to his ways. It is presumptuous and a *non sequitur* of science to claim that God is *not* present and creating. But it would be equally presumptuous to assert that by some source of insight or special information, including Scripture, that we could know the real answers. Either way it would be the height of prideful arrogance to claim to know the mind of God the Creator. Even if we could somehow fathom the mystery of creation and decipher the manifest intelligent design behind it all, what good would it bring us on our pilgrimage? The pinnacle of such an adventure could at best yield a variant of Deism, for we would still know only about creation — the God of Creation would allegedly be patent for the privileged ones. Well, yes and no — and more to the point, so what! The distance between the head and the heart can be measured in megamiles and parsecs.

On our long journey home, all the head knowledge about the God of creation simply pales in the light of the God of redemptive love. Humility is essential, so too a heart open with responsive love. Neither scientists nor religionists have the inside track on either of these virtues. Every person is sought out in God's unique way. I wish everyone a profoundly spiritual *bon voyage*. Please help take care of science, for it is the very best "head start" that many of us could ever have along the way. ✣

Creation and God's Judgment

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"If God in the final judgment would ask you a question about the Creation, what might that question be?"

Some years ago I addressed this question to a group of respected evangelical theologians and scholars who had come together as colleagues to attempt to resolve some knotty problems about origins. We were engaged in serious business that might affect academic careers and appointments, and it was because of seriousness of this business that I asked this very serious question. Among other things, it and it was because of the I asked this very serious is serious because my colleagues, as is true for all of us, not only confess God to be Creator of all things, but also expect to be judged by him.

My colleagues needed very little time to give their response. No doubt, you, too, could respond quickly and confidently to such a question. Perhaps you already have done so?

The immediate response from a theology professor was that God might ask, "What did you do with my creation?" Several nodded their heads in agreement, and then another observed that God might ask, "What do you *think* of my creation?"

As you might suspect, this was not the question about which we had assembled for our discussion that day. Our purpose was more closely related to the next question I asked of my colleagues. It was this, "Do you think that God might ask, 'How did I do it? How did I make the world?'"

The reply was immediate and vigorous: "Even to *suggest* that God would ask one of *us* how he made the world would be the height of human pride and arrogance!" And, then this respected seminary professor recited God's question to Job: "Where were you when I laid the foundations of the earth?" (cf. Job 38:1-40:5 and 40:6-42:6). We fell silent. We reflected deeply on what we had said, because we had come together for judgment.

And so I come to us who read this. As you and I discuss God's creation, which question or questions are we preparing ourselves to answer? A question of the first kind, or of the second kind? Are we preparing ourselves and those we influence to answer, "How did I do it?" or "What did you do with it?"

Something peculiar (to me it is even sinister) has been happening through the decades during which I have been studying our Lord's creation. In my first two decades, mention of creation brought from fellow church members something like psalms — they would be moved by the thought of God's power and soon might be heard humming "How Great Thou Art." During my fourth, fifth and now sixth decade, mention of creation more often than not elicits from fellow believers — after just two or three sentences of conversation — a particular word and a specific question. The word is *evolution* and the specific question is, "What is *your* stance on creation?" (Meaning of course, "What is your stance on evolution?") It is a response in which there usually is no hint of praise, no reference to Psalm 104 or 148 or anything like that, and no telling of an awesome experience in creation that wonderfully displayed God's divinity and everlasting power.

Knowing the question on Creation and evolution to be asked in all seriousness, I reply by saying I am willing to answer, but only after I ask *them* a question, and only then if they still want an answer. My question to them is the very one I asked my

theologian friends, *"If God in the last judgment would ask you a question about the creation. what might that question be?"* ... "If God would ask *you* about his creation, what do you think he might ask?"

Their question soon is diminished by their answer to my question — as they realize that while we discuss "creation" the real creation is being degraded through human abuse, indifference, and negligence — including abuse of our own. While debating creation, if not participating in its destruction, we often are on the sidelines watching its dismemberment: permitting many species to be extinguished, not speaking out against rampant soil erosion, obscuring the testimony of the heavens with our polluting wastefulness, becoming the only occupants of the land, muddying the waters, trampling the vegetation, and much more.

The world *God loves* is being subjected to destructive use even while we debate how God made it. As we (seemingly) defend creation by our words, we may find that we destroy it by our deeds — deeds of omission and commission.

A meditation by Abraham Kuyper on John 3:16 is helpful in this regard. He confesses with Scripture, "God loves *the world*. Of course not in its sinful strivings and unholy motions ... But God loves the world for the sake of its origin; because God has thought it out; because God has created it; because God has *maintained* it and *maintains* it to this day."

Kuyper reminds us that "Not we have made the world, and thus in our sin we have not maltreated an art product of our own. No, that world was the contrivance, the work and the creation *of the Lord our God*. It was and is His world, which belonged to Him, which He had created for His glory, and for which we with that were by Him appointed. Not to us did it belong, but to Him. It was His. And *His* divine world we have spoiled and corrupted. And herein roots the love of God, that He will repair and renew this world, His own creation, His own work of wisdom, His own work of art, which we have upset and broken, and polish it again to new lustre."

And he warns: "But the children of men meanwhile can fall out of that world. If they will not cease to corrupt His world, God can declare them unworthy of having any longer part in that world, and as once He banished them *from Paradise*, so at the last judgment He will banish them from this earth, and cast them out into the outermost darkness, where there shall be weeping and gnashing of teeth. And therefore whoever would be saved with that world, as God loves it, let him accept the Son, Whom God has given to that world, in order to save the world."

The Scriptures, in their depiction of the last judgment, confirm dire consequences for the destroyers: "The time has come ... for destroying those who destroy the earth" (Rev. 11:18b). And so it was that my colleagues and I were sitting in judgment, not fully cognizant of God's final judgment.

"If in God's final judgment we would be asked a question about the Creation, what might that question be?" What is *your* answer? ✣

Note

The reference is to Abraham Kuyper, *Keep Thy Solemn Feasts: Meditations by Abraham Kuyper*, from Chapter 7, "God So Loved the World!" (Grand Rapids, MI: Wm. B. Eerdmans Publishing Company, 1903), 70-71.

Dialogue

In response to the question of J. W. Haas, Jr., "Are Evangelical Scientists Practical Atheists?"[1]

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When Al Plantinga encouraged me a few years ago to embrace a theistic science[2] or when less thoughtful fellow evangelicals have accused me of naturalistic materialism or practical atheism I could truthfully claim ignorance. I had no idea what this theistic science that Plantinga was pushing would be like. What could I possibly do differently? When I asked him, he said something to the effect that he wasn't a scientist but he thought that evangelical scientists should seriously consider the issue and come up with a valid theistic science. Fair enough. But I have considered the issue some and have yet to find anything of substance to embrace.

It does seems possible to imagine hypothetical *Universe/God combinations* in which some kind of theistic science would make practical sense. But ours is a combination of *natural Universe/personal communicating God,* which doesn't leave a lot of room for making significant changes in how we go about making discoveries about the Universe. It's hard to swim up stream against the way things are, especially in scientific discovery.

Does this mean that faith has no impact on my life as a scientist? May that never be! I've been a scientist for 36 years and a Christian for 18. Some aspects of my science have changed profoundly and some haven't changed at all. What has changed is that I have seen the Lord lay discovery after discovery before me like a banquet set in the presence of my enemies. And he has led me by the Spirit through difficult interactions with my fellow scientists and faculty. But the way I've gone about making discoveries about the history and mechanics of mountain belts on Earth and Venus hasn't changed. And my salvation hasn't compelled me to abandon earlier insights, nor would we expect it to. Even if I had been working on the origins of life or evolution I can't see how the logic of discovery could possibly have changed by my becoming a Christian. This is because successful discoveries about the Universe have to mirror the way things are.

Now there are realms of thought, inquiry and experience where something like theistic science makes sense within our *Universe/God combination.* For example, answered prayer and the providence of God are realms in which Biblical and non-Biblical perspectives lead us in quite different directions. These are realms in which some evangelicals could be accused rightfully of being methodological atheists.[3] How we think in this area profoundly affects how we act.

For example, some evangelicals are afraid to pray about the weather because weather is controlled by physical processes of the universe. How could God change the weather without violating physics? In the same mail that brought the issue of *PSCF* with J. W. Haas' challenge, I received an account from

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Zambia of a drought and crop failure. The villagers had been doing traditional rain dances asking their gods to send rain, but none came. The Christians asked them to stop for a week while they prayed; the pagan villagers agreed. The Christians spent their whole Sunday evening service praying for rain, then went home. That night the rains came and continued. "The villagers were amazed and now ask the Christians, 'So you really talk to God?'"[4] It is, of course, possible to develop wholly naturalistic explanations of the Zambian experience. But the fact is that very little serious research has been done by scholars on this sort of grass-roots Christian experience from either a theistic or a naturalistic perspective; I am convinced it is because of methodological naturalism. Under methodological naturalism, answered prayer isn't a very interesting thing to research.

There is more to be learned from our Zambian brothers and sisters. Note that they didn't attack their pagan fellow villagers but were bold to pray for their physical needs. Perhaps they can serve as a model of more fruitful ways for evangelicals to interact with scientists and other intellectuals. For example, the Zambian experience reminds me of a non-Christian Chinese professor of computer science who was a visiting scholar at Princeton University. He was staying in our home for the last month or two before going back to China and was under a great deal of pressure to successfully complete a machine-language program to control a multiprocessor computer. The program had a significant bug and he couldn't find it. One morning at breakfast he once again told my wife and me about his distress, My wife and I offered to pray right there at the breakfast table that the Lord would show him the bug that day. We prayed with the Chinese professor listening. He came home at lunch time excited to report that God had answered our prayer; the bug was found!

This is an example of a realm in which methodological naturalism would have been self defeating; as a result my wife and I wouldn't have experienced the joy of seeing God's personal communicating action in the natural Universe, and the non-Christian professor would not have been confronted with an experience that caused him to ponder whether this was coincidence or the power of the personal communicating God. Maybe praying for the needs of our non-Christian colleagues is a better way to witness on the university campus than attacking the scientific enterprise we evangelicals generally don't understand or value.[5] ✣

Notes

[1]Haas, J. W., Jr., "Are Evangelical Scientists Practical Atheists?" *PSCF* 48, no. 2 (1996): 73.
[2]Plantinga, Alvin, "When Faith and Reason Clash: Evolution and the Bible," *Christian Scholar's Review* 21 (1991): 8-33.
[3]Brown, Colin, *Miracles and the Critical Mind*, (Grand Rapids, MI: Eerdmans/Patemoster, 1984), 383.
[4]Francis, S., "God answers with rain," *Africa Action* (Africa Evangelical Fellowship, Charlotte NC 28241-1167) 10, no. 2 (1996): 2.
[5]Noll, Mark A., *The Scandal of the Evangelical Mind*, (Grand Rapids, MI: Eerdmans, 1994), 274.

How Does My Faith Affect My Scientific Work?

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A healthy human being is a whole person with inputs from a variety of the disciplines and insights of life. First of all, therefore, it is important to note that an interaction between my Christian faith and my scientific work is inevitable, if I make a consistent effort to live life as a whole integrated person.

How does my faith affect my scientific work? There are several ways that I will describe a little further along, but first it is necessary to make the negative of this statement clear: how doesn't my faith affect my scientific work? The answer can be given simply: my faith does not affect my scientific work by giving me knowledge of mechanisms, interactions in the physical world, or insights into proper and improper scientific theories. The reason for this is again simple. My faith is that God has created and sustains the universe, and my scientific task is to try to describe in the scientific categories available to me how it is that God does this. If I attempt to decide first what God could do because of my concept of who God is, then to decide that God must have done what he could do, and then to use this conclusion as a guiding principle in doing my scientific investigation, I make a critical mistake and fall victim to pseudoscience. The proper approach to finding out what God has done is to look at what God has done and is doing, and to draw relevant descriptions of his work from that.

The positive ways in which my faith affects my scientific work can be summarized under five headings.

1. My faith provides strong motivation for doing scientific research. With the conviction that there is indeed a reality that can be addressed by scientific research, I can enter into the joy of "thinking God's thoughts after him," and helping to unravel the complex structure of the world.

   Example. A recent Ph.D. student of mine put together 300 pieces of data on the dark conductivity, the defect density, and the temperature in a sample of undoped hydrogenated amorphous silicon. It was an exciting realization that these data showed that there was an intricate relationship between these three variables so that if any two were specified, the third was known with striking accuracy, regardless of the past history of the material.

2. My faith provides a worldview and an ethical sensitivity that allow me to decide which areas of scientific work are the most appropriate in terms of knowledge gained and human conditions helped.

   Example. I eagerly seized the opportunity to put my experience and knowledge of photoelectronic properties of semiconductors to work in the development and research of materials suitable for photovoltaic solar energy conversion. Although no aspect of scientific research is free of the possibility of human misuse, still this was an area where the opportunities for providing benefit to human beings all over the world seemed to be very high, where the benefit to the poor and suffering of the world could greatly outweigh any other effects.

3. My faith provides a framework of values within which it is possible to evaluate a par-

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ticular career choice or involvement in scientific work. I deliberately chose a definition of excellence (or success) as referring to a life lived after Christian standards, rather than a definition as calling for a life that is better than any one else's in scientific career development and position.

Example. I consciously chose to accept or refuse opportunities for career development depending on whether they were consistent with a life lived with personal relationships with family, friends, church, and community, or whether they would make such a set of relationships difficult or even impossible. I did not always seek to be No. 1 regardless of the effect it might have on my relationships, and in fact at various times I did not even consider some possible career options because of this.

4. My faith enabled me to be open to the apparent descriptions of modern science, no matter how difficult or unexpected they might be, while at the same time protecting me from falling into non-Christian extrapolations or generalizations of these results beyond the range of authentic science.

   Example. For many people the challenge of resolving the paradoxes of quantum mechanics and relativity, or of determinism vs. chance, or of God's omnipotence and a creation that obeys physical laws, has proved to be a threat to their faith or leads them into mystical or new-Age-like worldviews that are incompatible with Christian faith. My faith has helped me to be open-minded about the resolution of current problems in metaphysical philosophy, while holding to the basic truth that God is the Author of it all.

5. My faith has reminded me of the importance of personal relationships in daily life with the people with whom I work and relate — colleagues, students, and staff. My work also is expressed by my life in the office and lab, and this is guided by my faith.

   Example. Once a group of visiting dignitaries from China came to visit my Department of Materials Science and Engineering at Stanford during the time that I was Chairman (1975-1986). After some discussion, they asked me, "At Stanford what is the role of a Department Chairman?" I replied, "As for myself, the role of the chairman is to serve those in the department." They were a little taken aback.

The importance of my faith in my scientific work, and my scientific work in my faith led me in recent years to write two books: *Putting It All Together: Seven Patterns for Relating Science and Christian Faith*, and some personal memoirs, *One Whole Life*. They are the best that I can do to answer the question that heads this discussion. *

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Essay Review

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THE BATTLE OF BEGINNINGS: Why Neither Side is Winning the Creation-Evolution Debate by Del Ratzsch. Downers Grove, IL: InterVarsity Press, 1996. 272 pages, bibliography, no index. Paperback; $14.99.

Del Ratzsch is a professor of philosophy at Calvin College, specializing in the philosophy of science. He is the author of *Philosophy of Science* in IVP's Contours of Christian Philosophy series.

This book is devoted to a careful examination of a multitude of arguments launched from both sides in the war between creationists and evolutionists. Ratzsch does not evaluate scientific evidence or the soundness of various interpretations of Scripture. Rather, he focuses on the logic and the soundness of arguments and criticisms of opposing views. He shows that the creation-evolution dispute abounds with misunderstandings, inaccurate representations of opponents' views, and illogical arguments. He writes to expose these errors, and especially to aid lay Christians in sorting through these confusions. It is not his aim to convince readers to accept any particular point of view, but to point out those things that should not be persuasive.

Summary of Contents

Chapter 1, a brief introduction to the book, spells out the very specific ways in which Ratzsch uses the terms *creationist* and *evolutionist*. He adopts the present popular usage of the term *creationist* as one who holds the following:

> Whether or not God could have built evolutionary potentials into the creation, or could have brought about life and all its diversity by evolutionary means, he did not in fact do so. There are thus discontinuities in nature — e.g. non-life/life, reptile/mammal, animal/human — which cannot be crossed by purely natural means, each such discontinuity requiring separate supernatural creative action.

He uses the term *"evolutionist* to include all who accept a broad evolutionary picture of the origin of life and its diversity. That will include both theists and naturalists." However, naturalistic evolutionists are frequently the focus of discussion concerning *evolutionist* objections to creationism.

These definitions exclude theistic evolutionists from the creationist camp; most theistic evolutionists, I expect, would object to this exclusion. Theistic evolutionists hold to a theistic worldview, but would reject the tight characterization of this worldview held by some prominent creationists. Some, in fact, prefer to label their position as *evolutionary creationism*.

Chapter 2 is a descriptive history of the interwoven development of biology and geology from about 1700 to 1850, prior to Darwin's work. In geology during this period, most theorizing shifted from catastrophism to an early concept of uniformitarianism. Among the concerns of biology were the classification of organisms, and a growing awareness of progression in the fossil record.

Chapter 3 surveys Darwin's work and the stages in the development of his theory of biological evolution through natural selection. Ratzsch then describes the reactions to the theory from the religious, philosophical, and scientific communities. Despite questions raised from all sides, "the result of the publication of *The Origin of Species* was the nearly immediate conversion of most of the scientific community to biological evolution — to some kind of descent with modification." Early in the 1900s, the "'synthetic theory' of evolution — combining contemporary genetics and Darwinian natural selection — quickly rose to near absolute dominance in the scientific community."

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Chapter 4 examines several popular creationist misunderstandings of Darwin's theory, and shows how resulting creationist attacks on evolution are targeted on "positions that no one actually holds." These misunderstandings include the notions that (1) evolutionary descent is only linear, not branching; (2) every step of natural or artificial selection is beneficial in some absolute sense; (3) uniformitarianism in geology allows only geological processes that proceed at constant rates, and rejects the possibility of rapid processes and catastrophic events; and others.

Ratzsch concludes that these misunderstandings are seriously counterproductive because creationist arguments based on them stifle dialogue with opponents. Furthermore, they have tainted the image of creationism so that serious and professionally competent creationists have not been accorded a serious hearing.

Chapter 5 traces the historical background and development of the modern creationist movement from the late 1800s to the present, an expansion intertwined with the growth of Christian fundamentalism. After World War I, "fundamentalists came to believe nearly universally that evolution was inherently, ineradicably materialistic and naturalistic ... fundamentalist Christians would eventually settle on evolution as a deep enemy." After the Scopes trial in 1925, a "fundamentalist disaster," there was a deep need for creationist heroes who could claim genuine scientific expertise, and speak out as fearless defenders of creationism. To the fore in the 1920s came Harry Rimmer and George McCready Price. Later came Henry Morris, Duane Gish, and others. For them, "a straightforward reading of Scripture set the framework, the boundaries and the agenda for any scientific theorizing."

Chapter 6 examines the development of popular creationist positions since 1960 by outlining the central themes of three pivotal books: *The Genesis Flood* by John Whitcomb, Jr. and Henry Morris (1961), *Scientific Creationism* by Henry Morris (1974), and *What is Creation Science?* by Henry Morris and Gary Parker (rev. ed. 1987). In *The Genesis Flood* Whitcomb and Morris openly based their main argument and their conclusions on the presupposition that the Scriptures are true. But in *Scientific Creationism* it was claimed that the conclusions "could stand completely independently of Scripture." *Scientific Creationism* describes the "two models" associated with creationism and evolution. "The two models are not scientific theories but are ... in effect, worldviews. Unfortunately, many popular creationists use the term *evolution* to refer both to the larger philosophical worldview model and to the more restricted biological theory" (p. 77). This usage has created confusion among creationists and also among their opponents. More confusion stemmed from "creationist empirical arguments [that] frequently rested on broad generalities that often exhibited an ignoring of technical details and data. Trying to deal with technical details and painfully precise data is what in fact often makes science such a ... difficult business" (p. 79).

Ratzsch observes that "there is beginning to emerge a new generation of creationists ... who are undertaking to actually do some of the painstaking [work] that underlies any genuinely live scientific program." Among this "upper-tier" of creationists Ratzsch apparently includes scholars like the authors of *The Mystery of Life's Origins* (Charles Thaxton, Walter Bradley, Roger Olsen), *Darwin on Trial* (Phillip Johnson), and the contributors to *The Creation Hypothesis* (J. P. Moreland, ed.).

Chapter 7 examines several popular evolutionist misunderstandings of creationist theory, which lead to irrelevant criticisms of creationism. Among these misunderstandings are the notions that creationists (1) deny microevolution, (2) believe in the direct creation of all species, (3) believe that all current species were present on the originally created earth, (4) believe in fixity of species, and (5) use the Second Law of Thermodynamics to deny the possibility of biological evolution. Some of these misunderstandings arise from creationists' ambiguous and confusing statements about the Second Law, documented on pp. 92-96. It is also a misunderstanding to claim that the creationist assumption that the universe as created was fully functioning is in error *because* some parts of the new creation would have an appearance of age, making God a deceiver.

The next two chapters offer a short course in the philosophy of science with applications to the creation-evolution conflict. They lay a foundation for understanding the nature of science as it is actually done, in contrast to Baconian and positivist conceptions which are often assumed by participants on both sides of the contest. Chapter 8 surveys changes in the conceptions of science from the 1300s to the 1960s, concluding with an assessment of the impact of Thomas Kuhn's *Structure of Scientific Revolutions*. In his comments on Popper's emphasis that a truly scientific result must be capable of being falsified by empirical data, Ratzsch shows why "it is impossible to *conclusively* falsify any scientific theory by means of empirical data." And in relating Kuhn's conception of the role of paradigms in science, Ratzsch observes that "even if two scientists in different paradigms could all share the same observa-

tional data, they might be unable to agree on the proper explanation or interpretation of that data." The implications for the creation-evolution conflict are obvious.

Chapter 9 presents a contemporary perspective on the nature of science, and states that most scientists and philosophers of science today operate from philosophical realism. Ratzsch develops the notion that science involves three basic components: data, theories, and what he calls *shaping principles*, all of which interact with and influence each other. Shaping principles involve "*philosophical* positions concerning the nature of data, of proper theory, of acceptable explanation and of legitimate interpretation of data." Since every theory faces some nonconforming data, "to demand that a theory be given up merely because one can cite some, or even a lot of, apparently contrary data is to mistake how science works." Chapter 9 concludes with consideration of criteria for identifying correct theories, and applies them to issues in the creation-evolution debate.

Chapter 10 applies this understanding of science to expose some logical errors of creationist arguments. Creationists are mistaken when they claim, for any of the following reasons, that evolution *cannot* be true: (1) evolution violates some formal definition of science; (2) evolution is mere theory, not fact; (3) evolution has not been or cannot be proven; (4) there are some scientific facts that cannot be accounted for by evolution theory; (5) the data cited to support evolution can also be interpreted in alternative ways; (6) evolutionary processes and events are unobservable or unreproducible; or (7) evolutionists build their theory on a prior commitment to the worldview of naturalism. The chapter concludes with some helpful comments on a proper scientific approach to investigating origins.

In Chapter 11 a similar analysis exposes some logical errors of anticreationist arguments. Anticreationists are mistaken when they claim, for any of the following reasons, that creationism (or creation science) *cannot* be true: (1) creation science is not science, by the definition of science; (2) proper science with its empirical methods has no way of dealing with the supernatural or anything of that sort; (3) the failure of empirical methods to apprehend a supernatural reality shows that such a reality does not exist, or that it does not affect the operation of the cosmos; (4) creation science is really just disguised religion; (5) creationists never change their views regardless of the advance of data; or (6) the claim that things came into existence suddenly at one time is itself an *inherently religious* claim. Chapter 11 includes an evaluation of empirical philosophy.

After thus exposing errors in a multitude of arguments used by creationists and evolutionists (as defined in Chapter 1) to attack one another, in Chapter 12 Ratzsch looks at arguments coming from both sides which attack theistic evolution (or, to use a preferable term, evolutionary creationism). The "two models" postulated by Henry Morris et al. are *assumed* by them to be mutually exclusive, with no overlap. Morris seems to assume that God works on nature only by *supernatural* processes. Ratzsch counters:

> Many creationists note the logical incompatibility of the theistic creation model and the naturalistic evolution model, then apparently on that basis conclude that theism and biological evolutionary theory must be similarly incompatible ... But the fact that the evolution *model* is inherently contrary to the creation *model* and that biological evolutionary theory is perhaps absolutely indispensable to the evolution model does not by itself suggest in the slightest that there is any logical tension between theism and the biological theory of evolution (p. 182).

After dealing with other creationist objections to theistic evolution, Ratzsch concludes by exposing logical flaws in some evolutionist challenges to theistic evolution. He considers especially arguments regarding evidences for intelligent design in nature. He concludes that "one cannot simply rule considerations of design out of scientific bounds, either arbitrarily or definitionally."

The final chapter encourages both sides to think clearly, present their cases with sound arguments, listen to each other, and try to understand each other's views.

Evaluation and Comments

In this book, Ratzsch has made a unique contribution to the creation-evolution war, with the potential to motivate both camps toward more logical, more honest and more civil communication. A major strength is that it does not espouse any one position. It will be of benefit to every combatant who heeds its call to raise the level of debate, and to every thoughtful observer who uses it as a guide to separating valid arguments from faulty ones.

The book is clearly, carefully, and tightly written, touches on a multitude of topics, and calls for thoughtful reading. It follows a sequential "story line," outlined on pp. 10-11, but many readers will want to look for Ratzsch's treatment of specific topics. For them, an index would greatly increase the book's value; for this reviewer, the lack of an index

is its chief weakness. The extensive bibliography and very extensive endnotes are helpful.

Among those who agree in holding to a theistic worldview and thus see nature as a product of divine creation, there is a wide range of specific opinions regarding the how and when of God's creative work. Many labels have been pinned on these various positions. It seems unfortunate that Ratzsch chose to define the term *creationism* in a way that excludes evolutionary creationists (more widely known as theistic evolutionists). It would be preferable to define *creationism* in a way that includes them, thus recognizing the unity of all who acknowledge God as Creator. Then the term *special creationism* would more accurately label the view that Ratzsch calls *creationism.*

I recommend this book for careful reading by everyone who pays attention to the creation-evolution conflict. Conscientious scientists and scholars are used to examining data with care, evaluating details, and trying to get their science right. Opinion leaders have a special responsibility to be honest, cordial, civil, to use clear definitions, and clarify issues. Ratzsch can help them to get their arguments right.

The issues in the conflict are so complex that one wonders how to communicate accurately to the nonspecialist, to give her or him a truthful picture without simplifying to the point of distortion. As Ratzsch points out, vagueness (rather than precision) in stating an argument can easily lead to misrepresentation and misunderstanding. The average person who is interested in these issues is not accustomed to weighing every detail or to following complex arguments. He or she is satisfied with answers that make sense only in a general way.

I see three quite different agendas of those who are engaged in or watching the creation-evolution conflict:

1. To *learn* the truth: to gain a correct understanding of origins issues, so far as one can, and to integrate this understanding into one's worldview.

2. To *persuade* others, through civil discussion and sound arguments. Some persuaders want to work out an effective apologetics linked to science.

3. To *win* a fight, to protect oneself against one's enemies, and defeat them. When this goal is a priority, it can foster shabby "research," fuzzy thought, dishonest arguments. Those with this agenda may ask themselves: Are we captives of the prevalent sports mentality of our society? In the contentious creation-evolution arena, even scholars may tend to develop an emotional commitment to their position, and then attack those who disagree whenever they find a detail out of place.

Have popular advocates of creationism (or evolutionism) who speak with flair, enthusiasm, and a tone of authority become entertainers? Do audiences listen to their presentations as entertainment to be cheered, rather than as education to be pondered or as evidence to be weighed? Do audiences leave their thinking caps at home and go to see a contest and cheer the winner, as they go to an athletic event?

A major challenge to writers and speakers is how to give a thoughtful, honest presentation — on stage or in print — to an audience which eschews careful thought. Let us hope that many in the ASA will respond effectively to this need. ✤

O Praise the LORD, all ye nations: praise him, all ye people. For his merciful kindness is great toward us: and the truth of the LORD endureth for ever. Praise ye the LORD.

— Psalm 117

Book Reviews

QUARKS, CHAOS AND CHRISTIANITY: Questions to Science and Religion by John Polkinghorne. New York: The Crossroad Publishing Company, 1996. 102 pages, bibliography; no index. Paperback; $9.95.

This is the seventh in a series of volumes by John Polkinghorne, President of Queen's College, Cambridge. Polkinghorne is a former Cambridge Professor of Mathematical Physics, a Fellow of the Royal Society and, recently, an Anglican priest. This book is an overview of his first six books, all of which deal with some aspect of how the religious and scientific worldviews relate to one another. Reviews on three of these have appeared recently in *Perspectives*. Walt Hearne looked at *Faith of a Physicist* in December 1995, Richard Bube reviewed *Reason and Reality* in June 1993, and Daniel Wray analyzed *The Way the World Is* in March 1993.

In 1896, A. D. White's *The Warfare of Science and Theology in Christendom* presented the case for antipathy between these worldviews; Polkinghorne's thesis, splendidly expounded, is an account of the "friendship" between them, which he believes to be the truer assessment.

In a manner reminiscent of C. S. Lewis, Polkinghorne writes both clearly and concisely on issues of substance. He sees both science and religion to be "searches for truth." He writes: "The central religious question is the question of truth. Of course, religion can sustain us in life, or at the approach of death, but it can only do so if it is about the way things really are" (p. 97).

The science/religion relationship is explored in eight short chapters. In Chapter 1, "Fact or Opinion?" he explains how experiment and theory, and fact and interpretation are always intertwined in science, and that matters of judgment must be considered. As he develops this theme into religious matters, he finds interesting differences: "Religious knowledge is much more demanding than scientific knowledge. While it requires scrupulous attention to matters of truth, it also calls for the response of commitment to the truth discovered." And: "Nearly all that makes life worth living slips through the wide meshes of the scientific net" (p. 13).

Subsequent chapters address questions of clues to God's existence, his ways of creation (p. 46, "He did not create a magic world because he is not a magician"), problems of reductionism (p. 52, "A few H_20 molecules by themselves are not wet"), issues of miracles and resurrection, and questions of how a scientist can "believe." This last topic is, perhaps, the most important. Certainly, the popular image of a scientist in today's secularized world does not include a Christian faith relationship! For example, Margaret Wertheim asserts in her otherwise well-written book *Pythagoras' Trousers* that "today most physicists no longer maintain formal ties with any religion ... " (p. 7). I do not know that to be a fact; Wertheim does not cite documentation. But when I was a young Carnegie Tech physics student in 1949, I remember thinking this must be so. Counteracting this impression (thankfully) were the writings of a science popularizer of that day, Sir Arthur Eddington, a Quaker, who found science and religion compatible. John Polkinghorne continues this tradition. His writings are heartily recommended. This is an excellent book to slip in the hands of your young loved one as he or she sets off for a college education in the sciences!

Reviewed by John W. (Burgy) Burgeson, 6715 Colina Ln, Austin, TX 78759.

VISIONS THAT SHAPED THE UNIVERSE: A History of Scientific Ideas about the Universe by Joseph L. Spradley. Dubuque, Iowa: Wm. C. Brown Publishers, 1995. 277 pages, index. Softcover; $23.00.

This book provides an excellent history of science that chronicles science's quest to explain how the world came into being. In ten chapters, the book explores answers provided by Egyptian science through the Middle Ages and on to modern particle physics. The history is presented with exceedingly lucid explanations of phenomena that make this an ideal textbook and reference for those who want to become scientifically literate without becoming scientists.

Spradley compiled much of the book's content while teaching a general science course for nonscience majors at Wheaton College. The book was produced for Wheaton and is formatted as a text, being somewhat larger than normal (8x10 in.) with the text in two-column format. References are not indexed in the text but instead are collected at the end of each chapter.

The first four chapters consider the sun. Spradley begins with prehistoric cultures and their fascination with the heavenly motions. The religious or philosophical significance is presented in concert with the limitations that this engendered within Greek, Islamic, and Christian cultures. The result is a balanced treatment covering many philosophies, and it illustrates how and why scientific progress stagnated at different points in history.

Chapters 4-8 build on the theme of rapid scientific progress that began with Copernicus and Galileo. The development of heliocentrism is followed by three chapters describing the genesis of physical and inorganic chemistry, evolutionary biology, and electricity. These chapters pro-

vide a background to atomic structure that make a smooth transition into the final chapters on relativity and quantum theory ("A Relational Universe," Chapter 9) and particle physics ("An Expanding Universe," Chapter 10).

The beauty of this book is the way that complex ideas are clearly explained and made easy to understand. Spradley prevents the content from becoming dry by liberally peppering the book with snippets, some may say trivia, relevant to the topic at hand. Did you know that the days of the week are named after planetary deities e.g., Saturday (Saturn) or that Pasteur "who had developed cowpox inoculation to prevent smallpox [called] it 'vaccination' (from the Latin *vacca* for cow)" (p. 162)?

This book is a true asset for all those that teach introductory science courses and I urge ASAers to consider adopting this text.

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

BANGS, CRUNCHES, WHIMPERS, AND SHRIEKS: Singularities and Acausalities in Relativistic Spacetimes by John Earman. New York: Oxford University Press, 1995. 257 and xi pages, bibliography, index. Hardcover; $35.00.

Earman is Professor of History and Philosophy of Science at the University of Pittsburgh. In the Preface he writes that philosophers do not appreciate the seriousness of the foundational issues posed by singularities in general relativity. These issues are important for the philosophy of space and time. He wants to end that neglect with this book. Earman wrote the book primarily for philosophers who have some acquaintance with relativity theory and secondarily for philosophically-minded physicists. This book is not a comprehensive survey; such a survey would require too much history, philosophy, physics, and mathematics. Reading this book requires knowledge of differential geometry.

Scientists are interested in spacetime singularities. What causes singularities? Chapter three (on Cosmic Censorship) discusses what Penrose called the most important unsolved problem of classical relativity theory: the breakdown in classical predictability and determinism (p. 65). Laws of nature codify certain deep regularities (p. 97), but we are not (yet) able to predict naked singularities: points where the laws of General Relativity Theory break down. Is there cosmic censorship? We don't know. We should research the scientific problems posed. We cannot "reach" big bangs, black holes etc. and do not know what is on the other side of a singularity, but we know that God created laws and regularities. From Scriptures we learn that we will not know when the world will end. It is a "naked singularity" caused by Divine law, not understood by physicists.

God created the universe. Some theologians say that God used the Big Bang. Unfortunately scientific literature dealing with singularities like the Big Bang is difficult for theologians to read. This book is no exception. Theologians who open the book and see the mathematical symbols may close the book immediately. They should read about God's work on pages 207-210. Earman reasons that time is open-ended since we cannot learn the moment of the first singularity by going back in time. A similar argument exists for the end of time. Earman thinks it is sacrilegious to see God's creative force operating only at a singularity (p. 209). It is more to his glory if he operates everywhere and anytime.

Scientists who are Christians should be interested in this book. They will realize that we have hardly started talking about the consequences of relativity theory. What happens when we die? Does time continue for us? Are we in a timeless eternity? If God is eternal, what is eternity? Time without end? Before we start talking about these problems we should really know what spacetime is. Is space four-dimensional, or ten-dimensional? Foundational problems discussed in this book are important for all believers. Philosophizing physicists should lead the way.

This is an interesting technical and philosophical book. The book will mainly attract philosophers of science, physicists, and mathematicians.

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THE THREE BIG BANGS: Comet Crashes, Exploding Stars, and the Creation of the Universe by Philip M. Dauber and Richard A. Mullet. Reading, MA: Addison-Wesley Publishing Company, 1996. 207 and viii pages, bibliography, index. Hardcover; US $25.00, CAN $34.00.

Dauber and Mullet want this book to be read by the general public and used as a supplementary text in physics and astronomy classes. To keep it manageable for both purposes, the 23 chapters are short. Both writers teach physics. Muller still works as researcher in Berkeley, California, where Dauber used to be as well. Dauber is also a film maker.

This book is easy to read. Part I describes collisions of comets and asteroids with planets, ending with the crash that caused an almost total annihilation of life on earth 65 million years ago. Part II describes exploding stars and how these explosions created the necessary elements for life on earth. The creation of the universe is the subject of Part III. In the beginning of the book, we read that the violence of nature is key to answering the questions: How did we get here? If we believe in God, how did he do it? The authors acknowledge: "Omitted from our account of origins thus far is the biochemical (or possibly divine) step by which mere atoms and molecules became living beings" (p. 187). Further down the page we read: "So far, however, no one has been able to

take chemicals from the shelf, combine them somehow, and make an infective virus, priori, or bacterium."

This book is quite up to date. There are no footnotes or endnotes in the book. However, the short bibliography suggests some books for further reading. This book is a good first introduction to physics and astronomy.

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SCIENCE & RELIGION: From Conflict to Conversation by John F. Haught. Mahway, NJ: Paulist Press, 1995. 203 pages, notes, index. Paperback; $14.95.

Haught, Professor of Theology at Georgetown University and well-known author on similar topics, indicates that his purpose in writing this book is to provide an introduction for non-experts into the central issues in science and religion. He treats religions semi-genetically, lumping Judaism, Christianity, and Islam together as "God-religions" with a common perspective, described by their leaders Moses, Jesus, and Muhammad. The book takes its place along with others of a similar orientation, helpfully distinguishing between different ways that people relate science and religion, and then showing how these different ways express themselves when considering nine basic questions: "Is Religion Opposed to Science?" "Does Science Rule Out a Personal God?" "Does Evolution Rule Out God's Existence?" "Is Life Reducible to Chemistry?" "Was the Universe Created?" "Do We Belong Here?" "Why Is There Complexity in Nature?" "Does the Universe Have a Purpose?" and "Is Religion Responsible for the Ecological Crisis?"

Each of four principal ways of relating science and religion is described fairly completely in each chapter from the perspective of one holding that position. The author suggests to the reader: "imagine that you have in front of you representative spokesperson for each of the four ways of relating science to religion. Allow each of the four groups to present its case directly to you here without interruption." It is an effective technique.

All four positions represent corrections on a basic fifth position that the author names *conflation*,"the undifferentiated merging of aspects of religion with a few carelessly understood scientific ideas." The first position treated in each issue discussion is *conflict*. This is the position that "religion is utterly opposed to science or that science invalidates religion." It represents a virtually total rejection of the other perspective by advocates of one of them. The second position is *contrast*, the view that "religion and science are so clearly different from each other that conflict between them is logically impossible." The third position is *contact*, the view that "although religion and science are distinct, science always has implications for religion and vice versa." Interaction between them is inevitable and essential. The fourth position is *confirmation*, emphasizing the positive ways in which religion supports the scientific enterprise of discovery, and "even gives a special kind of blessing ... to the scientific quest for truth." The author himself essentially rejects the conflict position, sympathizes with the contrast position, and lends support primarily to the contact and confirmation positions.

Haught, realizing that most readers will support more than one of these four positions to some extent, rather than being an advocate of one to the exclusion of all the others, concludes that "the four ways seem to resemble less a fixed typology than differentiated phases of a single complex process." As he anticipated, some of the distinctions between the chosen positions can be confusing to the reader. The *contrast* position is often treated as if it argued for a compartmentalization and separation of all insights obtained from science and religion, which he opposes. Although Haught made strong efforts to avoid misstatements, it is difficult to consistently keep the reader aware that authentic science and religion provide us with intrinsically different descriptions of reality — which the author mostly supports — without being led to the false conclusion that this inevitably involves us in a compartmentalization of science and religion.

The *contact* position is advanced as the remedy for this compartmentalization of science and religion in the *contrast* position. Once again the reader may be a little uneasy with the assertion that *contact* is a new point of view that overcomes the compartmentalization of the *contrast* position. As a matter of fact, many people who hold to a complementary perspective with respect to science and religion, hold to both the different kinds of description that come to us through science and religion (as in the *contrast* position), while at the same time strongly urging that these insights must be integrated (as in the *contact* position). It would appear therefore that a *complementarity* position adopts both aspects of *contrast* and *contact* advocated by Haught, but the term "complementarity" does not even appear in the index.

I endorse and applaud the many efforts Haught made in this book to clarify differences and uphold defensible and desirable positions. In most of the book, this kind of support can readily be given once the reflections above have been understood. But occasionally Haught makes a statement that seems to simply say too much, e.g., "Today we need to recast all theology in evolutionary terms;" "... it now seems that the prospect of mind's evolving may have been a factor in shaping the cosmos as early as the big bang;" "[scientists] are now asking *why* nature tends toward emergent complexity. Doesn't this new 'why' question bring science to the brink of theology?" As in the case of other comments like these, we try to decide whether he is really being literal or simply poetic.

The scientific reader may be surprised at Haught's surprise: "What is the purpose of science? We thought it was to explain and predict, not just describe ... scientists who study chaos and complexity are less inclined to claim that science explains than that it describes ... But now scientists are starting to recognize how exquisitely sensitive most natural outcomes are to their initial conditions."

These "new" insights are certainly the old insights of anyone actually involved in science, except for those who regularly confuse metascience and philosophy with actual science.

There is a lot that can be learned by reading this book, and grappling with its various inputs can lead the reader to clarify thoughts on the subject.

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

IN SEARCH OF INFINITY by N.Ya. Vilenkin. Boston, MA: Birkhäuser, 1995. 145 pages, biographical notes. Hardcover.

This book is meant for readers who want to know how the notion of the infinite has changed in time. The author succeeded in writing an easy-to-read book. It explains the difficulties any study of infinity encounters in mathematics. Vilenkin brings us from old Babylonian mathematics via mathematicians like Cusa, Copernicus, Newton, Leibniz, etc. to the modern age. In the process, he talks about curved space and its difficulties. In Chapter Two, he described in story form the mysteries of the infinite in mathematics.

Vilenkin tells about the paradoxes which appeared at the end of the nineteenth century. He mentions difficulties arising in cosmology and physics when people use "old" theories. He discusses the idea of curved space. All this is done so that a non-scientist can understand it. I even recommend it for reading in a History of Mathematics and Science class. The book is helpful for someone who has difficulty with concepts of modern mathematics.

Mathematicians and philosophers of science should read *In Search of Infinity*. Reading it does not take much effort, and it may help in teaching.

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THE PHYSICISTS AND GOD: The New Priests of Religion? by Anthony Van den Beukel. North Andover, MA: Genesis Publishing Co., 1995. 182 pages, bibliography, index. Paperback; $24.50.

This book was originally published in Dutch in 1990 in The Netherlands, and the current issue referred to here is an English translation by John Bowden. The author tells us that "I have more than thirty years of teaching science and scientific research behind me. During that time I have tried to be a believing Christian." The book is an interesting personal reflection on several issues involved in the interaction between science and Christianity. In certain places, the author appears to be stating crucial decisions in ways that might be misunderstood; some of this may lie in the problems of translation.

One issue that appears several times is whether it can be claimed that there is an objective reality. In one place such "objective reality" is pictured as a philosophical commitment to a reality "which exists outside human beings, but which can be known by them." The author then goes on to tell us that the existence of such "objective reality" has been a major question in twentieth-century science and that the answer is definitely, "No." One might prefer a definition of "objective reality" as the nature and properties of the created order which do not depend on human intentions. Modern science has accentuated the essentially common-sense realization that human actions affect the world around them, but this does not remove the claim that such an objective reality, defined as the structure of all interactions including human observations, does indeed exist.

It may still be maintained that the properties expressed in the Heisenberg Uncertainty Principle give valid insights into the nature of reality, and that no human being by exerting his willpower or expressing his intentions can change the nature of created reality that gives rise to the properties currently expressed by the Uncertainty Principle. It is particularly troubling when the author says, "The percipient and the perceived are one and indivisible." A possible insight into the author's thought comes up later when he treats "commonsense reality" as almost synonymous with "objective reality." One has the feeling that one might agree with most of what the author is trying to say, but not necessarily with the way he says it.

On the other hand we can totally agree with the author when he says that modern science has brought us the "triple relativizing of scientific knowledge as 'an approximate description of a limited number of physical phenomena which in their turn are only a limited part of our human experience.' ... Nor can enough warnings be given against making a scientific theory the basis of a worldview."

After the first five more or less introductory chapters, the author indicates the path he intends to follow: "Is God an obsolete notion which has been made superfluous by the process of science? Or is God, as some contemporary scientists claim, to be found precisely through science? Or are there perhaps other ways which lead to God? Can anything be 'proved' in this area?" The lives and outlooks of four prominent scientists are considered: Newton, Pascal, Einstein, and Hawking.

The author then turns to a consideration of whether science can lead us to God. He rejects the claim of Davies that "science forms a more certain way to God than religion," and comments "I cannot help finding this final stage of this 'scientific way to God' extraordinarily poverty-stricken, to put it too mildly. It doesn't mean anything

to me at all. ... Physics is made a pseudo-religion of which the physicists are the priests."

In considering the possibility of "proof," the author offers his own definition of "proof" as "the collecting of evidence to make something acceptable 'beyond reasonable doubt.'" This is the legal language of the courtroom, and its introduction here has its usual confusing effects because it is not the meaning of the word "prove" in its normal mathematical or scientific context. On the other hand, when he completes this discussion it is with words with which we could heartily agree: "The conclusion to be drawn from all the evidence can never be an incontrovertible proof that 'God exists'; but for me the existence of God, his presence and effect in the lives of many people, is beyond any reasonable doubt."

The final three chapters are primarily a summary of personal beliefs. First the author describes his attraction to such personalities of faith as St. Francis, his teachers Master Bergsma and C. C. de Bruin, and finally his own father. Then he turns his attention to describing the common characteristics between the ways of science and religion. Since I had started a chapter on Physics for a Christian several years ago with the words, "Physics is fun," I was surprised to read in this book, "It is unique, it is exciting and fascinating, and it is no fun"; again I suspect a problem with semantics, particularly because later in the book he says, "In this book I have tried to give some indication of the joy that the explorations of physicists bring them now and then." He concludes with "A believer is someone who has taken a way, just as a physicist is someone who follows a way," which may be equivalent to saying that fundamental choices, whether in science, religion, or other aspects of life, must all be faith choices.

Finally the author considers "intersections" between science and Christian faith. "How do physicists who are believers practice their discipline in relationship to their faith? ... has faith anything to do with the social consequences of science and technology?" Here confusing semantics causes trouble: "Why should the laws of nature be sacred? Doesn't the God who made them have the power to suspend them at times?" This assumes the usual misunderstanding that "laws" have some independent existence, and are not simply human descriptions of God's regular activity. The author is outspoken in the simple declaration, "There is no such thing as Christian physics."

With his treatment of the scientist's responsibility for the social consequences of his work, the author leaves us uncertain. First he says that it is impossible for science researchers to have a sufficiently clear idea about the social applications of their work, so that "it is therefore hard to make the practitioners of fundamental physics responsible for the consequence of their work." To illustrate this he speaks of the consequences of research aimed at military goals and concludes that "arms manufacturing is not in principle a dirty job." But then he moves in the other direction, "If scientists have become involved, can they not at least do everything possible to limit the damaging consequences?" and back again, "In by far the great majority of instances, these consequences are outside their reach." Which is it: responsible or not responsible?

Let me conclude this review with the positive conclusion offered by the author: "Believers must not belittle science, but show science its due place, that of a servant of humanity and not its idol. That is what I have tried to do in this book." If the reader can come away with this conclusion, then the book as a whole can be recommended for thoughtful reading and guidance in living.

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

THE NATURAL HISTORY OF CREATION: Biblical Evolutionism and the Return of Natural Theology by M. A. Corey. New York: University Press of America, 1995. 446 pages, bibliography, index. Paperback; $42.00.

The writer wants to prove that scientific research about "natural" evolution since the "Big Bang" agrees with the Bible's creation story. His purpose is great, since we understand God's invisible power end divine nature through the things he has made. However, I don't think that anyone can ever "prove" the "correctness" of Genesis 1.

Corey says in the preface that he proved earlier the existence of a Grand Designer in a formal probabilistic proof using the Strong Anthropic Principle as a theoretical guide. Corey describes the basis of his reasoning (p. 35) as going backward to the beginning to discover that the values for constants were exactly right at the beginning. If any constant had been slightly different, the universe would not have formed stars. Thus natural laws are more basic then the Creator of the laws.

Freedom for man in all respects is a recurring theme. Corey says that moral evil is necessary so that man can be responsible for his own development (p. 330). In other words, the fall in sin in Gen. 3 was necessary; only then can we "develop" ourselves. This interpretation of the fall makes God the author of sin. In the last chapter, Corey talks about ecological disasters caused "by men." I would have said "by sin." Corey should have mentioned Jesus as Restorer of creation here.

Another problem is the relationship between time and eternity. On the one hand, Corey realizes that God created time at the Big Bang; on the other hand, he ponders about what "probably" preceded the Big Bang. If it were possible to talk about "before" the Big Bang, then the exactness of the natural constants should not surprise Corey. In unlimited time, an unlimited number of trials are possible, even if each trial takes billions of years. Corey knows that eternity is not extended time, but explores the consequences insufficiently.

The author realizes that all scholarly disciplines describe the same world. He complains that a schism exists between "philosophical theology" and the various "sci-

entific" disciplines (p. 345). Corey concludes that every scientist should know some philosophy. I agree. Corey's philosophical thinking starts with the pagan philosopher Plato. His theory of soul and spirit is more Greek than biblical. Corey mentions "Image of God," but he excludes the physical side of man (p. 148). He says, that it is "clearly" impossible for God to be physical. However, Jesus became human, though he was God.

The book may interest scientists who study philosophical foundations of their science.

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EVOLUTION: Fact, Fraud or Faith by Don Boys. Largo, FL: Freedom Publications, 1994. 353 pages, name and subject index. Paperback; $15.00.

Don Boys earned a Ph.D. at Heritage Baptist University and is a columnist, author, Baptist evangelist, politician, and frequent guest on TV and radio talk shows. As an author, he has written 10 books, numerous magazine and newspaper articles, and was a regular contributor to *USA Today* from 1985-1993. As a member of the Indiana House of Representatives, Boys co-authored legislation to require the teaching of creation on an equal basis with evolution in Indiana public schools. He now resides in Ringgold, Georgia.

In this book, written from his creation science perspective, Boys is "responding to evolutionists like Stephen Gould who admitted that creationist-bashing was in order for our time" by bashing back. In his words, "I'm willing to bare-knuckle it with any evolutionist ... we are in a battle for the minds and souls of men, so I have approached this subject like a war. And in this war I am not a conscientious objector." I will elaborate on this in a moment.

This book has 21 chapters which give reasonably good coverage of the usual creation science arguments against Darwinian evolution and for a young earth and recent creation. Boys begins Chapter 11 very emphatically: "According to the Bible, God created the universe, the world, and man in six literal days less than 10,000 years ago!" He is equally emphatic in his opinion of evolutionists. For example, in Chapter 19 he writes, "The thing that surprises me when an evolutionist spouts his drivel about how they can 'prove' the great age of the Earth is that informed people don't fall to the floor, gasping and holding their sides with raucous laughter!" This quote should give you a good idea of the attitude with which this book was written. Boys has included an extensive listing of references at the back, some thirty pages. However, many are pre-1980 and only very few are less than five years old. The book also has several black and white photographs, (e.g., one of an iron hammer found encased in stone) and one chart (of the geologic column which seems to be placed in the wrong chapter).

If the main intent of this book is to bash evolutionists, it may be considered a success. According to Boys, evolutionists are: skunks, vicious and vitriolic (p. 12), pathetic and pompous (p. 47), vain, venal, and venomous (p. 299), unfair, unreasonable, unacceptable, unblushing, unbecoming, uncivil, unconscionable, and ungentlemanly (p. 302), dishonest (p. 308), and unkind and unscholarly (p. 318). As to Darwinism, Boys says, "The only people who believe in the gradualism of Darwin are deceived children, fools, half-wits and college professors who get paid for teaching it" (p. 14).

In reading this book, I find that the character of Boys is more like a politician who delights in name-calling than one with any background in science. I agree with much of what Boys has to say, but I have significant problems with his style of presentation. Certainly many unkind and uninformed words have been expressed about Christian views of origins, but I wonder if we should respond in the same way.

If you want another book which summarizes many of the creation science arguments for a young earth and recent creation with rhetoric that goes well beyond that of Henry Morris, maybe you will want to read this book. If you want a book written from a well-informed scientific perspective that argues for creation by the hand of Almighty God, perhaps you will want to look elsewhere.

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

APE OR ADAM? Our Roots According to the Book of Genesis by William R. Van der Zee. North Andover, MA: Genesis Publishing Company, 1995. 107 pages, index. Paperback; $19.50.

This book is a book that I wholeheartedly recommend to anyone, scholar or not. The only requirement is love for God and a Bible nearby. My main criticism is the title. I anticipated that the book would discuss controversies between creation and evolution using the Bible as source for proof texts. That was not so. The Dutch title suggests the contents better: "The world becomes home. About beginnings: Genesis 1 – 12." Van der Zee tells how he first heard the stories of Genesis. He then explains how that might cause troubles in our faith later in life. After that he starts telling the story as he teaches it. The book is the result of a series of radio talks.

While reading the first few pages, I felt uncomfortable, probably due to the title of the book. We are so used to precise definitions that I inwardly started criticizing some ways the author talked about nature as directed by God. In our scientific work, we use very precise definitions. As a result, we say creation or evolution, ape or Adam. We often want either this or that, and are uncomfortable if we have to say this *and* that. Saying either creation or evolution sounds as if God stopped working when there

was a man. It sounds as if, after God had created, evolution took over. Worse, it may sound as if no god created. It is all chance. In that way chance becomes God. We believe, however, that God's hand is in everything. Therefore, any evolution that happened, or might still happen is in the hand of God. We should not contrast creation and evolution.

There are a few spelling mistakes. More serious is the error on page 56 where we read that there are 10 generations between Adam and Abraham. That should read 10 generations between Noah and Abraham. In the first few chapters, the writer should formulate some statements more carefully to prevent misunderstanding.

I am glad that this book is available. It is a book of connected meditations. The author uses only the actual biblical text or other Bible passages to justify a particular exegesis. For me it made sense; more than that, I enjoyed the connections the author made with other passages. Many people should read this small book.

Reviewed by Jan de Koning, Instructor of Mathematics, Box 168, St. Michael's College (University of Toronto), 81 St. Mary Street, Toronto, Ont., M5S 1J4, Canada.

EVOLUTION AS GROWTH OF ONE EARTH-ORGANISM by Thomas A. Morrill. 1995. 200 pages, index. Softcover; $10.

In his mid-seventies, Morrill independently publishes this book which covers a lifetime of ideas and opinions on the subjects of evolution and religion. A retired high school biology teacher, he describes himself as "naturalist, poet, scientist, in that order ... idiot and genius in that order also" (p. 16). In *Evolution*, Morrill is at times inventive and poetic, though hardly rigorous scientifically. Maybe it is for this reason that the many articles and books he purports to have written were, he admits, never accepted for publication.

Morrill begins with the assumption that "evolution is a fact" (p. 2). Darwinism's natural selection operating on genetic mutations strikes the author as too random. As introduced here, Morrill's "growth evolution" positions "intelligence," or the whole organism as the "prime mover" in the process (p. 23). In this way, life organizes. He finds support in recent speculations of directed mutation in bacteria.

Morrill defines evolution as the development of living complexity. Drawing from examples of African Rift Lake cichlids, he interprets an historical "cooperative proliferation" of life, rather than a diversification via competitive elimination (p. 62). His aversion to competition and extinction is such that at one point he suggests that the dinosaurs disappeared because they were "in a process producing life *higher than* dinosaurs" (p. 97, italics mine).

In the evolution of the planet, "intelligence" was apparent in the very first molecular interactions. Upon increasing in complexity, life's evolutionary "soul" or "consciousness" (p. 83) reached cellular, organismal, and now, community and biospheric levels of organization. Developing this analogy of evolution as growth of one earth organism, Morrill suggests that we, and our (dinosauran?) ancestors, represent the Earth's "germ lineages" and that all other organisms are the "somatic body," buffering, protecting, and feeding us (p. 84). The full implications of this idea are not explored. However, Morrill sees evidence that evolution has culminated in man; all traits are "trending toward," or are "brought to perfection" in humanity (p. 45). Finally then, the greater purpose of evolution is "heavening." What Morrill means by this is unclear, though the book's final paragraph lists cultural works of Western civilization which, presumably, represent our proximity to perfection.

Creative as Morrill is in *Evolution*, the work remains weak due to the absence of peer reviewers or an editor. Morrill misquotes, misrepresents, and inadequately cites many of his sources, a fundamental problem in the work. His grasp of evolutionary thought is immature. He is unable (or unwilling) to incorporate the evolutionary metaphor of a bush of diverging and introgressing lineages into his work, but he is willing to use, inappropriately, the metaphor of a ladder with humans at the topmost rung. As religious speculation, his teleological approach might seem appropriate, but as a posture taken towards science, he cripples his theory of "growth evolution." Finally, while parts of the work are colorful and descriptive, entire chapters are clumsy. Morrill suggests that the book is "for the defrocked priest and scientist," but I could not even recommend it to them. For those yet interested in obtaining a copy of the book, it is available from the author at Route 16, Box 9047, Tallahassee, FL 32310 for $10 plus postage.

Reviewed by Austin R. Mast, Department of Botany, University of Wisconsin-Madison, 430 Lincoln Drive, Madison, WI 53706-1381.

ENVIRONMENTAL VALUES IN AMERICAN CULTURE by Willett Kempton, James S. Boster, and Jennifer A. Hartley. Cambridge, MA: MIT Press, 1995. 226 pages, 4 appendices, notes, references, index. Hardcover; $39.95.

LIVABLE PLANETS ARE HARD TO FIND by Irving W. Knobloch. East Lansing, MI: Irving W. Knobloch. 153 pages, appendices. Paperback.

These are two books with a common theme: concern about the environment. Neither book deals directly with the interaction between the science and the theology of environmentalism. They are in many ways about as different as two books on the same topic could possibly be. Perhaps it was this striking difference that led me to consider reviewing them together. The first seeks to inform the reader about what diverse groups of people believe

about environmental issues; the second presents the heartfelt convictions on environmental issues of a lifelong professional environmentalist.

Environmental Values in American Culture is an anthropological study of how Americans regard a variety of environmental changes. Its goal is to understand American environmentalism and to investigate possible sources of support for environmental solutions. It is essentially an academic undertaking designed to find out what people think about environmental issues and why. Its authors are Willett Kempton, Assistant Professor and Senior Policy Scientist at the Center for Energy and Environmental Policy at the University of Delaware; James S. Boster, Associate Professor of Anthropology at the University of California, Irvine; and Jennifer A. Hartley, a doctoral student in the Department of Anthropology at Brown University. They have adopted anthropological techniques — semistructured interviews and a fixed-form survey — to determine public opinion on a range of environmental issues, using samples of that public opinion drawn from a variety of positions. In the appendices at the end of the book, 56 pages are devoted to a summary of the information and opinion-gathering techniques used. In the major text itself, a total of about six pages is devoted to the general subject of "religion" and environmental values. Major topics considered include cultural models of nature, cultural models of weather and the atmosphere, environmental values, and cultural models and policy reasoning.

The diversely representative groups involved in the survey are Earth First!, Sierra Club, the general public, dry cleaners, and sawmill workers. Their major conclusions are: "Among the surprising findings are that the public and scientists have completely different understandings of some critical environmental problems and proposed policy solutions, that environmental values have already become intertwined with other American values — from religion to parental responsibility — and that an environmental view of the world is more universal than previous studies have suggested." The major unanswered question emerging from the study is "If American environmental values are so pervasive and strong, why is there not more environmental action?"

Livable Planets are Hard to Find, on the other hand, is a passionate exposition of the problems and the need for solutions of a variety of environmental issues, by Irving W. Knobloch, Professor Emeritus of Botany with specialization in plant pathology, at the Michigan State University in East Lansing. The author is motivated by his Christian commitment to subscribe to the belief that God's resources must be managed to keep the earth livable. It is the purpose of this book to provide the information so that people not trained in science will understand the nature and the urgency of the situations in many areas. In the words of the author, "Is it possible for those with means to properly care for the billions who have little or nothing? Is it possible for the world's citizens to learn to live *with* the natural world, thus ensuring a continuing existence of life on the planet Earth?" Appendix A gives a list of suggestions for "What You Can Do," and Appendix B a list of organizations to consider supporting.

Starting with the realization that "the only organism here, among many millions, who is seriously befouling the earth is the human animal," the author proceeds to a consideration of people's basic needs: water, food, soil, and air. He then devotes a chapter to the issues related to the tropical rain forests, followed by a discussion of extra-tropical developments.

Finally he considers that central issue for all understanding of environmental responsibility in the future: the issue of overpopulation. If present trends in many areas continue on into the future, it may be possible to argue that the ultimate effects will not be seriously or ultimately destructive for life on earth; but in the area of overpopulation, this is simply not the case. If the world's population continues to grow at the present rate, only chaos and misery lie ahead: the population will be stabilized by the death of all those needed to stabilize it through starvation, disease, war, or other catastrophe. Here contraception, abortion, and immigration are related critical issues. The author concludes, "The first step is to *prevent the* human population from doubling."

Whether one adopts the academic attitude of the anthropological researcher seeking to find out the opinions that people hold on environmental issues, or the personal commitment and involvement of the informed Christian scientist, these two books each contribute helpfully in their own way to the growing literature on the nature of environmental problems and the need for large-scale commitment to their resolution.

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

THE BIBLE MAY AGREE WITH EVOLUTION by Marjorie Mary Gilfillan. Long Beach, CA: Wenzel Press, 1995. 306 pages, index, footnotes. Hardcover; $29.95.

The author, a researcher on folk dancing with three photo books on this art form published (all in 1995), makes the observation that dance costumes are much the same the world around. She has concluded that this data is a proof of the Genesis flood and has compiled her speculations about this and other origins questions in this book.

Claiming no scientific expertise, Miss Gilfillan liberally sprinkles "possibly," "maybe," and "probably" throughout the text, in which are discussed such concepts as: evolution ending at the end of the last ice age; the races originating with the wives of the sons of Noah; the probable location of Atlantis; Cain's mark — he was very tall; and Adam a crossbreed Neanderthal/Cro-Magnon.

The work may have usefulness for someone interested in compiling data on origins speculations, particularly because of the extensive footnotes. Otherwise, file it with Velikovsky.

Reviewed by John W. Burgeson, 6715 Colina Lane Austin, TX 78759.

JUDAISM AND THE DOCTRINE OF CREATION by Norbert M. Samuelson. New York: Cambridge University Press, 1995. 362 pages. Hardcover; $54.95.

Samuelson, a Professor of Religion at Temple University and prominent philosopher of Judaism, has an unusually keen interest in relating Jewish thought to modern science and philosophy. In many ways this book is the culmination of numerous earlier works on Jewish philosophy, with special emphasis on the relationship between revelation (faith, ethics) and reason (science, logic). He poses the question: How does modern Jewish philosophy relate to contemporary scientific thought, particularly in regard to the concept of "creation" as understood in terms of cosmology (what does the universe look like) and cosmogony (the origin of the universe)? The nineteenth century Jewish philosopher Franz Rosenzweig serves as the focal point because he provides "the fullest account of creation in modern Jewish philosophy" (p. 202).

The author divides the book into four parts, the first being an analysis of Rosenzweig's *magnus opus*, *Star of Redemption*. In an effort to demonstrate that Rosenzweig reflects basic Jewish thought and tradition, parts two and three provide a sometimes quite detailed overview of classical rabbinic commentary on Genesis and later medieval philosophical perspectives that were greatly influenced by Plato's *Timaeus*. From this Samuelson concludes that to qualify as a valid "Jewish" perspective of philosophy or science, existence/reality must be seen as "(1) something that is nothing out of which God, (2) through an act of will, (3) creates eternally and/or continually a universe. Furthermore, (4) the created universe, in virtue of God's intention, has meaning and moral value" (p. 151). Samuelson contends that Rosenzweig does qualify as a validly Jewish perspective.

In part four, the author takes this one step further by asking the question, "Is a Jewish interpretation of existence compatible with modern views of physics and contemporary philosophical perspectives?" He answers "Yes" by going beyond shortcomings he sees in Rosenzweig to propose a more up-to-date cosmology/cosmogony that he thinks finds a greater harmony with modern thought.

Samuelson does not provide concrete answers, in part because much of modern philosophical and scientific thought, particularly in the area of physics, is itself so theoretical that precise answers are elusive. On the other hand, he notes that enigmas in physics offer possible keys for explaining a greater compatibility between revelation and reason than many contemporary scientists might imagine. For example, (to condense an elaborate thought sequence), physicists have difficulty meaningfully defining the "space" between the nucleus and an electron. Is it "nothing," "something," or "not nothing"? Does space have reality? If the space actually defines the object (nucleus, electron), then space, in a sense, has a greater reality than the object, reflecting concepts inherent in the Hebrew terms in Genesis 1. This also would be compatible with classical Jewish views which tend to define "statements of scientific laws [as] ideal-limit claims and not descriptive generalizations" (p. 238). In other words, even in the world of science, whose rational basis is limited to the human senses, there are realities inadequately explained without a philosophical or spiritual reference.

Modern philosophy, which tends also to be very mechanistic, has several prominent philosophers who define reality in terms of non-physical entities, e.g., A. N. Whitehead's ontological process and Martin Buber's relational explanation of reality. These, of course, express a considerable affinity with traditional Jewish philosophy and its emphasis on ethics and purpose in creation. Thus, Samuelson suggests that much in traditional Jewish thought is far more compatible with than antagonistic to modern philosophy and science.

The modern dialogue/conflict between religion and science has been almost exclusively the realm of Protestants and Catholics. Samuelson's work is indeed a "voice crying in the wilderness" in regard to contributions from the Jewish perspective. He provides an impressive overview of key Jewish authors — ancient, medieval and modern — whose works provide the most meaningful insight into this dialogue. His grasp of modern physics is also impressive. Surprisingly, no attention is given to the theory of evolution, other than one reference in passing (p. 52).

The readers should be warned that more than occasional tough sledding through philosophical "esoteria," mathematical complication, and Hebrew linguistics awaits them. Those with some background in philosophy will find the sledding provocative and rewarding.

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

AT THE FRINGES OF SCIENCE: Science, Science Contested, and Pseudo-Science by Michael W. Friedlander. Boulder, CO: Westview Press, 1995. 196 pages, index. Hardcover; $24.95.

Friedlander is a professor of physics at Washington University. He has written a related book, *The Conduct of Science*, as well as *Astronomy: From Stonehenge to Quasars* and *Cosmic Rays*.

The purpose of *At the Fringes of Science* is twofold. First, by explaining how science works, Friedlander hopes to keep laymen — particularly journalists — from being taken in by non-science masquerading as science. Second, to help in the development of a healthy skepticism, he discusses the "scientific method" in detail, delineating its strengths and weaknesses. The book is well ordered, with a summary appearing at the end of each chapter, and a final chapter summarizing the entire book.

Friedlander considers in detail science's set of filters for excluding junk. He distinguishes between three types of possible junk, giving several examples in each category: strange ideas which arise from well-credentialed experts

or which are plausible given what is already known (the K-T impact hypothesis); strange ideas which seem to cross the line "separating the revolutionary from the incredible" (cold fusion), and strange ideas which "have the common distinction of being labeled as nutty by the experts" *(Worlds in Collision)*.

Friedlander devotes less space than one might expect to true pseudoscience, though there is the obligatory — and thankfully brief — discussion of Velikovsky. He devotes a single chapter to "tabloid science," in which he discusses sensational or popular pseudoscience: astrology, the "Jupiter effect," Iben Browning's earthquake predictions, and UFOs. This chapter is a stick with which to beat journalists, whom he sees rushing the sensational into print without bothering to check its accuracy. He also uses a chapter to discuss pseudoscience with a political motivation, under which are included Lysenko, "Aryan physics," and Creation Science.

Friedlander places more emphasis on "pathological science," in which effects are claimed based on results at the limit of delectability (polywater or psychic research) or in an area in which the experimenter has little or no experience (cold fusion). He is careful to distinguish these from deliberate fraud, and presents examples ranging from data massage (Millikan's oil-drop results), to over enthusiastic scientists seeing what isn't there (N-rays), to out-and-out falsification of data (Cyril Burt's data linking heredity and IQ is a probable case, and several proven cases are also cited).

Friedlander makes two main points. First, science, though imperfect, is the best system for evaluating the world and will eventually sort out truth from falsehood if left to itself. Second, science should be left to the scientists with minimal interference. He takes a position between "question authority" and "only scientists should be permitted to speak on science," but leans toward the latter.

At the Fringes of Science is a well-written discussion of how science is done, as seen by a scientist. It takes care to point out the fuzzy boundaries of science, and how today's maverick idea may be tomorrow's paradigm. Especially interesting is the short but excellent discussion of "what makes an expert." Friedlander has covered most of the bases.

Nevertheless, he is perhaps too sanguine about the ability of peer review and the judgment of posterity to keep fraud, rare as it may be, from influencing the future course of science. I grant that if one takes the long view one will find that results which cannot be reproduced will be abandoned; but meanwhile how many hours of valuable time are wasted chasing chimeras? Only one method for the detection of deliberate scientific fraud is presented — send skeptical, professional magicians into the suspected laboratories! — and much is left up to self-policing.

I found the book a mine of information. At least two examples of revolutionary science or pseudoscience are presented per chapter, and yet Friedlander manages to carry it off without the book seeming cluttered. He accomplishes this through judicious selection of facts, coupled with careful referral of the reader to bibliographical notes and a list of recommended further reading.

I recommend this book for those who deal with the public, particularly those who teach survey and introductory science courses. It is also designed to be useful to science journalists and to the general public. As a novice in the area of "weird science," I found it full of good examples and excellent references.

Reviewed by Daniel J. Berger, 313 Owens Street, Apt. P-3, Blacksburg, VA 24060.

JESUS, THE WISDOM OF GOD: An Ecological Theology by Denis Edwards. Maryknoll, New York: Orbis Books, 1995. 208 pages, notes, index. Paper; $19.95.

Father Edwards is very well qualified both by previous publications and by his mastery of relevant literature to produce this book. For the present reviewer, Edwards' main contribution is his effective reinforcement of the holistic-relational argument for Christian ecology. In Part 1 of the book, Edwards demonstrates the implications of God's creative work — through God the Son seen as Wisdom/Sophia. In Edwards' own words, he offers "a trinitarian theology which springs from a Wisdom Christology and leads to human ecological praxis" (p. 15).

The argument opens with a thorough review of Wisdom/Sophia materials in the Judeo-Christian tradition (Chapter One) including a heavy emphasis on Wisdom's relationally-oriented creative work. Edwards quotes Kathleen O'Conner in arguing for the relational character of "the Wisdom Woman" (p. 20). This quality of the Creator and creation then becomes the major ideological foundation for a relational, ecological theology. The argument is advanced by the identification of Wisdom/Sophia (with all the feminist overtones usually found in contemporary scholarship) with Jesus of Nazareth (Chapter Two). The reader need not accept all the feminist detail to appreciate the positive contribution of "Wisdom Christology" to the evangelical ecological debate. Chapter three can be roughly summarized by two quotations. First, "Wisdom Christology can ... show the interrelation between the expanding, inter-connected and self-organizing universe and all its creatures, and the saving work of Jesus Christ." A second quote exposes "what the cross tells us about the love that moves the universe, and what the resurrection means for the creatures of the universe" (p. 69). The relating of these themes to God's love for all creatures in the saving work of Christ may be the most significant emphasis of this work for evangelicals.

In contrast to the relative clarity and unity of Part 1, Part 2 is less focused. The concern remains ecological but the goal seems to be to grasp at any theological straw which can be construed as support for ecological respon-

sibility without any sense as to whether or not these many theologies form a cohesive, structured statement. The disunited, fragmented character of this bundling of theologies diminishes the moral authority needed to demand ecological responsibility. However, Part 2 still demonstrates very well the breadth of the writer's scholarship.

Most informed evangelicals will appreciate Edwards' argument that ecological responsibility honors the fruits of God's loving fecundity as seen in traditional Roman Catholic thought (Chapter 4). Chapter five states six ecological theses which the reviewer saw as relating holistic and relational ecology to the holism and inter-relationality of the Trinity, another approach which any evangelical should appreciate.

As Chapter Six opens, the unity of argument based upon a relational perspective is maintained as expressed in the following words: "the theology of the trinitarian God revealed in Jesus leads to a view of human beings which is inter-subjective, and interrelated with the Earth, the universe and all its creatures" (p. 133). But, then unity is lost in an eclectic, opportunistic methodology which takes a little bit from "every" current theology. Concepts such as Moltmann's "livingness of life" (p. 136), Rahner's "bodilessness" (p. 137), our "stardust" origins on the material side with an unnecessarily detailed exposition of Big Bang cosmology (pp. 139-142), Sally McFague's anti-evolutionary, Liberation perspectives (p. 144), and Gustavo Gutiérrez' Liberation Theology (p. 148) all combine to produce a treatment which lacks the clarity, unity, and authority of Part 1.

Edwards doses his book with a number of general proposals for ecological praxis (Chapter 7). These are generally instructive but some details seemed to the reviewer to go beyond the demands established by the positive arguments presented in the book. For example, the theological framework of the book does not demand that we enter into a "family relationship" with the animals (p. 166) or a Schweitzer-like "reverence for life" (p. 157). Further, while some of us might agree that the poor always merit special attention and grace, we also might suspect that Edwards' usage of this concept moves too close to the violent Marxist excesses of Gutiérrez' Liberation Theology.

Overall this is a scholarly, effective treatment of the issue, one from which any reader can learn and by which any reader can be challenged.

Reviewed by Andrew Bowling, Division of Biblical Studies, John Brown University, Siloam Springs, AR 72761.

THE ADVANCEMENT OF SCIENCE: Science without Legend, Objectivity without Illusions by Philip Kitcher. New York and Oxford: Oxford University Press, 1993. 421 pages, index, bibliography. Hardcover; $39.95.

Philip Kitcher received his Ph.D. from Princeton in the department where Thomas Kuhn and Carl G. Hempel both taught. As Professor of Philosophy at the University of California, San Diego, he has written three highly acclaimed books: *Abusing Science: The Case Against Creationism* (1982); *The Nature of Mathematical Knowledge* (1983); and *Vaulting Ambition: Sociobiology and the Quest for Human Nature* (1985), where he demonstrates a good command of knowledge in biology, mathematics, and philosophy.

This book's aims are to probe the notions of progress and rationality, to correct the excess of Kuhn (1962) and Feyerabend (1970), to incorporate their insights, and to re-establish science as a body of objective knowledge achieved through a communal exercise. Kitcher's effort to rehabilitate the *Legend* is similar to the neo-orthodoxy of Karl Barth in Christian theology. Kitcher's synthesis is reasonable and should appeal to a practicing scientist.

Chapter 2, "Darwin's Achievement," provides an example for the later discussion of goals, methods, progress, rationality, individual scientific behavior, and the social structure of science.

Chapter 3, "The Microstructure of Scientific Change," treats the growth of science as a naturalistic process in a social context. From the thoughts and actions of individuals, scientific change results in complex ways. Kitcher argues against theory-laden perception and affirms intersubjective agreement of perceptually induced belief. He defines the consensus practice of a community as consisting of a language, an assessment of significant questions, a set of accepted statements, a set of explanatory schemata, a set of paradigms of authority, a set of experiments and instruments, and a set of methodological exemplars and principles.

In Chapter 4, "Varieties of Progress" are defined as conceptual, explanatory, and instrumental. Kuhn's problematic cases (Priestley's phlogiston theory vs Lavoisier's oxygen) of conceptual incommmensurability are re-analyzed through a correspondence of key reference terms, thus negating the existence of communication gaps. Explanatory progress is illustrated by Dalton's atomic theory which introduced schemata, lately refined, generalized, and extended. Instrumental progress is exemplified by Galileo's telescope. These progresses eliminate falsehood in favor of truth, the mundane for the genuinely significant questions, and use improved language to reformulate prior truths.

Chapter 5, "Realism and Scientific Progress," defends the coherence of the realist conception of truth and the author's account of true knowledge. He espouses a correspondence theory of truth which is verified through common sense in our daily experience. A non-realist position will impoverish life; besides, the past history of science shows the unusual stability of scientific knowledge in many fields despite occasional errors. The scientific process depends mainly upon the objective, "real" nature instead of human social forces.

In Chapter 6, Kitcher agrees with Kuhn's insight in "Dissolving Rationality" for individual scientist; however, he endeavors to salvage the rationality for the scientific

enterprise through a compromised model. Rationality is not the logical connection among beliefs as logical positivists claimed, but rather a mental attitude, a psychologically connected state of mind which can promote cognitive goals. Rationality is achieved through debates within the scientific community and emergence of a new well-argued consensus practice.

Chapter 7, "The Experimental Philosophy," articulates individual methodology to attain the epistemic goals which pay attention to "encounter with nature" in addition to "conversation with peers." Here, Popperian's falsification of alternative hypotheses is achieved through instruments, experiments, measurements, and interpretation. Kitcher demolishes Kuhnian epistemological relativism through careful analysis of historical cases.

In the final chapter, "The Organization of Cognitive Labor," Kitcher discusses how the variety of individual strategies can combine to advance community, epistemic goals. Many social phenomena, like authority, cooperation, calibration, prestige, entrepreneurs, credit distribution, response to innovation, theory choice, and cognitive variation, are analyzed through simplified mathematical models. Kitcher concludes that there are advantages in cognitive diversity for a scientific community, just as the democratic process is beneficial for a political system.

This book presents an optimistic view about the progress of science. Christians have a basis for this optimism since God is the Creator and the Sustainer of this universe, and humans are endowed with the image of God. Newton understood nature as another book given by God. Everything is in God's control and science will progress as it reveals God's glory. This book describes the characteristics of science which are compatible to the thinking of a bench scientist. We sometimes are captivated by the recent trend of scientific relativism; this book provides a well-argued synthesis which demonstrates that a common-sense, realist approach is still commendable. I highly recommend this book to the readers of *PSCF*.

Reviewed by T. Timothy Chen, National Cancer Institute, Bethesda, MD 20892.

THE WORD OF GOD AND THE LANGUAGES OF MAN: Interpreting Nature in Early Modern Science and Medicine by James J. Bono. Madison: University of Wisconsin Press, 1995. 317 pages, index. Paperback; $22.95.

This was a difficult book to read and even more difficult to understand. I attribute this to two factors, the author's style and the complexity of the subject. On the first, note the following sentence (p. 172): "While 'form' gave evidence to the relationship of a particular entity to a divine archetype and hence its 'resemblance' to other material forms, the different 'virtues' of similar forms establish the particular place of individual entities within the analogically organized hierarchy of created things and hence each one's difference within this divine text." Imagine 300 pages of this kind of writing covering history and philosophy of science and its interaction with religion!

Despite the tough going and slogging through Latin and French quotes, I was inexplicably drawn into the topic. Being a plant taxonomist, I deal with the concept of typology, albeit usually unwittingly. I learned much about the origin of typology from this book as well as the philosophy behind the concept of "Natural History."

Before the Enlightenment Period, science tried to understand nature by trying to know the language of God, that is, the language spoken and understood by Adam in the Garden of Eden. Postlapsarian (a favorite term of Bono's) man was cut off from this God-given source of knowledge best exemplified by Genesis 2:19 where God "brought all the beasts of the field and all the birds of the air. He [God] brought them to man to see what he would name them; and whatever the man called each living creature, that was its name." In other words, it was the language of Adam that was important rather than the animals themselves because the name incorporated the essence of the object. In present western civilization, we are far removed from this concept. Not so with our scientific forefathers of the Middle Ages. A great effort was placed on trying to determine the mystery of the language through cabalistic approaches and mysticism.

The Protestant Reformation and especially the Puritan impact in England changed all that. Although Bono does not state it as such, it was the acceptance of the Bible as a divine revelation, completely outside human ken, that drew attention towards understanding the creation. Francis Bacon exemplified this approach and stimulated interest in what we now call scientific research. This change to an inductive study was more revolutionary than I realized before I read this book.

Despite the writing style and the scholarship included in the volume, I have been rewarded by the effort put into reading this book. It has helped me to understand how we arrived where we are in the scientific community and gives valuable insight into the current questioning in science regarding objectivity. The book also helped me understand the origin of the "Doctrine of Signatures," so important in ethnobotany. Bono gives insight into some sources of mysticism carried into present day practices of homeopathic medicine and other alternative medicines.

It was disappointing to find numerous typographical errors as well as references cited in the text not included in the references cited section.

Reviewed by Lytton J. Musselman, Eminent Professor of Biological Sciences, Old Dominion University, Norfolk, VA 23529-0266.

MISSIONARIES TO THE SKEPTICS by John A. Sims. Macon, GA: Mercer University Press, 1995. 234 pages, bibliography, index. Softcover; $22.95.

Sims is professor of Religion and History at Lee College, Cleveland, TN. I am not aware of any other books he has written. This book is a summary of the life and teachings of three twentieth-century apologists: C. S. Lewis, E. J. Carnell, and Reinhold Niebuhr. These three are presented as examples of theologians who attempted to defend the Christian faith intellectually. We live in a world where skepticism abounds, and it is imperative that Christian truth not be presented as simply a "blind leap of faith," but as a religion which can be defended intellectually.

The three men reviewed by Sims are quite different in their apologetic approach. Lewis was an academic atheist who was converted to Christianity, and who became an able defender of the gospel. His influence has been profound. Many skeptical intellectuals have found Christ appealing after reading C. S. Lewis. Many ministers (myself included) have recommended Lewis to those who struggle with the truth claims of Christianity.

Sims reminds us of how impatient Lewis was with biblical scholars who were so quick to dismiss certain biblical materials as "mythical." Lewis was a professor of literature and was very familiar with the nature of mythological writings, and affirmed that the New Testament does not fit into the typical mythical style of writing.

Carnell is one of the founders of neo-evangelicalism. He reacted against the rigidity of fundamentalism and sought to bring orthodox Christianity into the mainstream of academia. As the first president of Fuller Theological Seminary, he worked to bring academic respectability to Christianity while refusing to compromise on basic biblical truth claims. Camell believed that the Christian worldview is intellectually satisfying, giving solid answers to the basic questions of epistemology and metaphysics, sensibly outlining the nature and destiny of man, and making possible a relationship with the living God. No other worldview can accomplish these results.

Reinhold Niebuhr differs from the other two in that he must be placed in the liberal theological camp. He was more of a social action apologist than a doctrinal apologist. While Lewis and Camell accepted the orthodox Christian position regarding the inspiration and authority of Scripture, Niebuhr rejected the historicity of many biblical stories. He was enamored with some aspects of Marxism/socialism and advocated a Christianity which was active in the political realm, working for justice and human rights. While not as strong on the truth claims of Christianity as Carnell and Lewis, Niebuhr did argue that the Christian interpretation of life and history is truer to the facts of human experience than any other interpretation.

Sims gives a summary of each man's personal life followed by a review of their basic ideas as reflected in their writings. For persons who are unfamiliar with these three theologians, Sims book gives an adequate introduction. It would hopefully then lead into a first hand reading of these three apologists. As is probably true with any book about the beliefs of others, the summary is not nearly as interesting as the source material. This is especially true of C. S. Lewis who must be read first hand to be appreciated. The bibliography at the end of each section directs the reader to the source materials.

The book serves to remind us that the gospel has always had able apologists. Those who dismiss Christianity as intellectually indefensible only reveal their ignorance. While one may not agree entirely with these three defenders of the faith, their intellectual ability is undeniable. Those who question the Christian truth claims should not be cast aside by the church. They should be led into the writings of the great Christian apologists who may be able to answer their doubts.

Reviewed By Richard M. Bowman, Director of Research & Publications, Disciple Heritage Fellowship, PO Box 109, Lovington, IL 61937.

WHY FREUD WAS WRONG by Richard Webster. New York: Basic Books, 1995. 673 pages, bibliography, index. Hardcover; $35.00.

Richard Webster is a British scholar who also wrote *A Brief History of Blasphemy*. He is the author of many articles for *The Critical Review*, *The Observer*, and *The Times Literary Supplement*. While his degree is in literature, he has obviously done considerable homework in the field of psychoanalysis. His criticisms of Freud are well documented and profound.

The book contains three main sections. The first addresses the background and development of psychoanalysis, which Webster calls a "pseudoscience." The second part would be of interest to Christians. It is titled, "The Church and the Psychoanalytic Gospel." The third main section is a summary and conclusions, with a look towards the future.

Freud continues to be honored, if not revered, in some circles. However, few of those who work in the mental health field use his methods. When I worked for a mental health center some 15 years ago, the techniques of psychoanalysis were regarded as much too lengthy and complex, and of doubtful value. However, there are psychiatrists in practice who use some Freudian methodologies.

This rather long but very interesting book by Webster argues persuasively that Freud was wrong. Freud is pictured as an egotistical man who deliberately set out to make a name for himself — a man driven to achieve fame and recognition. While he succeeded in his goal, he did so by creating a theory of human behavior based on very faulty research. He often misdiagnosed organic problems in his zeal to explain things through mental categories. In several lengthy studies of Freud's own case notes, the author shows how certain patients undoubtedly

had organic problems (brain lesions, epilepsy, etc.) but were treated as though their symptoms were mental. His own daughter, Anna, is a prime example. Freud believed she was suffering from "hysteria," a "disease" which does not even exist according to Webster.

The author shows that one of Freud's problems was his tendency to follow other charismatic physicians of his day (Charcot, for example) whose theories later proved to be false. Webster presents much evidence suggesting that many of Freud's patients fit themselves into his system, accepting his explanations of their problem. One suspects that the power of suggestion and Freud's growing reputation caused many to accept his "analysis." Most of Freud's psychoanalytic theories have little relationship to science.

One of Freud's more interesting errors was his "discovery" of the benefits of cocaine. Freud was able to wean one of his friends, Fleischl-Marxow, from morphine addiction by substituting cocaine for morphine, but then his friend died from cocaine addiction. As Freud describes this case, he shifts the blame from himself to his unfortunate friend, seeking to cover up his own role in his friend's death.

In Freud's lengthy analysis of Anna, he delved deeply into her secret fantasies. He reconstructed her daydreams (which she did not even remember having!) and got her to believe his reconstructions, reminiscent of today's "recovered memory therapy." Webster claims that Anna was never "cured" by her father because she did not have the "illness" he claimed she did.

In the second section of the book, the author points out how psychoanalysis was more of a religious cult than a scientific fact. Freud saw himself in Messianic terms, and others promoted this image. Carl Jung recalls how Freud tried to persuade him never to abandon the theory of infant sexuality, much in the manner of a father asking his son to always remain faithful to the church. Psychoanalytic teachings were dogmas not to be questioned. It is somewhat amusing to realize that many of Freud's followers imitated him by taking up cigar smoking, growing beards, and in some cases trying to imitate his speech and mannerisms.

Christians reading this book (or Freud's own writings) will note Freud's dislike for Christianity and his Jewish heritage. In some ways Freud attempted to replace biblical understandings of human behavior with his own theories. Those who believe that the Scriptures reflect the mind of God are not surprised to learn how widely Freud misunderstood human behavior. Those who turn away from divine truth to create their own version of reality usually end up where Freud did — in mythology, pseudoscience, and just plain nonsense. Sadly, some Christian theologians have embraced psychoanalysis and tried to make it compatible with Christian doctrine. Webster gives several examples of this phenomena. While Webster is not a friend of orthodox Christianity, his book should caution Christians against embracing theories promoted by those who set themselves up as new Messiahs. This book is must reading for those who continue to be enamored with Sigmund Freud.

Reviewed by Richard M. Bowman, Director of Research and Publications for Disciple Renewal, Box 109, Lovington, IL 61937.

CHILD REARING AND PERSONALITY DEVELOPMENT by Paul D. Meier, Donald E. Ratcliff, and Frederick L. Rowe. Grand Rapids, MI: Baker Books, 1993. 244 pages, index. Hardcover; $12.99.

As the authors indicate, "It is always easier to prevent problems in the first place than to cure them after they develop." This book offers biblically sound, parenting guidance, especially for the first six years. It provides a comprehensive look at many aspects of child development.

This book describes development from a prenatal stage through adolescence. The challenges of demanding respect when children are young, rewarding good and productive behavior, avoiding confrontation in front of the child's friends, using more reasoning and adult-to-adult style communication are explained. This book not only encourages parents to understand their children better but also provides them with general guidelines about seeking professional help when their children are having great difficulty. The authors share personal experiences as parents and offer unique insight as professionals.

Throughout the book, the importance of a father figure is repeated in different chapters; so is the parents' responsibility. The authors say, "The father and mother's first responsibility from God is the family. All else comes in a distant second. Our children are our first calling from God, no matter what occupation God may call us into. The family has to be our first and utmost calling from God."

The repetition concerning the importance of a fatherly figure may not be necessary, because some readers may be offended by the strong and repeated emphasis on a fatherly figure but not on a motherly figure. Also, the statement, "Children learn academic subjects faster and better if they do not begin school until eight years of age," is debatable; at least it is contrary to the experience of my family members. Love and stability at home are vital for children. However, it may not be quite right to compare the situation of a domineering mother and a weak father to the fatherless home. A weak father can still be a loving father who can comfort and support his children financially, emotionally, and spiritually.

As we face a society gripped by conflict and despair, this book provides a clear path for our confusing age. It urges parents to teach children the values of good character, desirable behavior, and hard work. It will be helpful for parents to read this book while children are young

because much of the adult personality is formed during childhood.

Reviewed by Meei-ming L. Chen, National Library of Medicine, National Institutes of Health, Bethesda, MD 20892.

HEALING WORDS: The Power of Prayer and the Practice of Medicine by Larry Dossey. San Francisco: Harper Collins, 1993. 207 pages, 4 appendices, notes, index. Hardcover; $22.00.

Dossey is a medical doctor internist who noted in his practice that prayer for healing of disease worked. He decided to look into the experimental evidence for or against the effectiveness of prayer in this area, and this book is the result of that research. Dossey is not a neophyte in this area, having written four previous books on "consciousness in health." Furthermore, the book jacket says he is co-chairman of the Panel on Mind/Body Interventions, Office of Alternative Medicine, National Institutes of Health. Raised a fundamentalist Protestant in rural Texas, he became an agnostic in college and later developed an interest in spiritual things, manifested by his involvement with Eastern and Western mysticism. He believes in an unnameable absolute, not necessarily God.

From this background, he has attempted to evaluate in a non-judgmental way the evidences for healing, giving all the reports and studies equal consideration, regardless of their source. He judges them on the basis of their scientific merit and finds substantial statistical evidence for healing through prayer. The healing comes whether the prayer is local or distant, or focused or unfocused. The healing can be immediate or delayed or even before the disease occurs. He finds there is no formula for prayer, and it doesn't seem to matter who offers it, what they pray for, or to whom they pray. He concludes that the success of prayer may simply be aligning ourselves with unconscious divinity, from which healing comes, whether specifically requested or not.

Dossey deals in detail with the evidence, listing 131 trials of which 77 showed, based on statistical analysis, that prayer was effective. Most of the experiments dealt with living organisms other than humans, such as bacteria and mice, but 37 dealt with humans. He spends several pages discussing the article by cardiologist Randolph Byrd published in the *Southern Medical Journal* in 1988. It showed that patients in a coronary care unit who were prayed for in a double-blind experiment did statistically better than those not prayed for. Although Dossey congratulates Byrd on his courage in doing the experiment, he raises several questions, both ethical and procedural, about his study.

He describes three eras in medicine: the mechanical era where we have been for a while, in which every effect has a distinguishable cause; the mind-body era, where we are gradually understanding that one's mind has a major effect on one's well-being; and the transpersonal era to come, in which the body is affected by nonlocal events such as prayer, not measurable by any energy fields. Dossey optimistically predicts that we are moving towards the third era in which the rift between science and religion will be thus healed as each recognizes "a soul-like quality of consciousness."

This book is well researched, thorough, and well written. Believers will be interested to know that there is statistical evidence that prayer works, even though the experimental setting may not correspond to our idea of prayer. However, we would be more comfortable reading a classic on Christian healing such as *Healing and Christianity* by Morton Kelsey.

Reviewed by Edward M. Blight, Jr., Professor of Surgery, Loma Linda University, Loma Linda, CA 92354.

THE SEA OF GALILEE BOAT: An Extraordinary 2000 Year Old Discovery by Shelley Wachsmann. New York: Plenum, 1995. xviii + 420 pages, index, endnotes, maps, diagrams, photographs. Hardcover; $24.95.

Several years ago we were fascinated by reports that Jesus' boat had been discovered. The truth, as is so often the case, is somewhat less sensational, but electrifying enough in its own right. We are treated here with a popularized version of the preliminary report (*'Atiqot* v. 19). Wachsmann is a nautical archaeologist and expert on seacraft of the Ancient Near East (Inspector of Underwater Antiquities in Israel from 1976 to 1989, Assistant Professor of Biblical Archaeology in the Nautical Archaeology Program at Texas A&M, excavator of several wrecks, author of three books on ancient seafaring and numerous journal articles), and a master storyteller. Fast-paced chapters narrating the discovery, excavation, and troubles of the expedition more or less alternate with background chapters. For instance, Chapter 6, an adventure tale of the background, conduct, and results of the great First Revolt naval Battle of Migdal, sets the stage for the chapter evaluating the possibility that the boat had been a part of this battle. Comprehension is greatly enhanced by a large number of fairly clear photographs, maps, diagrams illustrating the shipwright terms and construction that he describes, a photograph of a detailed model of the boat as preliminarily reconstructed, and a glossary with two diagrams clearly showing the nautical terms.

The excavator's de facto motto, "Never a dull moment" (p. 295), appears to be the one stable condition of the entire campaign. Premature announcement of the find, rumors that it was full of gold, and a serious shortage of funds got things off to a tension-filled start. More crises

and problems followed in rapid succession: demand of a neighboring kibbutz for possession of the boat, including a brief armed interference, endangered the boat's very existence. Tight deadlines, weather threatening the boat early in the excavation, storm waves nearly eroding away the preservation tank and its hut after excavation, and bacteria fermenting the water and eating the boat in the preservation tank are a few of the events providing excitement after work started. Experts in many fields, diplomats, and lay people from all walks provided ingenuity, all out effort, technical skills, donation of materials, and dirty, cold, back-breaking work in the mud.

Wachsmarm writes a detective story interweaving evidence from the remains of the boat, a mosaic picture, incidental information from the Gospel accounts, the writings of Josephus, knowledge of shipbuilding and seafaring elsewhere in the Mediterranean world at that time, and other sources. He discusses the dating problems and possibilities in detail, concluding that the boat was in use for a couple decades somewhere between 100 B.C. and 67 A.D. It is statistically improbable that Jesus or the disciples were ever in the boat, but it is the type of boat that they did use and they could have been in it. Also, it is not too likely that the boat was in the great naval battle. Nevertheless, preliminary results do include a tentative solution to the problem of "rafts" that Vespasian built for the naval Battle of Migdal; they were probably catamarans, constructed by building platforms across pairs of commandeered fishing boats like the Galilee boat being excavated.

Prior to the excavation of the Galilee boat, we "knew nothing about how watercraft had been built on the Sea of Galilee in antiquity" (p. 15), but the amount of information that will be gained from this discovery is amazing. Its final resting place was the salvage yard of a shipbuilding area; the few still useful parts were removed for reuse before it was abandoned and forgotten nearly 2,000 years ago. Because it was found in a remarkable state of preservation due to its rapid and nearly complete burial, the cleaning and preservation processes are revealing tool marks which will illuminate the shipbuilding tools and techniques used. The wide variety of materials used in building and repairing the boat indicates the difficulties faced by a master shipwright working in a poor area with a scarcity of nimble material. The results of studying this boat will provide very important data for interpreting the life and culture of the times and geographic locale of Jesus. We will have to wait for most of it, however, because the long, complicated preservation process will not be complete until 1996 or 1997.

In sum, this is an exciting adventure tale, complete with an improbable string of near disasters averted by teamwork, selflessness, and ingenious improvisations just in the nick of time. It also contains a remarkable amount of information on the milieu of the boat, shipbuilding of the period, and nautical archaeology. Highly recommended.

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

CHRISTIAN SCRIPTURE: An Evangelical Perspective on Inspiration, Authority and Interpretation by David S. Dockery. Nashville, TN: Broadman & Holman Publishers, 1995. 257 pages, indexes. Paperback.

Those who have followed the Southern Baptists' acrimonious debate over Scripture in recent years will recognize the urgency with which this book was written. Dockery, Vice President for Academic Administration and Dean of the School of Theology at The Southern Baptist Theological Seminary, has produced an exposition and defense of the inerrantists' position. He rejects the extremes of liberal and fundamentalist interpretations and "seeks to offer an evangelical understanding of the inspiration, interpretation, and authority of Scripture" (p. 2). Dockery laments that twentieth-century developments in Southern Baptist teaching have left their people unable to understand the infallible vs. inerrant debate, and he is apparently writing to help correct this deficiency. He does a remarkable job of clear, lively writing and avoids most of the opaqueness so frequently found in theological discussions.

Christian Scripture uses a quite detailed and cautious definition of inerrancy which gives a very high view of the full inspiration of Scripture, its truthfulness, reliability, and authority, while avoiding the excesses many attribute to the doctrine. He insists on full recognition of human authorship as well as the divine authorship: the human authors wrote in their own words and understanding, but God superintended the authors' human creativity so that Scripture says what he intended and there is no error in what it affirms. Dockery recognizes that different genres, such as poetry, laws, and proverbs, have different effects on the hermeneutical task. This definition seems to allow one to avoid being boxed in by excessive literalism, yet he does not spell out what it means in actual exegesis. We are not given even a hint of how much latitude he would allow in, for instance, the interpretation of Genesis 1-11. Must it be history and science, albeit a simplified history and science expressed in ancient words but without varying from modern *scientific* description, or can we recognize it as a more symbolic work inerrantly and infallibly expressing the theological truths that God wants us to know? Given the rancor and intransigence of the debate, perhaps this vagueness is wise in a book that hopes to reach both sides.

While his comprehensive and basic sketch of the doctrine of Scripture is placed within a historical framework — from earliest Christian times through the modern worldwide crisis on biblical authority, it is focused on the Southern Baptist experience. In fact, Dockery may have spread himself too thin by trying to cover too much material in such a short span of pages. After a survey of the present crisis and attitudes in the universal church, he goes into a discussion of the writing, inspiration, transmission, and authority of Scripture, followed by an extensive sketch of the history of interpretative approaches from that of Jesus through modern times. This is supposedly the basis for his final presentation of the proper use and interpretation of Scripture in the church today. An appendix summarizes the use and interpretation of Scripture in the history of the Southern Baptist Convention.

The problem is whether this book presents enough detail to do the job. There is some very good material in it on revelation, inspiration, authority, Jesus' method of interpretation, inerrant vs. infallible, etc. However, this reviewer kept finding himself wishing that there was a bit more information, a bit more tying things together, and pointing toward additional sources. The historical section on interpretation is a case in point. It was included to form a basis for the final section on the proper use and interpretation of Scripture, yet there is a hiatus between them; it's like there is a 52-page insertion of extraneous material. No doubt the connection is quite clear in Dockery's mind, but we are left to guess at his views.

In spite of the criticisms, this is a good book for the purpose for which it was written. There is much food for thought and the extensive footnotes and bibliography provide a pathway for further study for those who are interested.

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

THE FINAL SUPERSTITION: A Critical Evaluation of the Judeo-Christian Legacy by Joseph L. Daleiden. Amherst, New York: Prometheus Books, 1994. 444 pages, endnotes, bibliography, index. Hardcover.

It is debatable as to whether a review of this book in *Perspectives on Science and Christian Faith* can be responsibly defended. The author is a former director of corporate planning for Ameritech who has written and lectured on public policy issues. In his own words, "I concluded that precisely because fundamentalism is so pervasive, there was sufficient reason once again to expose the dark side of the Judeo-Christian tradition." It is his hope to be able to so discredit theological inputs to public ethics that people will no longer pay attention to them. The publisher is described as "one of the few publishers dedicated to publishing works of the highest quality on skepticism, rationalism and ethical issues." Books advertised on the back jacket include the titles, *Atheism: the Case against God* and *Living without Religion*. After surviving the attack of most of the book, the reader awaits with interest the alternatives that the author will provide to resolve the issues discussed; it is disappointing to be told on page 443 that the reader will have to wait for future volumes that are being planned to describe these alternatives and "to forge a new, verifiable ethic to serve as a foundation for social policy."

If one looks at the history of mankind, one sees fairly readily that the sinful nature of human beings can and will distort and devalue any particular public perspective; this distortion and misuse is greater the greater the authority attributed to the leaders of that perspective. It is not difficult, therefore, to describe at great length — as Daleiden does in this book — all of the distortions, failures, and abuses that human beings have fallen victim to in the history of religion, and of the Christian Church in particular. What Daleiden does not reveal or establish is the counterpart of this, namely all of the distortions, failures, and abuses that human beings have fallen victim to through the rejection of the Christian faith as biblically revealed. Although one might well argue that gross distortions of truth produce great suffering, it is no less true that gross acceptances of falsehood also produce great suffering. The solution is not to be found in rejecting the truth.

Of course, this is exactly what the author focuses his attack on: the advancement of the thesis that Christianity per se is false, and that, therefore, Christianity in the hands of powerful and authority-drunk individuals must be opposed and rejected. The first 15 of 19 chapters are written in the form of a pseudo-dialogue between "God" and "Joseph." It is most revealing to let Daleiden speak for himself. After a presentation of the aberrations of several cultic groups with the implication that they simply reflect the shortcomings of Christianity itself, he attacks the abuse of Papal authority in the Catholic Church (could it be that his worldview has been shaped by rebellion against "sixteen years of Catholic training" [p. 51]). He dismisses the New Testament as a collection of fabricated myths related to the "discredited Old Testament" and claims that "nothing in the gospel story of Jesus was original." Daleiden characterizes the gospel account of the resurrection as "a crude lie," contending that "Jesus, as depicted in the gospels, never existed." He claims "that there is a causal relationship between the theology of Christianity and intellectual suppression ... it is the very nature of all institutions based on faith, such as Christianity, to lead to this disastrous end."

One could go on with a listing of the author's charges: "Evil is not a function of 'inherent weakness' or 'original sin' as Christians declare, but rather genetic characteristics and environmental conditioning." His fear and hatred overflow in statements such as, "Christianity would once again shackle human thought and freedom in a tyranny of ideological intolerance. It must be understood that this evil intention is not due merely to a few ignorant or wicked men, but is inherent in the belief system of Christianity." His tragic distortions are seen in such statements as "That Christianity is a religion of love, as some would have us believe, is a complete denial of the New Testament writings;" "The first three commandments expressing man's relationship to You never were of any relevance. The rest are of no pragmatic value as written, and never were;" "... the emphasis is always on faith, and faith, I submit is incompatible with love. Love is free, universal, and forgiving, while faith is narrow-minded, unyielding and fanatical." What tragic experiences marked the life of this man in his youth to so completely mislead him in adulthood?

Where then do we end up? "I wish to close this chapter with a brief discussion of a modern alternative to theistic religion which meets the needs of all human beings more fully than today's religions and does not suffer from their fatal flaws. This viable alternative to religion is a form

of secular humanism which places humanity in its proper perspective vis-a-vis the environment and rejects all forms of theism as ignorant and dangerous superstitions." "As for those who believe ... that faith and reason can live side by side, they are only deluding themselves. As I have shown, these two approaches to truth are fundamentally irreconcilable."

What then is the final answer? "I have presented the position that since there is no evidence or logic to support the belief in a god, the only supportable intellectual attitude is that of nontheism i.e., atheism." How ironic it is that we have just lived through some 70 years of world history in which the adoption of atheism as advocated in this book was put into practice throughout the Communist world. That worldview has come crashing down in a way seldom before experienced. In societies where atheism held authoritative sway for so long, today people are open to and longing for the word of the Gospel. How tragic that the author, suffering what seems to be a personal psychological injury, has misinterpreted his own tragedy and advocated a tragedy for all, which the world has experienced at this very moment and is recovering from.

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

WHO WROTE THE NEW TESTAMENT? The Making of the Christian Myth by Burton L. Mack. San Francisco: Harper Collins Press, 1995. 304 pages. Hardcover; $22.00.

Burton Mack, John Wesley Professor of the New Testament at the Claremont School of Theology, a biblical scholar and historian of religion, takes on an old topic in this book, i.e., "are the New Testament documents reliable." As for Mack, he thinks the early Christians engaged in mythmaking and that as an historical document the New Testament is not reliable.

Members of the American Scientific Affiliation will find little to agree with in Mack's book. They "accept the divine inspiration, trustworthiness and authority of the Bible in matters of faith and conduct" (ASA Statement of Faith).

A scholarly presentation of the view that the New Testament is reliable can be found in *Christianity and the Hellenistic World* by Ronald Nash. He writes: "Many scholars still claim that early Christianity (first century A.D.) borrowed some of its essential beliefs and practices from the pagan religions and philosophical systems of that time. Scholars in the fields of biblical and classical studies regard this claim as highly improbable."

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

RECLAIM YOUR HEALTH by David and Anne Frahm. Colorado Springs, CO: Pinon Press, 1995. 239 pages. Softback; $12.00.

This is a collection of 50 anecdotes about sick people who have been put on the road to health via non-traditional therapies. The chronic and sometimes degenerative diseases from which they suffered included allergies, cancer, heart disease, AIDS, lupus, and diabetes. The therapies included nutrition, exercise, and a variety of supplements. Conventional medicine is presented in a somewhat unfavorable view, and alternate approaches to health maintenance and reclamation are espoused. The skeptic will question the scientific basis for the therapeutic approaches, the inquisitive will be motivated to explore these alternatives, and the believer will find this an affirmation of strongly held views.

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

Letters

Comments On Collins, et al

My primary concern here is to correct a misunderstanding of my view of Gen. 1 contained in the letter of Jack Collins (*PSCF* 48:2, June 1996, 140-42), commenting on my article, "Space and Time in the Genesis Cosmogony" (*PSCF* 48:1, March 1996, 2-15).

Collins and I are in fundamental agreement on the basic issues, but in my essay I contested his view of the fourth "day" and in responding to that he alleged some methodological problems in my article. Pending the appearance of the results of his on-going study of the interpretative process, his criticisms are, as he acknowledges, only unargued assertions. As such, they are too tentative to warrant extended assessment at this time. I would simply say that the "top-down" kind of procedure Collins attributes to me does not accurately characterize my handling of the hermeneutical circle. As a matter of fact, on the point of disagreement over the exegesis of the fourth "day," it is actually Collins' method that is "top-down" in that his linguistic analysis assumptions compel him to give the terminology of the text a different meaning (viz., human perception) than a "bottom-up" approach shows it has throughout the rest of the creation narrative (viz., divine production).[1]

Further as to methodology, I would only express the hope that Collins' abstruse remarks about hermeneutical theory will not discourage those in the Christian scientific community who are not biblical specialists, sapping their sense of competence and responsibility to understand what God is saying to us in the Bible. Biblical exegesis is not so esoteric a business but what the *PSCF* readers can readily judge for themselves whether my exegetical arguments against the rigid literalism of the young earth creationists ring true.

To deal with Collins' erroneous statements about my interpretation of Gen. 1 (the chief purpose of this response), we must examine the key term "concordist." In the context of ASA dialoguing, "concordist" apparently denotes the view of a biblical narrative which sees it as a record of actual events, recognizably described. This allows for the presence of figurative elements, especially but not only in more poetic passages. For example, to recognize as figurative the statement in Exod. 15:8 that God parted the waters by the blast of his nostrils is consistent with taking Exod. 15 (like the Exod. 14 version of the event) in concordist fashion as an account of the Lord's actual creation of a path for the Israelites' crossing through the sea. Now, the concordist classification would not apply to a narrative which as a whole was figurative; that would be an allegory. But even in the case of so strongly a figurative view as that which interprets Gen. 4:16-21 as employing stereotypical pictographs reflecting Neolithic and later culture to portray the less advanced culture of prediluvian times,[2] ASA usage would presumably deem this as at least low-degree concordist — the people and episodes in the context being historical, not mythical or allegorical symbols.

Collins' use of "concordist" fits in with this ASA usage, for he speaks of different degrees of concordism, as in his reference to his own view of Gen. 1 as "mildly concordist." And my complaint is that given this definition of "concordist," Collins radically misrepresents my position when he writes: "Kline's view is explicitly non- (or even anti-) concordist, at least for Gen. 1," and in contrast to that identifies my position on Gen. 2-3 as "more concordist." Contrary to Collins, my view of Gen. 1 is precisely the same as my view of Gen. 2-3 (and of Gen. 4-50 and all the rest of the Bible's historical narratives). It is essentially concordist, absolutely opposed to interpretations of Gen. 1 as myth or saga or existential allegory. My position is not that Gen. 1 as a whole is figurative; it is rather that the chronological framework of the creation narrative is figurative but the persons and episodes mentioned there are historical in a concordist sense. My view of Gen. 1 differs only in the degree of figurativeness from Collins' own "mildly concordist" view.

What has happened, I surmise, is that Collins has fallen in with an inconsistency in the (unofficial) ASA usage of the term "concordist." In the treatment of Gen. 1, concordism has come to be identified in an exclusive way with acceptance of a chronologically sequential order of the narrative (whatever the length of the "days"). While taking the duration aspect of the chronology figuratively is classified as concordist, interpreting the narrative order of Gen. 1 figuratively (by taking it as not chronologically sequential) is quite arbitrarily equated with taking the account as a whole as figurative and hence gets classified as non-concordist.[3]

In this connection it should be noted that non-sequential order is not uncommon in historical narratives. Non-sequential arrangement with chronological recapitulation is indeed a prominent structural feature throughout the Book of Genesis. Note, for example, the account of Adam's creation in Gen. 5:1 after the narrative in Gen. 4 has carried the history far down towards the flood event.

Whatever the explanation of Collins' misleading comments, I wish then to state emphatically that I regard the creation prologue of Genesis as the record of events that actually transpired (with the angels of God as "eyewitnesses" of most of them). I posit no fundamental contrast between Gen. 1 and Gen. 2ff. They are alike historical records, embellished with figurative features in varying degrees.

On this view of the early chapters of Genesis, they confront us with data that function as a control in the scientific enterprise. With respect to Gen. 1, my interpretation certainly facilitates the concordist process by removing the false chronological constraints imposed by the more traditional types of exegesis. That was the modest goal of my article. Synchronizing the history of Gen. 2-8 with the data provided by current anthropological, geological, and archaeological investigations presents a tremendous challenge. The proper solution will inevitably be found. Meanwhile, our sense of urgency in this fascinating quest must be tempered by the patience of faith.

Notes

[1]Since Collins and I subscribe to the same confessional standards, I have assumed that his "topdown" description of my method does not refer to my pre-commitment to the analogy of Scripture principle as an implication of the nature of Scripture as inerrant Word of God.

[2]I do not adopt this view of Gen. 4:16-21, although from a literary perspective my view of the Gen. 1 chronology is similar to it.

[3]Even on this explanation of Collins' classification of my view as "non-concordist," his alternative label, "anti-concordist," seems strangely inappropriate.

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Clark and His Critics on Pacifism

The responses (p. 69, March 1996) to Dr. Clark (pp. 220-232, December 1995), which generally ignore his logic and data, are what I would expect. However, Garrison correctly points out an error in Clark's reference to a parable as justification. On the negative side, he tries to discount the nature of Roman military service. One must grant that the legions' duties involved keeping the peace. But one must also note that the distinction between the

army, which in the United States is forbidden to act as a posse, and the peace officers — police, sheriffs, marshals — was unknown in antiquity. I would like to know how he would have persuaded the Gauls that Julius Caesar's legionnaires were state troopers, and the Jews that the assaults and massacres on Pilate's orders were police work or that Titus' army was merely keeping the peace at the sack of Jerusalem and the attack on Masada. He also passes over the total lack of condemnation of military men by John the Baptist, Christ, Peter and Paul (p. 228). Is it not significant that the first Gentile God brought into the church was a centurion?

Both critics ignore completely God's commands to Israel to exterminate some of their opponents (p. 222), though this has important consequences. The tacit rejection of the divine command to go to war (equated with murder) in favor of an absolute prohibition on killing (see p. 221) makes the God of Israel different from the Father revealed by Jesus. Although unintended, this is heresy.

Burka names pacifist authors whom Clark does not need to consider, for he has rendered them totally irrelevant (pp. 226ff). That pacifism demands the confusion of personal with national responsibilities came as a surprise to me some years ago, for all my ancestors were Mennonites. So I sympathize with Burka's confusion, but cannot condone it.

Burka is right that Christians are to be peacemakers. I thank God for their recent successes in South Africa and, since the carnage, in Rwanda. However, I note that both countries have a strong Christian witness. It is otherwise in Nigeria, Sudan and Iran, whose authorities brook no opposition as they try to set up fundamentalist Muslim states. Additionally, how long would the Kurds survive in Iraq except for the presence of armed Americans? The Marsh Arabs of southeastern Iraq, lacking foreign military protection, are being systematically exterminated. These Iraqi actions involve genocidal attacks by Muslims against Muslims, where elsewhere it is commonly Muslims against Christians and other non-Muslims. Need I remind Burka that peacemakers, simply because they were not partisan, were systematically killed by both parties in Rwanda? For that matter, I am here today because some of my non-violent ancestors, living near where Switzerland, France and Germany meet, made it to the border ahead of the authorities. They were not allowed to be peacemakers.

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Response to Macer and Boyle

Macer and Boyle open their Communication (Dec. 1995, p. 255) with "The debate over the compatibility of science and religion has been a feature of the last 120 years ... "[1] *That's long enough!* The ASA should adopt a policy to terminate the debate and include "compatibility" in the Statement of Faith.

Science and religion, the two most influential philosophies of all human knowledge, are compatible for most religions. For example, Albert Einstein, a Jew, said "Science without religion is lame, and religion [=Judaism] without science is blind."[2] Bucaille wrote "The association between the Qur'an and science is *a priori* a surprise, especially since it is going to be one of harmony, and not of discord."[3] About the Baha'i Faith, Aull wrote "A fundamental teaching of the Baha'i Faith is that science and religion are harmonious and complementary."[4] But for science and Christianity, the pervasive relationship is debate, or controversy, or contradiction, or warfare, or antagonism, or versus. Why?

Whitehead wrote "The *conflict* between science and religion [=Christianity] is what naturally occurs in our minds when we think of this subject."[5] Now isn't that curious? Not for Buddhists. Not for Hindus. Not for Jews. Not for Moslems. Not for Unitarians. Not for the Baha'i. Not for any other major religious grouping. Therefore, does the *conflict* relationship for science and Christianity make logical, common sense? My answer is "*No*!" What is your answer?

But Whitehead also wrote "A clash of doctrines is not a disaster — it is an *opportunity*."[6] There is a much more important question. What is *God's* attitude on the relationship between Christianity and science? On the basis of a couple of finite samplings, I perceive that *God's* attitude on this relationship is positive, compatible, and harmonious. Can you perceive that *God* considers Christianity is in *conflict* with science, or visa versa? I trust you agree this is not common sense, in fact it is nonsense. Christians should adhere to *his* attitude.

I suggest all Christians adopt as a fundamental conviction that a compatible relationship exists between Christianity and science. What is the ASA mandate? Provide a forum to perpetuate *debate*, or pursue compromise and conciliation to initiate resolution.

Pause for moment and think about the future of Christianity and its influence on the peoples of the world, particularly our Western society, when the pervasive mindset on its relationship with science is a harmonious one.

Notes

[1]Darryl Macer and Time Boyle, "Science and Christianity in Japan," *Perspectives on Science and Christian Faith* 47 no. 4 (1995): 255.
[2]See Louis De Broglie et al., *Einstein*, (New York: Peebles Press, 1979), 153, 219.
[3]Maurice Bucaille, *The Bible, The Qur'an, and Science*, (Paris, Seghers, 1987), 121.
[4]Brian Aull, "The Faith of Science and the Method of Religion," *Journal of Baha'i Studies* 1 no. 2 (1988): 1.
[5]Alfred North Whitehead, *Science and the Modern World*, (New York, Mentor Books pb, 1925), 162.
[6]Ibid., 166.

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Response to David Wilcox

In regard to David Wilcox's "Adam Where Are You? Changing Paradigms in Paleoanthropology" (*PSCF* 48:2, June 1996, 88-96), I would like to suggest that more recent data has changed many of the factual statements made in the article.

The article begins with the statement that paleoanthropology is in a state of crisis. The reference supporting this statement discusses the Out-of-Africa view vs. the Multiregional Model of human origins.[1] I was unable to find the word "crisis" or a synonym anywhere in the article. The authors certainly do not give any indications that paleoanthropology is in trouble. They simply attack the Multiregional Model.

Wilcox (p. 89) states that Neanderthal had "questionable phonetic ability". This was based on the work of Phillip Lieberman.[2] Lieberman claimed that the Neanderthal vocal tract was different from modern human vocal tracts preventing the formation of vowels. Lieberman's work predicted that the Neanderthal hyoid bone when eventually found would be radically different. This was disproved by the 1990 discovery of a complete Neanderthal hyoid bone, the first hominid hyoid (Adam's apple) ever found, which is identical to those in modern humans.[3]

Wilcox (p. 90) claims that Neanderthal is the ancestor of modern humans and claims that modern humans appeared first. Neither statement is correct. It has been many years since the prevailing belief was that Neanderthal was the direct linear ancestor of anatomically modern humans. Anatomically modern humans first appear in deposits dated 130,000 years B.P.[4] and Neanderthals first appear at Erhingsdorf, Germany and the remains are dated to 230,000 years ago.[5]

Wilcox states (p. 92) that the Mousterian culture arose around 100,000 years ago. The oldest Mousterian culture is dated to 250,000 years ago, very close to the first appearance of Neanderthals.[6]

The statement is made (p. 91) that there is no evidence of culture among *Homo erectus*. Among the earliest *Homo erectus* sites are found chunks of red ochre, a material with no known stone age use except body painting.[7] Microscopic examination of the edges of the stone tools of *Homo erectus* reveals wear patterns consistent with wood working and leather working.[8] Body painting and wood and leather working strongly imply a being with a culture.

The author (p. 93) compares the tool making ability of Neanderthals with that of Kanzi the chimp who has been taught to make stone tools. Neanderthals are called imitators but "not creative inventors." This comparison is quite flawed as the teachers of Kanzi note: "Moreover, Kanzi's progress so far as a tool maker suggests to us that early Oldowan hominids may exhibit a much greater cognitive understanding of the principles and mechanics of tool making than modern apes seem to be able to develop."[9] Neanderthal tools were much more complex than Oldowan tools which appear in rocks dated 2.4 million years ago.

The claim is made that there is no evidence of art among the Neanderthals (p. 92). Admittedly, the amount of art is small by comparison with the Magdalenian culture, but to say that there is none is wrong. Pendants made of reindeer phalanx and fox canine have been found in deposits dated at 50,000 years B.P.[10] Coloring pencils, made from minerals, have been found at many sites. It is not known what these pencils were coloring but they appear to have been artist tools. A fossil nummulite was found at Tata, Hungary, with a cross inscribed on it.[11] This came out after the Wilcox paper went to press, but the cover photo on the May 16, 1996 *Nature* shows a Neanderthal necklace which was either made or traded for by the Neanderthal.[12]

The anatomically modern people who constituted the Azilian culture (ca. 12,500-9,500) produced art no more spectacular than pebbles with lines, crosses, and dots on them.[13] If Neanderthal is to be excluded from humanity for only having simple art, then so should the Azilians.

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[1]C. B. Stringer and P. Andrews, "Genetic and Fossil Evidence for the Origin of Modern Humans," *Science* 239 (1988): 1263-1268.

[2]P. Lieberman and E. S. Crelin, "On the Speech of Neanderthal Man," *Linguistic Inquiry* 2 (1971): 203-222.

[3]B. Arensburg, et al., "A Reappraisal of the Anatomical Basis for Speech in Middle Palaeolithic Hominids," *American Journal of Physical Anthropology* 83 (1990): 137-146.

[4]Chris Stringer and Clive Gamble, *In Search of the Neanderthals*, (New York: Thames and Hudson, 1993), 218.

[5]Ibid., 66.

[6]James R. Shreeve, *The Neanderthal Enigma*, (New York: William Morrow and Co., 1995), 139.

[7]D. Bruce Dickson, *The Dawn of Belief*, (Tuscon: The University of Arizona Press, 1990), 42-44.

[8]Kathy D. Schick and Nicholas Toth, *Making Silent Stones Speak*, (New York: Simon and Schuster, 1993), 271.

[9]Ibid., 139.

[10]Victor Barnouw, *An Introduction to Anthropology: Physical Anthropology and Archaeology*, Vol. 1, (Homewood, Illinois: The Dorsey Press, 1982), 156.

[11]Leslie Freeman, "The Development of Human Culture," in Andrew Sherratt ed., *The Cambridge Encyclopedia of Archaeology*, (New York: Cambridge University Press, 1980), 85

[12]J-J Hublin, et al., "A Late Neanderthal Associated with Upper Palaeolithic Artefacts," *Nature* 381 (May 16, 1996): 224-226.

[13]Dickson, *The Dawn of Belief*, 83.

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