PERSPECTIVES on Science and Christian Faith

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

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Does the Trinity Play Dice?

Solomon's Plant Life:
Plant Lore and Image in the Solomonic Writings

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

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Perspectives on Science and Christian Faith

MANUSCRIPT GUIDELINES

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Creation and the Churches

The understanding of the opening chapters of the Bible has been a particularly difficult question for Christians in the more conservative wing of the church. Our founders wanted the ASA to be a mediating force. This was not to be the case as the ASA was fractured by a group who formed an organization to proclaim their truth. The issue arises periodically in all conservative groups—Baptist, Reformed, Presbyterian, Lutheran, Nazarene, Methodist—on the floor of denominational conventions, in the local church, Christian schools and colleges. The fires are fueled by TV evangelists, traveling lecturers, and (today) the Web. The matter becomes personal when candidates for the ministry are denied credentials, church board members brought to trial, and Christian teachers and college and seminary professors are attacked for their views.

PSCF has offered papers on all sides of the question over the last five decades. While there appears to be a shift from a wooden, literal interpretation almost universal in an earlier day, there is still a vocal and influential minority which sees "loss of faith" in such a move. The lines seem to be cast in concrete.

There have been two recent signs of hope. A *World* magazine article, "The Genesis of the Problem" (*World* 12 [July 26/August 2, 1997]), emphasized the need to discuss issues rather that snipe at one another—"more discussion, less defensiveness ... more debate, less denouncement." A Nazarene church conference of biblical scholars and scientists found common interests and respect for each group's concerns. Evangelicals need to address science/faith questions in the core curriculum of their colleges and seminaries in ways that will enable students to grasp the issues and the solutions that have been offered. Church-related study groups and the inclusion of science/faith discussion in the Christian education program at *all* levels can be effective. ✣

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In This Issue

David Moberg begins this issue with a plea that we consider scientific research as a "Christian calling." Arguing that his case is strongly supported by "biblical exhortations and advice," he counters the negative attitudes toward research held by some Christians and draws attention to the benefits and pitfalls of a life in research.

George Murphy's "Does the Trinity Play Dice?" takes a different tack on the interpretation of quantum theory by employing a trinitarian approach rather than that of the vague god of Einstein and others. Key to his interpretation is God's self-revelation in Jesus Christ.

Lytton Musselman offers a view of David's son Solomon as "naturalist king" in his examination of the thirty-three plants and plant products found the Solomonic writings. Francis Bacon was influenced by the work of this student and teacher of natural history.

In our first communication, Joseph Spradley considers the old question of extraterrestrial life in the light of recent discoveries of Extrasolar planets orbiting several sunlike stars. Dennis Jensen then challenges agnostic Paul Draper's three arguments against theism: evolution, distribution of pleasure and pain, and intrinsic probability.

Young Scientists' Corner

How You Can Help Young Christians in Science

by Jennifer J. Wiseman,* Johns Hopkins University

This longer edition of the "Young Scientists' Corner" is primarily intended for those who would like to know how to encourage the younger generation of Christians entering scientific vocations. These are exciting times for those of us entering careers in science as Christians. With relativism governing many philosophies in the humanities these days, the sciences remain (ideally) devoted to the pursuit of Truth, and consequently many young Christians are attracted to the sciences and are pursuing productive and creative careers. There is a level of openness and curiosity about Christian faith among young non-Christians in the sciences that stands in contrast to the antipathy between religion and science often assumed in decades past. We feel the excitement of opportunity to reach out to our scientific colleagues with the Light of the Gospel, to serve in science as our Christian calling, and to share the discoveries of God's creation with our fellow Church members. But we need encouragement and support.

There are ways that more experienced scientists and the ASA can help. Over the spring and summer of 1997, five graduate student and postdoctoral members[1] of the ASA were invited to share ideas with each other, via an e-mail discussion group, on ways ASA members can help us to be fruitful, and ways young scientists can help the ASA. Our recommendations were presented as a report to the ASA. Highlights are summarized here under four main concerns: vocational direction, personal support, outreach to the Church and to the world, and young people and the ASA. A fifth section reviews suggestions for ways experienced ASA members can help us.

Choosing a Scientific Vocation in a Changing World

Science is inevitably directed largely by the motives of those providing the funding and support. Science funding often ends up directing what questions get asked, and what kind of "truth" is sought. As young scientists looking for stable job support, it will be almost impossible not to be swayed by money/job availability. The giant drivers of much of science research are profit-seeking corporations and military/government concerns. While these directives have merit in their own right, the percentage of science funding from alternative organizations is possibly shrinking (e.g., the NSF, charities, nonprofit organizations, research branches of the government, etc.). Ethical issues are also growing in complexity. Young scientists are finding themselves working and grappling directly or indirectly with tough issues such as bioethics, cloning, human fetus research, animal experimentation and alternatives, and weapons research. Political and economic pressures are affecting the balance of "applied" versus "basic" research.

Young Christians in the sciences can no longer simply follow the conventional steps of a scientific career path without understanding the bigger picture of the directions and global implications of science and technology. We could benefit from the wisdom of more experienced ASA members in helping us to choose our career paths such that we can be most effective in molding the direction of research or teaching in our spheres of influence. We need to be made aware of the pros and cons of all sides of complex ethical issues. And we need to be educated and prepared if we are called upon to "speak out" about issues threatening the world today (e.g., sustaining

ASA Member

growing populations, pollution, habitat destruction, spread of disease, etc.). If we enter teaching, we need to learn about creative methods that present the details and the history of science in ways that bless students and honor the Lord.

Personal Support

Young Christians need encouragement to see their calling as scientists as a valuable Christian vocation. Though there are painful exceptions, the work environment for most Christian students in science today is not hostile. In fact, there are many young Christians in training in the sciences. Christian fellowship groups for graduate students are beginning to form and flourish on many campuses, and a large percentage of these Christian graduate students and postdocs are scientists.

It is during these formative years that young scientists are faced with some weighty decisions. For example: What kind of thesis research should I pursue? My advisor has asked me to do fetal tissue experiments; should I refuse and risk my position in graduate school? (This really happened to one student.) How do I explain my faith to my advisor and my fellow graduate students? Wouldn't it be more valuable to God for me to join some of my Christian friends who are planning careers as evangelists or in direct ministry to the poor rather than to spend my life, for example, evaluating molecular spectra? Traditional Christian churches and circles do not always recognize the unique environment that the young Christian scientist faces. Science is sometimes viewed with misunderstanding and suspicion or ignored as unspiritual. These reactions are discouraging to young people who want to choose a career path that glorifies God. Hearing encouraging talks from older Christian scientists can be a great encouragement to younger people seeking guidance.

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Personal issues also come into play as students and postdocs prepare for a lifetime career. How do single scientists find a circle of supportive, believing friends when they are no longer students? How does one balance family life with career calling? In past decades, most scientists with children were men in "one-career" families where their wives could help them by carrying much of the load of child-rearing and domestic support. Today, more women are entering scientific fields, and of these women scientists, those who marry often marry scientists. These partnerships can produce amazing opportunities for joint service in science. Yet this does often mean that now two adults are juggling two scientific careers, trying to be productive and publish, and seeking tenure during the years of raising young children. These young Christians want to be able to serve God faithfully as good scientists and also to be good, nurturing parents. They have questions: How can we be most supportive of our spouses as scientists and as parents? Should our career goals and expectations be lessened or dropped to allow for more time with our children? Or, if our scientific opportunities are truly God's calling, then how do we work out a cooperative balance of child care and research time with our spouse? Meeting Christian scientists who have trod these difficult paths is a great encouragement.

Christian women are serving in growing numbers as researchers, laboratory directors, and teachers in both Christian and secular universities and laboratories. These expanding opportunities to use scientific talents are encouraging. Yet there are sometimes few role models or little encouragement for science as a calling from traditional Christian circles. (A recent ASA-related conference for Christian women in science at Eastern College was attuned to this need.) Young scientists from traditionally under-represented ethnic groups can also feel a deep sense of loneliness and self-doubt. Having Christian "mentors" can help to continually revitalize our vision for science as a personal calling and ministry.

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Outreach to the Church and to the World

"I think the most important outreach of the ASA is to nonbelieving scientists." This is a quote from one of the contributors to this report; we all feel that reaching out to

our colleagues is an important desire we face in our everyday lives. We work side-by-side with colleagues and friends from many different countries and religious backgrounds. We want them to know the Lord, but we recognize that some popular methods of sharing the Gospel are not appropriate or helpful for our scientific friends. Many times our friends in science have heard Christian viewpoints through the media that give the impression that Christians are ignorant about science or that they reject what seems clear from scientific research. Naturalistic philosophy and scientism are also at work in the worldviews of some. We would find it helpful to learn ways our more experienced Christian colleagues have reached out to their scientific peers. Clear materials, which would introduce our friends to the Christian faith while embracing modern scientific discoveries, are needed.

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We are also challenged by the need to reach out to our Christian friends. Churches and Christian schools are sometimes heavily influenced by the perception that Christianity and scientific processes (e.g., Big Bang cosmology, evolution, etc.) cannot mix, and that Christians must always have a "defensive" stance toward science. This is tragic because our Christian friends can miss out on rejoicing in some of the wonderful discoveries about our universe that reveal God's glory and creativity. And Christian children can be discouraged from considering scientific careers. Many of us enjoy going into schools and churches and offering presentations and classes relating faith and science. Diligent observations of God's creation and the faithful presentation of our discoveries should draw people to the Lord in a powerful way. We would benefit from having materials to present in these settings as well as examples of how to find and use such opportunities to the fullest.

"Outreach" can also be viewed in the prophetic sense and can include speaking out about environmental destruction and the misuse of technology. Another part of "outreach" is to share the wonders and the benefits of scientific knowledge and opportunity with the poor and others who might otherwise be left out. It helps us to hear of ways to join in such efforts.

Young People and the ASA

Young scientists must join the ASA and remain in it if it is to continue to thrive. We believe the ASA can be a great help to young scientists, and we are glad and honored to know that the ASA is seeking to serve younger scientists in new ways. One result of this concern is the appearance of this "Young Scientists' Corner" in *Perspectives on Science and Christian Faith*—very nice! We hope, also, that more people will write articles for *PSCF* from experience about the "nuts-and-bolts" of being a Christian researcher or science teacher, such as papers about discerning God's will for a career, sharing faith with scientific colleagues, running a laboratory, surviving the tenure track, and maintaining family and professional balance.

We would benefit from having materials to present in [schools and churches] as well as examples of how to find and use such opportunities to the fullest.

Many of our young colleagues have simply not heard about the ASA. But a great way to get the word out is for ASA members or local sections to provide literature, books, and speakers to campus graduate school Christian fellowship groups and campus-related churches. This is an effective way to establish relationships with young scientists, who seem to be joining graduate fellowships in larger numbers than ever before. There are also regional and national conferences now for Christian graduate students, and having an ASA presence at these meetings is crucial to encouraging students and advertising the ASA.

One student commented that visiting local ASA section meetings can be a bit intimidating because of the stark age and career differences between most of the attendees and the few students attending. Perhaps occasional meetings could be arranged with special efforts to invite students from the area.

Even secular scientific conferences can provide opportunities for Christian fellowship. I am a postdoctoral astronomer. Over the past two years, Christian astronomers, including students, postdocs, and faculty, have gathered informally for lunch during the annual national professional astronomy conference to meet new friends and discuss being Christians in astronomy (and we introduce these new friends to the ASA, too).

What Can You Do to Help?

How can you help young Christians considering a calling to serve as scientists? Many of you have gone before us living lives of faithful obedience to the Lord in your scientific careers. Here are some ways the ASA or individual Christian scientists can help us "carry the torch":

- Be a "mentor" to young Christians in the sciences. ASA scientists can visit local university chapters of Christian fellowship groups and meet the graduate and undergraduate students considering scientific careers.
- Help your new friends "one-on-one" to make wise decisions. It's unlikely that students will have the time or courage to seek out mentors on their own, but meeting Christian scientists who come to a friendly setting, such as a church or campus fellowship meeting, is a wonderful encouragement for students and a good way to start friendships.
- Help establish a network between ASA and related organizations like InterVarsity and science fellowships in other countries so that we can share resources (e.g., speakers, books, and conferences).
- Seek to be aware of current directions of science and career paths for young people, including the larger funding and ethical issues.
- Explain the differences between a career of teaching and one primarily of research.
- Show us how to have a healthy family life while keeping up with publishing pressures.
- Equip us to start our own discussion groups on campuses or in churches.
- Provide us with examples of courageous people who have made difficult decisions or statements involving science ethics and goals.
- Keep advertising job opportunities.
- Educate us about even "nontraditional" career and ministry options that might be our most effective service to the world.
- Help us to become aware of and to connect with groups serving the poor in various ways, such as teaching in the inner city, encouraging people to join in the scientific endeavor who have historically been left out, and improving living conditions in developing countries.
- Continue to provide materials we can use for outreach to our non-Christian colleagues and to the Church.
- Write articles for *PSCF* that discuss the "how-to" of being Christians in science.

This is a long "wish-list"! We are grateful that many of you are already striving to do many of these things. Perhaps the most important request is for fervent prayer that God would keep us all, young and old, tightly bound to the Vine, our Savior, the Lord who created the universe we study. May he raise up good scientific stewards who serve with love, and may he be praised and glorified by our service.

We hope that more people will write articles for* PSCF *from experience about the "nuts-and-bolts" of being a Christian researcher or science teacher, such as papers about discerning God's will for a career, sharing faith with scientific colleagues, running a laboratory, surviving the tenure track, and maintaining family and professional balance.

[1]The contributors to this discussion and report include: Eric Arnoys, Michael Everest, Steven Hall, Johnny Lin, Liskin Swint-Kruse, and Jennifer Wiseman.

News & Views

The *Nature* Debates

*by Editorial Staff**

The Web offers a wide variety of opportunities to discuss science/faith questions. For practical reasons most discussions are *unmoderated*. The result is often less than ideal. The loss of focus, dominance by a few vocal participants, contributions by those with dubious qualifications, a flood of material, repetition of points by latecomers to the discussion, fiery rhetoric, and uncertain termination points; the reader is left to sort out the wheat from the chaff.

Moderated discussions offer many advantages. An effective moderator can keep the debate focused and insure quality of discussion, independence, breath of view, broad intellectual appeal, brevity, and closure. One recently inaugurated series, *Nature* debates, sponsored by the British journal, *Nature*, illustrates this strategy. Beginning 19 November and running through 24 December 1998, Moderator Andrew Smith (Natural History Museum, London) led a discussion on the question, "Is the fossil record adequate?" Smith's two-page introduction laid out the pros and cons on the question and provided basic references. Three differing points of view of similar length followed. Succeeding weeks saw exchanges by an international set of experts and *representative* e-mail contributions from the audience. Smith concluded the discussion by drawing together the main ideas that had emerged during the six weeks. Publication on the *Nature* web site: http://helix.nature.com/debates/index.html allowed both timely discussion and a permanent record.

Moderated discussion on the ASA web site offers many opportunities for an organization committed to freely discussing questions on which there is disagreement. The editor would be open to proposals for exchanges on the ASA site. ✣

Politics & Environment

*by Editorial Staff**

Artificial intelligence researcher and Unabomber victim David Gelernter is vociferous about environmentalism. He wrote an opinion piece in *The New York Post* (August 27, 1998, Thursday, Post Opinion; p. O37) under the headline, "Religious Leaders' New False Idol; Is Environmental Hypochondria an Excuse to Avoid Their Real Jobs?" Gelernter wastes no time signaling his position about ecclesial backing of the UN Kyoto Protocol:

> The protocol commits rich nations such as the United States to fight global warming by sharply reducing the amount of carbon dioxide we vent to the atmosphere. Roman Catholic bishops and many southern conservatives are not on board; Orthodox Jewish groups (as far as I know) are likewise uncooperative. But the rest of our religious mainstream seems to have endorsed Kyoto—thereby executing a startling one-two combination punch that slams science and religion simultaneously, by subordinating both to cheesy politics.

The U.S. Constitution (Art. VI) gives ratified treaties the force of law, so that domestic goals of the federal administration which stand no chance of passing as legislation can be advanced through the treaty route.

Gelernter further opines:

> Granted, global warming might turn into an actual, confirmed problem some day. In the meantime, we face an actual, confirmed problem right now. Our natural environment is in good shape, but our spiritual environment is in steep decline. And with every passing year, our religious leadership seems to care less about religion.

While the ASA addresses the science-religion interface, the political aspect of this and other issues continue to grow in significance. The range of viewpoints expressed within the ASA on environmental issues, in the context of a common commitment to the Gospel, helps to sharpen our discernment on this matter, and to inform non-ASAers of its multiple dimensions. Political scientists in the ASA are likely to have an increasing contribution to make to this issue, as it engages the interest and use of the international elite in influencing global economics. ✣

Carbon 14 and Lead Deposition

*by R. Joel Duff**
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The 11 September 1998 issue of *Science* included an article, "History of Atmospheric Lead Deposition Since 12,370 ^{14}C yr BP from a Peat Bog, Jura Mountains, Switzerland" (pp. 1635–40, summarized on pp. 1622–3). This article reports the findings from

*ASA Member

the study of lead (Pb) and scandium (Sc) concentrations in a core from a Swiss peat bog. The lead concentrations were found to vary greatly over the length of the core and, based on previous studies,[1] are attributable to the effects of atmospheric lead deposition alone. Interestingly, lead concentrations from a depth of 145 cm, dated at 3000 ^{14}C yr BP, to the top of the 650 cm core can be easily correlated with the record of lead production over the past 3000 years. At the 145 cm mark, the $^{206}Pb/^{207}Pb$ ratio begins to decrease and the amount of Pb relative to Sc no longer remains in the same proportions. This is indicative of the advent of mining and the subsequent release of lead into the atmosphere. Prior to this time, ratios of radiogenic lead and Pb/Sc match those from exposed soils from Europe and Northern Africa. Above 145 cm, changes in deposition rates and $^{206}Pb/^{207}Pb$ ratios follow patterns of the use of lead throughout history including the rise and fall of the Roman Empire, the medieval silver production in Germany, the Industrial Revolution, and, finally, to its highest levels with the introduction of gasoline containing lead.

The ^{14}C dates of each of these events in the Swiss bog correlates well with the dates for these events as they are understood from other archeological and historical records. Hence, the lead concentrations in the core provide dependent confirmation of the validity of ^{14}C dating over at least the past 3000 years. Further ^{14}C dating of the core gives a date of 12,370 yr BP for the bottom of the core and the dates derived from 30 cm and below (above represents less compacted peat) suggest a uniform rate of peat production over the entire period. Lead concentrations increase, though the ratios of radiogenic and Pb/Sc do not change, at 220 cm dated at 5320 BP. This is thought to be the result of human occupation of the surrounding regions and deforestation resulting in increased release of dust into the atmosphere. Lower in the core, there are two notable peaks at ca 520 and 400 cm that were ^{14}C dated at 10,590 and 8230 years BP, the former of which corresponds to the Younger Dryas period. These peaks are distinguished as being non-anthropogenic in origin because the $^{206}Pb/^{207}Pb$ and Pb/Sc ratios are reflective of the natural compositions of rocks that would have been exposed during these times of reduced vegetative cover and increased erosion.

Because presumably well-understood historical events are recorded in the top 145 cm of this 650 cm core, it seems natural to ask what happened during the deposition of more than ¾ of the peat in this bog. Both ^{14}C dates and peat production rates over 3000 years suggest at least 12,000 years of elapsed time. If the $^{12}C/^{14}C$ ratio had been much higher in the past, as some suggest, then the peat would have to be interpreted as having been deposited at much higher rates in the past. Though it is not impossible that these two could be correlated in some fashion, I would suggest that there are further complications that make this unlikely. For example, the timing of the origins of this bog is not clear. I would submit that no current model of a young earth would place the origins of this bog near the time of a global flood. Rather the bog would have originated at least several hundred years after the flood, due to the age and nature of the rock lying below the bog and the origins of the valley in which the bog is found. This would then force the production of over four meters of peat into a period of less than 1000 years, during a time postdating the supposed time of a much higher $^{12}C/^{14}C$ ratio. Further, the physical position of these bogs as isolated, raised mounds leaves virtually no opportunity to have materials transported into them from anywhere but the atmosphere. Examination of the entire core demonstrates that when the effects of anthropogenic sources of lead are eliminated, the amount of atmospheric influx of lead has been nearly constant throughout the entire core (except for two short periods around 520 and 400 cm). If the *Sphagnum* in the bog had simply accumulated at much faster rates in the past, I would not expect the amount of lead deposition in that *Sphagnum* to have remained at a nearly constant level. Lastly, the observed pattern of changes in lead concentrations in this core have been shown to be correlated with similar patterns in other bogs and lake sediment records in Europe and the Greenland GRIP ice core. ✣

Note

[1]P. Steinmann and W. Shotyk, "Chemical composition, pH, and redox state of sulfur and iron in complete vertical porewater profiles from two *Sphagnum* peat bogs, Jura Mountains, Switzerland," *Geochimica et Cosmochimica Acta* 61:6 (1997): 1143–63; and ———, "Geochemistry, mineralogy, and geochemical mass balance on major elements in two peat bog profiles (Jura Mountains, Switzerland)," *Chemical Geology* 138 (1997): 25–53.

The Great Commission and Research

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Many Christians fail to realize that the Great Commission of Jesus Christ includes teaching believers to obey everything he commanded. They assume that only church-related occupations are "full-time Christian service" and, as a result, deprecate scientific research. Yet research has a solid biblical basis. It helps us apply biblical teachings about being good stewards, loving God and neighbor as we love ourselves, filling our minds with praiseworthy things, and living as children of light. It is an important tool that is greatly needed for the improvement of Christian ministries and institutions. For believers, scientific research is a Christian calling.

Research is as ancient as human society, so pre-scientific applications of research methods are clearly evident in the Bible. For example, in the Old Testament, we read that "to search out a matter is the glory of kings" (Prov. 25:2)[1] and "Plans fail for lack of counsel, but with many advisers they succeed" (Prov. 15:22). Censuses were taken both with and against God's approval (Num. 1:1–54; 26:1–62; 2 Sam. 24:1–17; 1 Chron. 21:1–15; Luke 2:1–3). Caleb and other representatives of the twelve tribes were sent into the land of Canaan to explore and evaluate the land and its people (Num. 13:1–25). Jesus reminded his first hearers and us that no one successfully builds a tower or goes to war without planning based upon information-gathering research (Luke 14:28–33). Nonetheless, the systematic development of research methods as a scientific enterprise has emerged only in modern history, so there is no word directly equivalent to *research* in the original languages of the Bible. As a result, many Christians fail to recognize that modern scientific research methods are strongly supported by biblical exhortations and advice.

Research is firmly grounded in the "Great Commission," Jesus' concluding summary of what he wants Christians to do between his first advent and second coming:

> All authority in heaven and on earth has been given to me. Therefore go and make disciples of all nations, baptizing them in the name of the Father and of the Son and of the Holy Spirit, and teaching them to obey everything I have commanded you. And surely I will be with you always, to the very end of the age (Matt. 28:18–20).

Most Christian groups have more faithfully followed the evangelistic commands, to go, to make disciples (evangelize, save souls, produce converts, etc.), and to baptize them, than the ethical command, to teach obedience to Jesus' commands (though a few groups have emphasized ethics more than evangelism). What Jesus commanded was not intended to destroy the Mosaic Law but to fulfill its essence. Thus, the New Testament repeatedly shows how its ethical precepts, as well as the soteriological emphasis of the Law, point always to Jesus as the Messiah (Christ), the Lamb of God who provided the final and perfect sacrifice for the sins of all humanity. Teaching *all that Jesus commanded* requires learning his words and following his example of what is right and wrong conduct. Simply knowing these commands intellectually is not enough. Christians must act upon that knowledge.

Curtailing and Repressing Jesus' Commission

While most pastors, religious educators, and other church leaders accept the Great Commission as a synopsis of the "job description for all Christians," they tend to interpret "going into all the world" as mainly a geographic concept that pertains to territories, nations, and people groups. Some as-

*ASA Fellow

sume that obedience to the will of Christ automatically follows conversion and baptism, while others act as if they believe that teaching how to live is not important because "saving souls" constitutes the entire work of the church. Far too few recognize that "all" includes pervading every nook and cranny of every society with the light of the Gospel. Still fewer appreciate the fact that scientific and scholarly research is included in the specifically Christian work of the body of Christ. Some, indeed, actively oppose the use of research in their organizations and ministries.

Ironically, even those Christians, who give no explicit attention to research as a part of obeying Christ's commands, sometimes do use research. They benefit from its applications as a tool for church growth or as a means by which to identify people groups, to analyze their cultural traditions, to reduce their languages to written symbols and translate the Bible into them, and to apply its message to the realities of their cultural contexts.

Moreover, some members of the "anti-research" camp preach sermons that include references to selected research findings to illustrate or drive home a particular point. Typically they do this to bolster a predetermined conclusion about the realities of people or society, not to test whether a tentative conclusion is, or is not, true. If ever they do use research methods, they tend to do so only to prove that their foregone conclusions are correct. They gather all the supportive evidence they can find, overlook contrary data, and conduct tests that do not seek all pertinent data, whether pro or con. Thus they violate their own integrity and that of true scientific methodology by card-stacking techniques, not realizing that the biblical admonition to "prove all things" (1 Thess. 5:21, KJV) actually means to "test all things," even as automobiles still are tested on "proving grounds." Genuine evaluative research does just that—it tests to discover observable evidence about realities in the world God created.

Apart from the occasional use of "research illustrations" drawn from a preacher's general reading or television viewing and the use of research as a tool for evangelism and missions, one seldom hears the clergy treat scientific and scholarly research as a legitimate, honorable, and important *vocation or calling* from God. There still is a tendency to believe that only a few select people are "called into full-time Christian service" (as if anyone can be Christian less than full-time!) and that "serving the Lord" occurs mainly, if not exclusively, through "church work" careers, such as pastors, missionaries, church musicians, religious educators, or, among Catholics, in a "vocation" as a priest, monk, or nun. People with such views do not look upon research as an aspect of fulfilling Christ's commission, nor do they view scientific occupations as a Christian calling.

Negative Views of Research Among Christians

When research directly pertains to the lives or work of Christians, their reactions and comments typically are much more derogatory and censorious than supportive. Negative criticism is especially harsh against any evaluative studies suggesting that change in Christian institutions or ministries is desirable. Anti-change spokespersons implicitly fail to acknowledge that there has been absolute perfection in only one person, Jesus Christ; that if we who are Christians claim to be without sin, "we deceive ourselves and the truth is not in us" (1 John 1:8); and that therefore no church or other Christian institution or agency can be perfect. Unless their flaws are discovered and diagnosed—as research can help us do, we are not likely to correct them. So, the institutional diseases are likely to fester and spread. Negative criticism also is expressed against the real, contrived, or imagined flaws of "the university" in which scientific and scholarly work is done, for its research often contributes to changes that disturb old customs, folklore, and traditions.

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Those who resist constructive changes of personal and institutional behavior, whether inspired by research or not, usually are unaware that their rigid attempt to remain without change, while the surrounding society is changing, actually results in a changed relationship to that world. "To oppose social change categorically is the equivalent of idolatrous worldliness, the features of which are outlined in a non-religious context by the social sciences."[2]

Negative criticism is especially harsh against any evaluative studies suggesting that change in Christian institutions or ministries is desirable.

Change is inevitable, for people change as long as they live. Society likewise is continually changing. Thus, applications of the Gospel to it (but not the Gospel itself) must also change. Only the Creator is unchanged from age to age and generation to generation. "Jesus Christ is the same yesterday and today and forever" (Heb. 13:8).

Even some scientists and scholars are tempted to believe that research is of little or no value in God's kingdom, except for the mild concession that they earn a living by it and hence can tithe their incomes and make other contributions to the financial needs of their churches. Often this negative belief is created and reinforced by active participation in those fundamentalist and conservative-evangelical fellowships that emphasize a narrow interpretation of God's call to Christian service, limiting it to directly church-related pastoral, evangelistic, and missionary vocations.

The truly biblical teaching is that *all believers in Christ* have been gifted by the Holy Spirit and are called to exercise those gifts for the common good (1 Cor. 12:1–31). The church is the body of Christ. Whatever its members do to serve that body and to reveal the love of God in the world—not only within the institutional church—is the work of Christ. The narrow, dogmatically limited version of what constitutes a "call to Christian service" has been the source of many misfits in Christian ministries. Instead of thinking of themselves as first-class servants of God, many people negate themselves as inferior third-class professionals just because they are not ordained and are "only" in research-related or other "secular" vocations. Therefore, this limited view has caused misery and guilt feelings among many and has impeded the impact and effectiveness of Christianity in society.

Truncated beliefs and actions of Christians devalue research and inoculate believers against its beneficial contributions to the work of Christ today. The antagonism of many Christians toward "secular science" and their suspicion of all applications of "worldly investigations" greatly reduces the effectiveness of Christianity. Repulsing scientists and "the intelligentsia" from churches and from hearing the Gospel is anti-evangelistic. It also contributes to the failure of Christians to benefit from many rich findings from research done in non-Christian settings. We must always remember that God can use the work of skeptics and atheists to praise himself, even as the pagan King Cyrus was God's "anointed," his "shepherd" whom he used to fulfill his word and accomplish his purposes (Isa. 44:28; 45:1; 2 Chron. 36:22–23).

Many problems in churches, society, and even our own psyches can be overcome, at least in part, by recognizing that *there is a solid biblical basis for good scientific research*, whether applied or theoretical, in all of the biological, physical, and social sciences. If Jesus walked among us today, his comment about the low status assigned to the sciences and scientists in his kingdom on earth might be similar to his teaching on so many other subjects: "You are in error because you do not know the Scriptures or the power of God" (Matt. 22:29). The Bible is our fundamental guide to faith and conduct in the realm of research, as well as in all of the rest of life. Although research is always limited, sometimes biased, and open to abuse, its practical and theoretical applications can make Christians much more effective disciples of Jesus Christ.

The Biblical Mandate for Research

Those who are uninitiated to the nature and importance of research in God's kingdom do not recognize most biblical passages related to the nature and importance of research as relevant to research. They are as blind to that reality as the countless people who do not realize that ordinary words like *many, more, some, few, several, less, often, numerous, plentiful, least,* and *plurality* are imprecise statistical concepts.

No specialized fields of investigation and study, such as anthropology, astrophysics, biochemistry, criminology, demography, economics, geology, linguistics, microbiology, physiology, psychology, sociology, and the myriad other sciences and areas of

specialization as we know them, were known when the Bible was written, so why they are not mentioned in the Bible is no mystery. Nevertheless, there is much in Scripture that is directly pertinent to modern methods, manifestations, and styles of research activity. Insufficient attention has been given to the core elements of just what it means in the twentieth and twenty-first centuries to apply the pre-technological-era teachings of Jesus in order to obey everything that he commanded. Here is a brief introduction to some biblical teachings that are especially relevant to research.

Humanity has a **stewardship responsibility**. "The earth is the Lord's, and everything in it; the world and all who live in it" (Ps. 24:1; see also Gen. 2:15; Ps. 50:10, etc.). This fact contributes to many New Testament admonitions to dedicate our possessions, abilities, time, energy, opportunities, and our very selves to Jesus Christ, for all these belong to God who created and redeemed us. People are not owners, but merely stewards of them. "Each one should use whatever gift he has received to serve others, faithfully administering God's grace in its various forms" (1 Pet. 4:10). We can do this much more effectively with the help of systematic observation, evaluation, and other research methods and tools.

There is much in Scripture that is directly pertinent to modern methods, manifestations, and styles of research activity.

Sometimes we find it difficult to know precisely how to **love the Lord with all our heart, soul, mind, and strength** (Luke 10:27; Deut. 6:5) in the midst of today's circumstances, technology, and institutions. Research to discover the environmental, psychological, social, and spiritual motivations, causes, and consequences of personal and collective actions can help us to love God more sincerely and completely.

Often we find it even more puzzling to know how to **love our neighbors as we love ourselves** (Luke 10:27; Lev. 19:18). Social and behavioral research can help to teach us how to prove ourselves to be neighbors to those who are in need (Luke 10:36). "Love does no harm to its neighbor. Therefore love is the fulfillment of the law" (Rom. 13:10). Research sometimes demonstrates that "good" actions have harmful results. Whenever that occurs, the acts must not represent perfect love, no matter how affectionate our interpersonal relationships with others or how fervent our internal sentiments.

Christians should **"do good to all people,** especially to those who belong to the family of believers" (Gal. 6:10). Most major political battles of our society pertain to opinions about the ways in which Christians or the body politic at large can and ought to do good. Research can disclose the extent to which doing good to some people harms others. It can reveal whether what seems to be good on the surface actually has more short- or long-range negative consequences when seen in its larger context.

Believers in Christ are told to "**fill your minds with those things that are good and deserve praise:** things that are true, noble, right, pure, lovely, and honorable" (Phil. 4:8, TEV), as well as to take pains "to **do what is right**, not only in the eyes of the Lord but also in the eyes of men" (2 Cor. 8:21). Often research is necessary to determine whether certain kinds of attitudes, thoughts, and actions have scripturally wholesome consequences or result in more harm than good, as well as to determine people's opinions about what is considered right "in the eyes of men."

The Scriptures often warn us about the wiles of Satan, the Evil Tempter who is "**the father of lies"** but comes disguised as an **"angel of light"** (John 8:44; 2 Cor. 11:13–15) to deceive even God's elect children (2 Cor. 11:3–4, 14; 2 Thess. 2:9; 2 John 7–8). Countless groups and movements today, especially those connected with ancient paganisms that deceitfully pose as "*New* Age," use words and symbols associated with holiness, happiness, spirituality, health, wealth, and light. Many scoffers against Christianity play the "Gotcha" game of identifying moral and behavioral flaws among God's people in an erroneous assumption that even one peccadillo or hypocrisy of a believer invalidates the entire Gospel of salvation through Jesus Christ (see Jude 17–19; 1 John 2:21–23; 2 Pet. 2:1–3). Various enemies of Christ use Scripture, but twist or misinterpret it even as Satan did in his temptation of Jesus (Matt. 4:6). They lift biblical words and phrases out of context and (usually for a fee) disclose "new revelations" of "the Bible's secret meanings." Careful theological, philosophical, semantic, psychological, and sociological research can help to prevent seduction by their glittering words and enticing ideas.

Research under the aforementioned and other ethical precepts can help us to "**Live as children of light** ... and **find out what pleases the Lord**. Have nothing to do with the fruitless deeds of darkness, but rather expose them" (Eph. 5:8–11). Research can

help us establish and retain our qualities as "the salt of the earth" and "the light of the world" so that people who see our good deeds will praise our heavenly Father (Matt. 5:13–16).

This, in turn, overlaps with the **evaluation or "fruit testing"** encouraged in passages like Gal. 5:19–24 and by Jesus' words, "By their fruit you will recognize them [those who are false prophets, as well as the good trees]," for "Not everyone who says to me, 'Lord, Lord,' will enter the kingdom of heaven ..." (Matt. 7:15–23). To be sure, this type of research can be dangerous, for we all are tempted to do it censoriously, with a haughty spirit, or with preconceived criteria based on personal interests or worldly identities rather than on biblical standards.

In all evaluations, we must heed the Lord's warning **to judge not lest we ourselves be judged** (Matt. 7:1). Our objective should be that of redirecting ourselves in humility and restoring those who have fallen, instead of arbitrarily and summarily excluding them from our fellowships (Gal. 5:26; 6:1–3) without giving them a second (or seventh, Luke 17:3–4; or seventy-seventh, Matt. 18:21–22) chance.

Possibly the most direct biblical instruction to do research is found in 1 Thess. 5:21–22, "Test everything. Hold on to the good. Avoid every kind of evil."

It is not always our privilege to know those who belong to God through faith in Jesus Christ, for as mere humans we never can see the whole picture known to God alone. Therefore research that classifies people into categories of Christians and non-Christians must always be interpreted with great care. The Christian life is one of growth and development from spiritual infancy at the "second birth" of regeneration. It advances toward the spiritual maturity of "the whole measure of the fullness of Christ" (Eph. 4:13) that arguably is not perfectly attainable in this life. We must remember the two-sided seal of 2 Tim. 2:19—the Lord knows who are his, and all who confess his name must turn away from sin.

Possibly the most direct biblical instruction to do research is found in 1 Thess. 5:21–22, "**Test everything.** Hold on to the good. Avoid every kind of evil." We must test even our traditional interpretations of the Christian lifestyle and ethics, lest they have different meanings and consequences in today's rapidly changing society than they did in the past. Our old sinful nature clings to us long after we become Christians (Rom. 7:14–25). Our knowledge and wisdom are very finite, truncated by human limitations, by the vastness of the universe, and by the complexity of society. No matter how much we know, there is ever more that we know we do not know. We need the humility to recognize that we may be wrong and others right and that there always will be secrets known only God, no matter how many have been revealed to us through Scripture and research (Deut. 29:29; 1 Cor. 13:8–12).

The Bible and Contemporary Research Methods

Every profession, scholarly discipline, and scientific specialty has its own methodologies and techniques for conducting research. Each has methods that are appropriate for conducting various types of research. All of them together "test [almost] everything" to make us better stewards of the gifts and opportunities God has entrusted to us. Here are a few examples.

Mal. 3:10, which tells God's people to bring all their tithes and offerings to him and then to observe the results, and Rom. 12:2, which tells us to test and approve God's will by not conforming to the pattern of this world, imply **prospective experimentation**. Other forms of experimentation and pseudo-experiments can be very helpful, provided one carefully considers all of the assumptive, methodological, observational, and statistical limitations when conducting the studies and applying the implications.

Evaluation research is implicit in the Lord's making Jeremiah "a tester of metals and people the ore, that you may observe and test their ways" (Jer. 6:27). Jeremiah is moved to plead: "Let us examine our ways and test them, and let us return to the Lord" (Lam. 3:40). Other Bible passages cited above also encourage evaluation.

This overlaps with **comparison research**. The sincerity of love among the Christians in Corinth was tested by comparing their generosity in giving with the model or example provided by believers at other locations, but most of all with that of Jesus who was rich, yet became poor, so that they through his poverty might become rich (2 Cor. 8:8–9). Using Christ as a criterion for comparisons regarding hardships, trials, and persecution is the theme also of Heb. 12:2–3 and, by implication, "the heroes of the faith" in Hebrews 11.

Complementing a thorough knowledge of the Scriptures, **sociopsychological methods** similarly contribute to the goal of personal and collective self-examination. Their use is supported by passages like 2 Cor. 13:5–7, "Examine yourselves to see whether you are in the faith; test yourselves ...," and Gal. 6:4, "Each should test his own actions ... without comparing himself to somebody else." Continual comparisons of oneself to Jesus Christ vanquish the spirit of pride that crops up whenever we yield to the temptation to compare ourselves with other people. Invariably we can find someone whom we judge to be inferior to ourselves in abilities, service, faith, motivation, or character. Jesus is the only perfect model by which to judge our character and personality (John 13:15; Phil. 2:5–8; 1 Pet. 2:21).

Above all else, the sciences are **descriptive.** We seldom use the words of early scientists who tried to "think God's thoughts after him." Yet in deciphering ever more of God's awesome work, we in effect are trying to do the same. Describing the beautiful and intricate universe that declares his glory and analyzing the wonders of living organisms and mysteries of human life, we see ever more of the majesty and providence of the Creator and Sustainer of the universe. Although we now can only imperfectly and incompletely "taste and see that the Lord is good" (Ps. 34:8), eventually in the fullness of time we and all of creation will receive our final deliverance from "the bondage of corruption and decay" (see Rom. 8:18–23).

Many types of **research on religion,** such as the sociology and psychology of religion, can be of direct help to Christian agencies and ministries. Not the least important among those requiring cooperation with theological investigation is "**testing the spirits**," to determine whether they are from God. There is a plethora of spirits in countless ancient cults and "new religious movements," for there still are many false prophets in the world (1 John 4:1–3).

Abuses of Research

If ever there has been any perfect research, it has not come to my attention. The Great Deceiver who is the "father of lies" eagerly stands ever ready to lead even God's own children astray. Among other things, he declares that only perfection can please God. However, imperfect people with their actions and products can be used to serve and glorify God. In our scientific work, we must guard against the temptation not to report imperfect investigations, while we also work hard to overcome the abuses of investigative methods and techniques that crop up so easily, even in research conducted by and for Christians.

Much of the training in every scientific and scholarly discipline aims to correct methodological fallacies, whether of domain assumptions; conceptual definitions; operational specifications; inappropriate choice of methods for a given research problem; theoretical orientations; observation techniques; sampling, collecting and analyzing data; biased reporting, or other issues. Not only in handling money, but in all else we should be "taking pains to do what is right, not only in the eyes of the Lord, but also in the eyes of men" (2 Cor. 8:21). Christians above all others doing research should "Be careful to do what is right in the eyes of everybody" (Rom. 12:17). The best way to be fully honest and above board in such work is to be thoroughly grounded in the theories and methodologies of our fields of research and in the awareness of the abuses and flaws that so easily penetrate them.

Sometimes Christians are even more inclined to be dishonest in research that pertains to themselves than are nonbelievers, for they know from Scripture what the findings* ought *to be.

Sometimes Christians are even more inclined to be dishonest in research that pertains to themselves than are nonbelievers, for they know from Scripture what the findings *ought* to be. They especially do not want "the world" to discover moral discrepancies within Christian circles. Thus, they are pressured into stacking up proofs for foregone conclusions, especially when those prejudgments seem to be based on the Bible. Rather than testing generalizations to discover what all of "the facts" really are, they are consciously or unconsciously beguiled into using methods for collecting and analyzing data, then reporting results, that provide self-justification, "good publicity," or "positive feedback" instead of the more honestly balanced approach of "letting the chips fall where they may."

Partly because of the biblical contrasts between polarities, such as good and evil, God and Satan, light and darkness, and the old and new nature, Christians are strongly inclined toward believing that there are only two positions or sides to nearly every pragmatic issue that confronts science, soci-

ety, and the church. Seldom are modern social, political, and economic issues that simple. Mixtures of good and evil elements make life in a democracy very complex and research difficult.

Yet there is no such thing as genuine **neutrality** regarding such issues. In a democracy, inaction is itself a form of action, usually for the most powerful and wealthiest side of any contested issue. Neutrality often results in greater harm than taking sides with and working for "the lesser of two evils" when there are no other viable alternatives. The refusal to work actively for righteousness and justice, not realizing how such efforts complement and supplement "winning souls to Christ," ironically often sustains the very evils that Christians condemn. In research choices, as in the rest of life, we must actively struggle against all sin and especially against the "spiritual forces of evil in heavenly realms" (Eph. 6:12) that usually are disguised by cloaks of righteousness. Only by being "strong in the Lord and his mighty power" (Eph. 6:10) will we prevail.

The refusal to work actively for righteousness and justice ... ironically often sustains the very evils that Christians condemn.

Even the best planned Christian ministries sometimes have **indirect negative results and undesirable side effects** of the kind sociologists call "latent dysfunctional consequences." Research can uncover many of them, though powerful persons and groups will try to keep them hidden. Those who have vested interests in the religious establishment scoff at any research that reveals errors, deficiencies, misleading advertising and propaganda, falsehoods, hypocrisies, and pretentious claims. Most of all, they scoff at any research that exposes them and often divert attention by calling it groundless "debunking," character assassination, or even doctrinal heresy.

Researchers employed to evaluate religious agencies and programs often attract the suspicion and opposition of leaders in local, regional, or national ecclesiastical power structures. Sometimes the enemies of such research are right. Many scientists and other researchers do tend to assume an arrogant, holier-than-thou pose, almost as if they are an incarnation of our perfect, righteous, omniscient, omnipotent God. They dogmatically imply about their own work what Jesus often said about his, "You have heard it said ..., but I say unto you ..."

Alternatively, just as bad money squeezes out the good, those who conduct evaluation research projects may be enticed into using defective methods to obtain results that please their clients and win their praise and other rewards. Distorting or covering up reality violates the commandment not to give false witness. In other words, it is a form of lying even if the intended result is good. The end does not justify the means.

In contrast, good research methods help us to be honest in all our work, to love the Lord with our minds (Luke 10:27), and to humbly use our findings to please him, even if they may not please ecclesiastical bureaucrats and others.

Limitations of Research

Even when we conduct research of the highest quality, we discover many limitations to our findings. Each significant exploration results in **new questions**, so in one sense the more we know we know, the more we know we do not know. Despite the vast increase in human knowledge, there still are unimaginable **secret things** that "belong" only to the Lord our God (Deut. 29:29). It is not possible to observe him directly, or even to interview him. However, we can see indicators and reflections of him, "For since the creation of the world God's invisible qualities ... have been clearly seen, being understood from what has been made ..." (Rom. 1:10).

Yet these "clearly seen" manifestations of God and his creations are easily distorted and misinterpreted because of sinful ignorance, misleading preconceptions, and the finitude of human mentalities. For example, the amazing developments from astronomical probes into outer space thousands of light years away, on the one hand, and the knowledge of the intricacies of minuscule particles and cells through new techniques and tools developed in microphysics and microbiology, on the other, are vastly expanding our recognition of the size and complexity of the universe God created. They are convincing both six-day creationists and theistic evolutionists that their conceptions of God have been too small. We all will be surprised and amazed when, in the presence of our Almighty Creator, we learn how the universe actually was created by God's word.

That which is verifiable "scientific truth" today may be as incomplete and erroneous as the lesson taught my generation in high school and college to the effect that an atom is the absolutely smallest particle of matter. Not only was nuclear fission subsequently used during World War II, but many new subatomic particles have been discovered as well.

All human observations, even when fully accurate, occur within the limited scope of then-current methods, concepts, theories, sampling techniques, and other methodological and observational variables. We humans are so finite that we can spend an entire lifelong career studying but one tiny detail of God's creation. Together all human discoveries fall far short of fully understanding the products of God's infinite wisdom and power. The tiny "truths" of humanity pale in the light of our Lord Jesus Christ, who is THE TRUTH, as well as the Life and the Way to our eternal home with God (John 14:6). Humility must accompany even the greatest discoveries of knowledge and understanding that emerge from sound research.

> Is there knowledge? It will vanish away; for our knowledge and our prophecy alike are partial, and the partial vanishes when wholeness comes. ... Now we see only puzzling reflections in a mirror, but then we shall see face to face. My knowledge now is partial; then it will be whole, like God's knowledge of me (1 Cor. 13:9–12, NEB).

Despite the vast increase in human knowledge, there still are unimaginable* secret things *that "belong" only to the Lord our God (Deut. 29:29).

Implications for Action

When we who are Christians recognize that research is among the Holy Spirit's gifts and that serving God through a research career is one way to help fulfill the Great Commission of our Lord, several implications for blending faith and conduct emerge.

First, we will be fully persuaded of the value of research as a Christian calling or vocation. Whether others acknowledge it or not, each of us serves God within the context of our respective professions and job assignments—not only when we serve on a church committee, hold a church office, or teach a Bible class.

Second, we will sincerely and repeatedly communicate to Christian friends, church groups, and parachurch associations the need for, benefits of, and findings from good research that pertain to their particular interests and needs. They eventually will hear and heed our message about the relevance and importance of research to God's kingdom. Then they will be less inclined to interpret the work of research as subordinate, if not antithetical, to their evangelistic, educational, social service, and mission-related Christian activities.

Third, we will demonstrate that research-gleaned information is helpful to the ministries and pet projects of our own and other Christian groups by small, as well as large, projects conducted by ourselves, students, or volunteer helpers. An ounce of demonstration is worth a pound of proclamation.

Fourth, we will emphasize the numerous biblical instructions that are best applied today by systematic research rather than by easier, more convenient, cheaper, but often deceptive forms of haphazard and biased information gathering. Explicit references to Bible passages are absolutely essential to win the favor and support of fundamentalist and evangelical constituencies. When they are appropriately cited, Christians who honor the Bible as a guide to both faith and conduct will listen.

Fifth, we who are on the faculties of educational institutions will teach students about the Christian value of research more effectively than we have in the past. Ideally our students will do actual research, not just read about it. Some will produce such well-designed, even if small-scale, research projects that, with appropriate adaptation and guidance, their reports will be publishable in scholarly or semi-popular periodicals, either with or without the faculty mentor as a coauthor.

Sixth, we will identify and work on some of the countless topics for research that are crucial to improved ministries, institutions, agencies, projects, and programs that serve Jesus Christ.[3] Much of this work will never be done by people who are not Christians, but if it is, it may be done under anti-Christian presuppositions and biases. Politicians and others who shape society need factual "scientific" data about "the other side" of issues they confront, so research on them is a part of being "the salt of the earth." The findings of good research will make some sincere people see things "our way," motivate them to be more open to positions consistent with Christian ethics, and bring about their cooperation with believers in civic, educational, political, social service, and other ventures for the common good.

Seventh, we will recognize that conducting well-designed research and reporting its findings in the language, styles, and publication outlets of the scholarly and scientific world is itself a form of wit-

nessing. "Scientific" research is in many ways a major "global language" of the modern world. Sharing the findings of our work in professional meetings, journals, and books gains the attention of educated non-Christians. They will benefit from our discoveries but also will recognize that Christians are among the respectable contributors to their disciplines. This type of "pre-evangelism" will make some nonbelievers less antagonistic toward Christianity, more open to hearing about their colleagues' faith in Jesus Christ, and more curious about how that faith influences personal experiences and helps believers cope with the crises that invade most people's lives. Their curiosity eventually will draw some to become disciples of our Lord.

Conclusion

Research is an important tool for helping believers learn and obey all that Christ commanded, thus fulfilling his Great Commission. A career in research is a Christian vocation to which some people are called and gifted by the Holy Spirit. Research is a valuable spiritual resource for the warfare of God's people against the forces of evil and powers of darkness in the high places of society. It provides both defensive armor and offensive weapons for obedience to the will of our Lord (Eph. 6:10–18). While using it in God's service, "whatever you do, whether in word or deed, do it all in the name of the Lord Jesus, giving thanks to God the Father through him" (Col. 3:17). ✣

Notes

[1]Unless otherwise indicated, quotations are from the New International Version of the Bible. (KJV refers to the King James Version, NEB to the New English Bible, and TEV to Today's English Version, which is also known as the Good News Bible.)

[2]David O. Moberg, "The Social Sciences," in Robert W. Smith, ed., *Christ and the Modern Mind* (Downers Grove, IL: InterVarsity Press, 1972), 119.

[3]For examples, see David O. Moberg, "Overcoming the Intellectual Inferiority Complex and False Guilt of Evangelical Educators," *Faculty Dialogue* 20 (Winter 1993–94), 45–58.

Books Received and Available for Review

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

Paul Anderson, ed., *Professors Who Believe: The Spiritual Journeys of Christian Faculty*, IVP, 1998

T. R. Casten, *Turning Off the Heat: Why America Must Double Energy Efficiency to Save Money and Reduce Global Warming*, Prometheus Books, 1998

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M. A. Cremo, *Forbidden Archeology's Impact: How a Controversial New Book Shocked the Scientific Community and Became an Underground Classic*, BHA Book Publishing, 1998

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Raymond Nogar, *The Lord of the Absurd*, Nortre Dame University Press, 1998

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Does the Trinity Play Dice?

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The interpretation of quantum theory and its implications continue to be controversial. In this paper, we survey some issues raised in debates in order to pursue the belief that the God who is involved with the world in quantum phenomena is the Holy Trinity. Interpretations which emphasize participatory aspects of quantum theory are especially congenial to an understanding of divine action which centers on the Incarnation. In this light, we examine questions about reality, knowledge of the world, the role of chance, complementarity, material identity, and the entanglement of systems.

Creation as a Work of the Trinity

Questions about the meaning of quantum mechanics usually are not posed as in the title of this paper. Statements about the theory are, following Einstein, sometimes put in terms of "God" playing dice with the universe. The difference is important, and must be dealt with if we are to make significant progress toward a theological appreciation of quantum mechanics.

A statement that God does something means little unless we know what concept of deity stands behind it. Einstein expressed his own belief in God as "a superior mind that reveals itself in the world of experience," a belief which he identified with Spinoza's pantheism.[1] Some New Age writers have tried to use ideas from quantum theory itself to develop a concept of the divine.[2] For process thinkers, God is necessarily involved with the world, while it seems obvious to many other people that "God" must be the transcendent Supreme Being of traditional philosophical theism.

The latter is the working view of most Christians. Western theologians, in spite of their Christological and Trinitarian beliefs, often revert to philosophical unitarianism when they discuss creation and providence. Barth pointed out that classical Reformed and Lutheran ideas of providence were vitiated by the fact that the deity who preserved, accompanied, and governed creatures in those theologies did not have the distinctive features of the God who is revealed in Jesus Christ.[3] This tendency to be content with a general theism, rather than a distinctively Christian belief, poses dangers for dialogue between science and Christian theology, including theological assessment of quantum theory, because such dialogue must consider creation and providence.

Unfortunately, Barth's own treatment of these doctrines was weakened by the fact that he saw no need to discuss questions raised by the natural sciences.[4] That attitude will not suffice today. Science should not dictate our theology, but theology must be engaged with science if it is to support the proclamation of the Gospel to people in a scientific world. God's revelation in Christ must illumine scientific discoveries, which in turn will help us to understand God's actions in the world.[5]

How might we try to see quantum phenomena in a Trinitarian manner? One approach would be to search for "vestiges of the Trinity" in subatomic phenomena. For example, Augustine thought that the Trinity was imaged by such triads as human memory, understanding, and will.[6] But even if one accepts the underlying idea of an "analogy of being" between God and the world, the fact that there is much disagreement about both the interpretation of quantum theory and Trinitarian theology today means that such a search would likely result only in some speculative and transient parallels.[7]

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We will stay closer to the foundations of Trinitarian thought by attempting to relate our understanding of quantum theory to God's self-revelation in Jesus Christ. It is, after all, the belief that God is definitively revealed in Jesus which requires a Trinitarian conception of God. Our theological focus, then, will be on the economic Trinity: God revealed in interaction with the physical universe. We will try to gain a better understanding of this interaction by considering what quantum physics can teach us about the world and what our role is in it.

It is not my intention here to attempt a thorough discussion of quantum theory and the proposals which have been made for its interpretation. Our concern with quantum physics is primarily theological, not philosophical (even though philosophy cannot be avoided). We will concentrate on issues and ideas which seem promising in the science-theology dialogue and suggest some possibilities for engagement. Interpretations which emphasize *participatory* aspects of quantum theory are of particular interest for a theology which places Incarnational and Trinitarian concepts at the forefront.

The Quantum Revolution

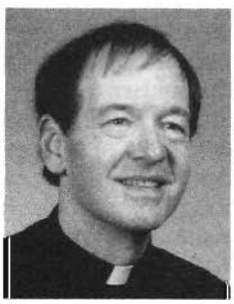
Modern quantum theory is now over seventy years old, and many authors have considered its religious implications.[8] Quantum physics, however, has not played a major role in serious theological reflection, and has not provoked anything like the religious debates which have surrounded biological evolution, the big bang, or genetic engineering.

The scope of quantum theory is not always appreciated. It involved first simply the idea of a discrete or "quantized" character for some phenomena. To deal with the thermodynamics of radiation, Planck in 1900 introduced the idea that electromagnetic radiation of frequency f could be emitted or absorbed only in "quanta" of energy hf, where Planck's constant h is very small on the scale of everyday phenomena. (h has dimensions of energy multiplied by time, or action.) Then Einstein suggested that light actually existed as such quanta or photons, though many well-known observations indicated that light was a wave phenomenon. Bohr applied Planck's constant to explain why atoms could exist only in certain states. And de Broglie's proposal, that wave-particle duality extended to all matter, was confirmed.

Heisenberg, Schrödinger, and Dirac developed the basic structure of modern quantum mechanics in the mid 1920s. The theory was quickly found to explain and unify whole areas of physics and chemistry. It also explained many new phenomena. Quantum theory today is not just the theory of a limited regime, like a theory of optical systems. It is a theory about how *any* physical system must be described, and has been applied successfully to phenomena as diverse as superconductivity and elementary particle reactions. Many systems can be treated adequately by classical physics, but such descriptions are approximations. While we should beware of simplistic reductionism, quantum theory does seem to be foundational for all physical phenomena, even where explicit reference to it is not made.

There is little debate about the *correctness* of quantum theoretical descriptions of phenomena which have been subjected to experimental test. The equations of the theory agree with observation. But when we seek a philosophical interpretation of the theory, arguments arise.[9]

Most working scientists use the machinery of the theory and ignore the philosophical questions. However, as soon as we do start to think about the meaning of our equations and experiments, fundamental problems surface. Quantum theory changes not only our understanding of the world but our understanding of what it means to understand it. One unnamed theologian has been quoted to the effect that quantum theory is "the greatest contemporary threat to Christianity," and compares its challenge to the one which confronted the western



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church with the rediscovery of Aristotle.[10] It is unfortunate for quantum physics to be regarded simply as a "threat," but it does demand some new theological thinking.

Reality?

We begin by exploring some fundamental aspects of quantum theory which seem to challenge traditional views. The role of *chance* has to be considered, but we must ask even more basic questions about *reality* and *knowledge*. Classical physics assumed that there is an objective, real world independent of the human mind. The role of observers in quantum theory questions this assumption.

An "observer" could be a piece of physical apparatus, such as a photographic plate. The need to consider such an observer might be attributed to its physical interaction with what is observed—an interaction which cannot be made negligibly small because of the quantum of action. (For example, a particle can be seen only if it interacts with a photon which will transfer momentum to it.) Measurements are often discussed in that way in elementary texts, but it is an oversimplification. We must also consider decisions to make one observation rather than another and, more profoundly, the possible role of *consciousness* in observation.

Questions about observers and consciousness are introduced when we apply the basic Schrödinger equation of quantum theory to physical systems. This equation describes the spreading in space and time of a wave function Ψ, whose absolute value squared at any point is proportional to the probability of finding a particle there. Where $|\Psi|^2$ is large, a particle is likely to be found, and where it vanishes, one will not be found. But speaking of a particle being "found" implies that someone looks for it, and it is here that questions arise.

Suppose a particle is projected toward a device which will, with equal ($\frac{1}{2}$) probabilities, scatter particles in two directions, A and B. After the scattering but before observation, Ψ will be made up of two parts, Ψ_A in direction A and Ψ_B in direction B. Each has an amplitude $1/\sqrt{2}$, representing probabilities of $\frac{1}{2}$ of a particle being found in either direction. As time passes, the waves move apart, corresponding to possible motions of a particle away from the scatterer. This evolution of the wave is described by the Schrödinger equation.

When an observation is made to determine where the particle is, something different happens which is *not* described by that equation, a "collapse" of the wave function. If a detector along A registers a particle, Ψ collapses to a wave of unit amplitude along A, that along B being reduced to zero. This collapse *cannot* simply be attributed to an interaction between the detector and the particle, for the same collapse will also take place if we look for a particle along B and do not see anything there![11]

The fact that the wave collapses even if there is no physical interaction suggests that it is not a purely objective entity. Some have argued that it is misleading to speak of the collapse as a physical occurrence. Ψ, they say, is a mathematical artifact containing our statistical knowledge, and the collapse is a change in that knowledge. We do not speak of a "collapse" of data in an actuarial table when someone dies! But the situations are not the same. There are physical factors, perhaps unknown to us, which cause one seventy-year-old to die while another survives, but attempts to construct corresponding "hidden variable" versions of quantum theory, while interesting, have not been very helpful. In standard quantum theory, Ψ gives as complete a description of a system as we can get.

Classical physics assumed that there is an objective, real world independent of the human mind. The role of observers in quantum theory questions this assumption.

Given that the collapse is significant, at what point in the measurement process does it happen? Is it when an atom in the detector is excited, when that excitation is amplified to a certain level, or when a conscious agent becomes aware of the signal? Bohr thought that collapse took place when information reached a classical level, but he did not clearly explain why a particular size and/or momentum of the detector would be critical in this regard.[12]

One recent approach makes use of the idea of decoherence.[13] When the measuring apparatus consists of many particles and dissipative effects are taken into account, any quantum interference between macroscopically different states of the apparatus (such as the "live cat" and "dead cat" states of Schrödinger's notorious thought experiment) is quickly destroyed. This explains that the wave function will appear to collapse without explaining in a deterministic manner why there is collapse to a particular state.

Wigner argued that it is not just observation but the *consciousness* of observation which causes the collapse. Thus, the collapse takes place when information from a detector enters a mind.[14] Wheeler has emphasized the *participatory* character of the world which such a view suggests.[15] This leads to a "Participatory Anthropic Principle," in which the suitableness of our universe for intelligent life is related to the need for the existence of intelligent observers to make the universe real.[16]

The theological task is then to explore the idea that God endows the world with reality ... through participation in it. The Incarnation ... would be seen as* necessary *for creation.

This is not solipsism, when each person's reality exists only in his or her mind, nor does the mind simply create its own reality, as in simplistic versions of New Age thought. (To make anything happen we have to observe systems, not just think about them!) But this idea—that human decisions about what to observe and consciousness of observation play a role in what happens with physical systems—is still disturbing to many scientists and theologians who would like to maintain some concept of an objective, real world. This idea is rejected sometimes because of its "anthropocentrism."[17] The doctrine of the Incarnation, however, suggests that in our attempts to understand the world, we could have a nuanced emphasis on the place of humanity.

One response to questions about reality, somewhat like Bishop Berkeley's idealism, is that things exist ultimately because they are in God's mind. If quantum theory requires an ultimate conscious observer, it has been claimed, then it proves the existence of God.[18] Such an argument stands within the tradition of independent natural theology: God's existence is derived from our experience of the world. The conclusion, that an Ultimate Observer exists, is similar to that of other arguments which claim to show the existence of a Prime Mover or an Intelligent Designer. Philosophers may argue about whether the existence of such beings really has been demonstrated. Christian theologians need to ask if they have anything to do with the biblical God.

The Christian doctrine of creation says that the God who has revealed himself in Jesus Christ is the Creator, Sustainer, and Goal of the cosmos. In the Incarnation, the Word of God has become a creaturely participant in the universe (John 1:14), and this participation is the *purpose* of the universe (Col. 1:15–20). The doctrine of the Incarnation can be regarded as a *The*anthropic Principle, paralleling Wheeler's Participatory Anthropic Principle.[19] It is not simply humanity, but humanity indwelt by the divine Logos, which is crucial for the existence of the universe. The theological task is then to explore the idea that God endows the world with reality, not simply by a decision imposed from outside the cosmos but through participation in it. The Incarnation, in other words, would be seen as *necessary* for creation.

Wigner's idea is subject to the criticism that the universe existed before conscious life evolved.[20] We certainly do not want to argue that the world first came into being when the baby Jesus first opened his eyes! In a later section, we will see that the "entanglement" of systems in quantum theory involves time as well as space, so that we must be wary of common-sense ideas of temporal ordering.

The "many worlds" interpretation of quantum theory, in which measurement causes a *split* in the universe itself, avoids the problem of collapse, but at considerable cost.[21] *Two* worlds would arise in our example, one with a particle on path A and an observer who sees it there, and another with it on B and a corresponding observer. The real world in this interpretation is a "multiverse," a multi-branched array of universes continually splitting as observations are made. Each of us has multiple copies, with variations, in many worlds. This is a serious proposal, though there is an air of science fiction about it. But contrary to the claims of some proponents, there is no compelling reason to adopt it unless we feel that no interpretation of wave function collapse is viable.[22]

A many-worlds interpretation would raise serious theological questions. We would need to consider, for example, Barth's concept of evil as the "nothingness" which God has not chosen.[23] Such a concept is meaningful for a single universe, but its significance in a many-worlds picture is unclear. For instance, there would be some branches in which Hitler won, and others, such as ours, in which he did not. Which branch represents the will of God? Which expresses the nothingness which God does *not* choose?

Much of modern theology suggests that such questions must be answered eschatologically. That means more than saying that everything will finally be all right. Eschatology must be Christological, for

the universe has its fulfillment in Christ. And it must be *axiological*, involving evaluation and judgment of what has taken place. Good is to be vindicated and evil condemned.[24] We would have to picture, in a sense broader than that envisioned by Teilhard, convergence of the *multiverse* upon Christ-Omega in which finally "the sea was no more" (Rev. 21:1).

Knowledge?

If there is some reasonable sense in which we can speak of a real world, what can we know about it? This topic can be approached via Heisenberg's uncertainty principle, which says that it is not possible to know precisely and simultaneously the values of two conjugate variables such as position and momentum. The product of their uncertainties must be at least $h/4\pi$.

We cannot have knowledge more precise than that, but can God? We may be tempted to answer, "Yes, God knows everything." But in the strongest interpretation of quantum theory, a pair of precise simultaneous values for position and momentum is not a real "thing." If so, then asserting that God has this knowledge may be like claiming that God knows the color of truth. Aquinas said that God's omnipotence does not extend to an ability to do things which are self-contradictory,[25] and the same argument can be extended to divine omniscience.

Christians, however, should not be excessively concerned to remove every hint of weakness from their concept of God. The focus of the divine self-revelation is Christ crucified, and God's "power is made perfect in weakness" (2 Cor. 12:9).

Chance?

These considerations can help us to deal with the question of our title. Does the Trinity uniquely determine everything that takes place, or is there an element of chance at the most basic level of reality? In most Christian traditions, any fundamental role of chance was seen as inimical to God's omnipotence, and rejected as "Epicurean" and verging on atheism. Must we respond in the same way to the notion of probability in quantum theory?

It would be anachronistic to look for references to quantum phenomena in the Bible, but chance is encountered there in the casting of lots (e.g., Josh. 14:2, Acts 1:26) and answers by oracles. God's will is made known by means not humanly predictable. In the Bible, that kind of unpredictable behavior is associated especially with the Third Person of the Trinity, the Holy Spirit.[26] The fourth Gospel compares the Spirit's activity in conversion with the unpredictability of the wind (John 3:8).

It is possible to develop hidden variable theories which reproduce the results of quantum theory. The role of probability would then be like that in classical statistical mechanics, where use of statistics is convenient in dealing with huge numbers of particles, but not essential. Even if it is not possible for us ever to know the values of the hidden variables, God might. As Prov. 16:33 suggests, phenomena which seem random to us today might be known and controlled by God.

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But God can be almighty without hidden variables! God need not control the precise trajectories of particles if, as standard quantum mechanics holds, such trajectories do not exist. To say that God does everything that happens does not mean that God does everything we can imagine. God knows the outcomes of events as fully as they can be known, but quantum theory says that that is not as fully as classical physics held. The limits on divine knowledge suggested here are not like the idea attributed to the Epicureans, that God simply does not bother to be involved with the world.[27]

We may think of the divine operations (Greek *energeia*), in the technical sense of classical theology, as being in close connection with the scientific concept of energy which has developed from the same root.[28] God's "cooperation" with natural processes in classical doctrines of providence means that divine and created energies concur in bringing about whatever happens in the world, just as the divine and human operations in Christ concur perfectly.[29] The Schrödinger equation of quantum theory is the statement that the change in time of a system's wave function is produced by the energy (Hamiltonian operator) of that system. We can, therefore, believe that the divine operations concur with physical processes to the full extent described by the Schrödinger equation, while recalling that what this equation determines in any given situation is not one definite outcome but a spectrum of probabilities.

If God does not control the precise outcome of every atomic scattering event, divine omnipotence must be eschatological. Despite uncertainties about what may happen on the way, the universe will finally be brought to its fulfillment in Christ. One basic rule of practical probability is that, in the end, the house always wins.

Complementarity in Physics and Theology

Quantum physics seems to require two types of description of one world, exemplified by wave-particle duality. Bohr saw in this a fundamental theme of quantum physics which he called *complementarity*. In any given experimental arrangement, an electron will manifest itself either as a wave or as a particle, and not as some hybrid. For some arrangements, it will be a wave and for others it will be a particle. *Both* descriptions are necessary if we are to account for all the observations which we can make. Wave and particle descriptions would be *contradictory* if we applied them simultaneously. However, if we are careful to use the appropriate one in each situation, they are *complementary*.

The uncertainty principle can be seen as a quantitative expression of wave-particle complementarity: The more precisely we can describe something as a wave, the less precisely we can describe it as a particle, and vice versa. Bohr also suggested qualitative applications of the complementarity concept, such as space-time or causality, and even descriptions of a biological system as living or as machine. (To observe a system precisely enough to describe it mechanically, we have to kill it.) What is common to all such pairs of descriptions is that the use of one in a given situation precludes simultaneous use of the other.

While attempts have been made to view science and theology as complementary,[30] it is more relevant to our present topic to consider the possibility of using the concept of complementarity within theology itself. Two pairs of concepts which one might think of as candidates for complementarity are the Trinity and Unity of God and the humanity and divinity of Christ.

Perhaps it is best simply to point out the need for some care. First, it is risky to divorce complementarity from the *observability* of properties in quantum mechanics and apply it simply to abstract concepts or doctrines. We do not "observe" God's inner life, but only know of God through God's action in the world. If we can be said to "observe" anything, it is the *economic* Trinity shown to us by God's works which extend "outside God." While the persons of the Trinity act in different ways, all that God does in the world involves the united activity of Father, Son, and Holy Spirit. Thus it is not clear how triune and unitary aspects of God are to be regarded as complementary.

Secondly, the ways we attempt to apply complementarity will depend on our underlying theological assumptions. The possibility of regarding the divinity and humanity of Christ as complementary has been discussed by some authors.[31] This seems plausible within the Reformed tradition, in which the properties of the divine nature are not thought to be communicated to the human nature. In the Lutheran tradition, in which this communication (which implies the omnipresence of Christ's humanity) is accepted, the idea of complementarity does not seem well suited for Christological description.[32]

Identity

We have noted the belief that quantum theory poses a threat to Christian views of reality, and have seen that some traditional ideas about reality, knowledge, and chance do require reconsideration. In the next two sections, we will point out some concepts of quantum physics which seem to support traditional theological arguments.

The ground of the ongoing importance of the Incarnation as God's revelation is the resurrection of Jesus. Belief in the resurrection of the body, however, has been challenged since the earliest days of Christianity. One type of criticism has been based on the supposed impossibility for the same material to be part of two different bodies in the resurrection. Thus a person eaten by cannibals or whose organs were donated for transplant would provide a *reductio ad absurdum* argument against bodily resurrection. These situations become a nonproblem in light of quantum theory's requirement that identical particles be absolutely indistinguishable. We cannot, in the last analysis, speak of "the same atoms," but only of the same *pattern* of atoms.[33]

Entanglement

In 1935, Einstein and co-workers Podolsky and Rosen presented a thought experiment which was supposed to show that quantum theory was incomplete.[34] Two particles, A and B, with net momentum 0 were to be allowed to move apart, as might happen in a decay process. The position of A and the momentum of B could simultaneously be measured with complete precision. But then conservation of momentum would also give the momentum of A, so

that A's position and momentum would be precisely known. Since the uncertainty principle does not allow this, they argued that the quantum theoretical description of nature is incomplete.

Basic to this argument is the assumption that, in accord with relativity, systems separated from one another by some distance cannot communicate with one another instantaneously. There is no "spooky action at a distance" in Einstein's phrase. Thus a measurement on A cannot have an immediate effect on B. This assumption of *locality* means that we can consider the universe to be made up of separate parts.

[Experiments which show that individual parts of a system remain "entangled" even when separated by space-like intervals] indicate that the world has a strongly holistic character. Theologically, [entanglement] suggests a way of understanding omnipresence of the humanity indwelt by the Word in the Incarnation (Matt. 28:20) ...

Yet when it became possible to do experiments equivalent to that in the above argument, the assumption of locality was challenged. The work of Aspect, et al. and related experiments show that individual parts of a system remain "entangled" even when separated by space-like intervals.[35] This indicates that the world has a strongly holistic character. *Theologically*, it suggests a way of understanding omnipresence of the humanity indwelt by the Word in the Incarnation (Matt. 28:20), a concept for which Luther ("the right hand of God is everywhere") and the Lutheran tradition have argued.[36] We can see the Incarnation as the beginning of God's "dwelling" in the universe (John 1:14) without thinking of it restricted to the interior of a sphere which expands at the speed of light from Nazareth!

Quantum entanglement is not only spatial but *temporal*, as Wheeler has pointed out in his discussion of "delayed choice" experiments.[37] Wheeler's example, observing light from a quasar which passes through the "gravitational lens" of an intervening galaxy, dramatically illustrates this. In such a case, there may be two images of the quasar. A present day terrestrial observer can decide what experimental setup to use to observe individual photons from the quasar in order to determine whether a photon has traveled along both paths around the galaxy or along only one. That choice today, in some sense, determines what was the case billions of years ago.

Such considerations indicate that it may be possible to hold with Wigner that it is consciousness which endows quantum potentialities with reality, and still believe that there was a universe before consciousness evolved. In connection with the Theanthropic Principle, which we have discussed, this suggests that the "scandal of particularity" of an Incarnation in the middle of cosmic history is compatible with the belief that the Incarnation is necessary for the existence of the universe.

The arguments in the last three paragraphs are attempts to apply the quantum entanglement of systems to the presence of God Incarnate in our spacetime reality. Thus they deal with possible implications of quantum physics for our understanding of the economic Trinity. It also would be possible, in a more venturesome way, to seek parallels between quantum entanglement and the concept of *perichoresis*, or mutual indwelling, of the persons of the Trinity in one another. This might be seen simply as an analogy or illustration for Trinitarian thought, but those who seek "vestiges of the Trinity" may pursue the idea that this feature of quantum reality is part of the divine imprint on creation.

Quantum Theory as a Stimulus to Dialogue

In closing, we may note a matter of general interest in addition to the specific topics which we have discussed. The fact that concerns about the interpretation of quantum theory are being posed in terms of "God" is significant.[38] As we have argued, the idea of "God" underlying such statements may be quite different from Christianity's Christological and Trinitarian concepts. But the use of theistic terms shows that developments in science have provided new opportunities for correlating the Christian message with current questions. ✣

Notes

[1]Albert Einstein, "On Scientific Truth," *Essays in Science* (New York: Philosophical Library, 1934), 11.

[2]E.g., Michael Talbot, *Beyond the Quantum* (New York: Bantam, 1988).

[3]Karl Barth, *Church Dogmatics*, vol. III, 3 (Edinburgh: T. & T. Clark, 1936–1962), 30–3.

[4]Barth, *Church Dogmatics*, vol. III, 1, ix–x.

[5]George L. Murphy, "Chiasmic Cosmology: An Approach to the Science-Theology Dialogue," *Trinity Seminary Review* 13 (Fall 1991): 83.

[6]Augustine of Hippo, "On the Holy Trinity," in *The Nicene and Post-Nicene Fathers*, First Series, vol. III (Grand Rapids MI: Wm. B. Eerdmans, 1978 reprint), especially Book X, 134–43.

[7]For a survey of modern Trinitarian issues and options, see Ted Peters, *God as Trinity* (Louisville, KY: Westminster/John Knox, 1993).

[8]Ian G. Barbour, *Religion in an Age of Science* (San Francisco: HarperCollins, 1990), 95–124, surveys issues. Two recent essays worthy of note are those by John Polkinghorne, "The Quantum World" (pp. 333–42), and Robert John Russell, "Quantum Physics in Philosophical and Theological Perspective" (pp. 343–74), in *Physics, Philosophy, and Theology: A Common Quest for Understanding*, ed. Robert J. Russell, et al. (Vatican City: Vatican Observatory, 1995).

[9]Jim Baggott, *The Meaning of Quantum Theory* (New York: Oxford, 1992) introduces the theory and interpretations. An older but more detailed treatment is Max Jammer, *The Philosophy of Quantum Mechanics* (New York: John Wiley, 1974).

[10]Allen Emerson, "A Disorienting View of God's Creation," *Christianity Today* 29, no. 2 (1985): 18.

[11]M. Renninger, "Messung ohne Stöering des Messobjekts," *Zeitschrift für Physik* 158 (1960): 417.

[12]Classical phenomena are those for which the action integral, roughly distance traveled multiplied by momentum, is much larger than $h/2\pi$. In such a case the Schrödinger equation is equivalent to an equation for conservation of probability together with the classical Hamilton-Jacobi equation.

[13]Roland Omnès, *The Interpretation of Quantum Mechanics* (Princeton, NJ: Princeton University, 1994), especially Chapter 7. The concept of "consistent histories" is also important here. See Robert B. Griffiths, "Consistent Histories and the Intepretation of Quantum Mechanics," *Journal of Statistical Physics* 36 (1984): 219.

[14]Eugene Wigner in I. J. Good, ed., "Remarks on the Mind-Body Question," *The Scientist Speculates: An Anthology of Partly-baked Ideas* (London: Heinemann, 1961).

[15]John A. Wheeler in O. Gingerich, ed., *The Nature of Scientific Discovery* (Washington, DC: Smithsonian, 1975), 261–96; 575–87.

[16]John D. Barrow and Frank J. Tipler, *The Anthropic Cosmological Principle* (New York: Oxford, 1986).

[17]E.g., Omnès, *The Interpretation of Quantum Mechanics*, 81.

[18]F. J. Belinfante, *Measurements and Time Reversal in Objective Quantum Theory* (Oxford: Pergamon, 1975), 98–9.

[19]George L. Murphy, "The Incarnation as a Theanthropic Principle," *Word & World* XIII (1993): 256; and "Cosmology and Christology," *Science and Christian Belief* 6 (1994): 101.

[20]E.g., John Polkinghorne, *Serious Talk* (Valley Forge, PA: Trinity Press, 1995), 28–9.

[21]Jammer, *The Philosophy of Quantum Mechanics*, Chap. 11. George L. Murphy, "Parallel Worlds, Quantum Theory, and Divine Sovereignty," presented at the 1987 Annual Meeting of the American Scientific Affiliation.

[22]E.g., Frank J. Tipler, *The Physics of Immortality* (New York: Doubleday, 1994), 167–73.

[23]Barth, *Church Dogmatics*, vol. III, 3, 289–368.

[24]Willem B. Drees, *Beyond the Big Bang* (La Salle, IL: Open Court, 1990), Chap. 4.

[25]Thomas Aquinas, *Summa Theologicae*, vol. 2 (Garden City, NY: Doubleday, 1969), 198.

[26]George L. Murphy, "The Third Article in the Science-Theology Dialogue," *Perspectives on Science and Christian Faith* 45 (1993): 162.

[27]E.g., the comments of Chemnitz in Heinrich Schmid, ed., *The Doctrinal Theology of the Evangelical Lutheran Church*, 3rd ed. (Minneapolis, MN: Augsburg, 1961), 188.

[28]George L. Murphy, "Energy and the Generation of the World," *Zygon* 29 (1994): 259.

[29]Ibid.

[30]E.g., John W. Haas, Jr., "Complementarity and Christian Thought – An Assessment," *Journal of the American Scientific Affiliation* 35 (1983): 145, 203; and K. Helmut Reich, "The Relation Between Science and Theology: The Case for Complementarity Revisited," *Zygon* 25 (1990): 369.

[31]E.g., William Austin, "Waves, Particles and Paradoxes," *Rice University Studies* 53 (1967): 85; Ian G. Barbour, *Myths, Models, and Paradigms* (New York: Harper & Row, 1974), 151–5; and Christopher B. Kaiser, "Some Recent Developments in the Sciences and Their Relevance for Christian Theology," *Reformed Review* 29 (Spring 1976): 148.

[32]For the differing views of Reformed and Lutheran dogmaticians compare Heinrich Heppe, *Reformed Dogmatics* (Grand Rapids, MI: Baker, 1978), 439–45, and Schmid, *The Doctrinal Theology of the Evangelical Lutheran Church*, 314–5; 327–34.

[33]George L. Murphy, "Quantum Theory and Resurrection Reality," *CTNS Bulletin* 11 (1991): 25.

[34]A. Einstein, B. Podolsky, and N. Rosen, "Can quantum-mechanical description of reality be considered complete?" *Physical Review* 47, (1935): 777.

[35]A. Aspect, et al., "Experimental Tests of realistic Local Theories via Bell's Theorem," *Physical Review Letters* 47 (1981): 460. A helpful survey is R. A. Bertlmann, "Bell's Theorem and the Nature of Reality," *Foundations of Physics* 20 (1990): 1191.

[36]In addition to the discussion in Schmid (Reference 32), see Martin Chemnitz, *The Two Natures in Christ* (St. Louis, MO: Concordia, 1971). This is a translation by J. A. O. Preus of the original edition of 1578.

[37]John A. Wheeler, "Beyond the Black Hole" in *Some Strangeness in the Proportion*, ed. Harry Woolf (Cambridge, MA: MIT, 1980). See also Nick Herbert, *Quantum Reality* (Garden City, NY: Doubleday, 1985), 164–8.

[38]E.g., Baggot, *The Meaning of Quantum Theory*, Section 5.5.

Solomon's Plant Life: Plant Lore and Image in the Solomonic Writings

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More plants and plant products (thirty-three) are associated with Solomon than with any other Bible character. Eighteen plants and/or their products unique to Solomonic writings are discussed here. Plants found nowhere else in the Bible are algum wood, caper, henna, saffron, and walnut. In addition, Solomon's image of almond flowers; the apple tree for human stature; hyssop ecology; gourds, lilies and pomegranates as decorations; pomegranate flesh for ruddiness; fragrance of mandrake fruits; olive wood in construction; spice tree for old age; and palm and wheat for feminine beauty is unique among Bible authors. Solomon's expertise in natural history was the basis of Solomon's House in Francis Bacon's New Atlantis *and provided a widely accepted model for science at the beginning of the Enlightenment.*

There are two noted botanists in the Bible. The first is Jotham, who delivered a remarkable lecture on plants on the slopes of Mount Gerizim (Judg. 9)[1] drawing on the well-known features of figs, grapes, olives, and thorns. The second is King Solomon, son of the warrior, King David, who brought Israel to its zenith of military power. Solomon reigned from approximately 1015 to 975 BC. This was an unparalleled time of economic prosperity (2 Chron. 9:13–28) with concomitant advances in literature and public building. These accomplishments are exemplified in the wisdom, songs, construction of the temple and palaces, and writings of the reigning monarch, Solomon.

Solomon authored several parts of biblical canon including Psalm 127. Portions of the book of Proverbs are ascribed to him as well (1:1; 10:1a, and 25:1). I have included the book of Ecclesiastes in this study although Bible scholars now generally agree that it was written long after Solomon's reign. Solomon wrote many songs (1 Kings 4:32) of which only one survives, the magnificent Song of Solomon.[2] This book best displays the naturalist king's botanical expertise. There are references to twenty-three different plants or plant products in this short book of eight chapters. The *hapax legomena* (unique words in the Bible) include caper, henna, saffron, and walnut. The book of Isaiah mentions more (twenty-five) but it is eight times longer than Canticles.

Solomon's father, David, had a deep appreciation for nature. Several of his Psalms are celebrations of the creation. Perhaps Solomon's love of nature, especially plants, came from David. The Qur'an also records David and Solomon's understanding of nature but emphasizes animals, not plants (The Ant 27: 14–21). Solomon drew upon his expertise in plants when designing and building the temple as reflected in the numerous timbers and plants used for ornamentation. He, however, did more than just use plants and gardens. "He described plant life, from the cedar of Lebanon to the hyssop that grows out of walls. He also taught about animals and birds, reptiles and fish" (1 Kings 4:33–34). In short, the Scriptures present Solomon as a student and teacher of natural history.

At the beginning of the Enlightenment in England, Solomon was held up as an example for the newly developing investigative sciences.[3] His pattern inspired Francis Bacon. In *New Atlantis*, Bacon describes a king named Solamona, who in the tra-

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dition of his biblical predecessor establishes a kind of research center called Salomon's [Solomon's] House. According to Bacon, "It is dedicated to the study of the works and creatures of God."[4] The early establishment of the College of Physicians in London was known as "Solomon's House" and was an outgrowth of this idea.

Despite Solomon's fame as a student of natural history, there are few studies on his unique use of plants and plant products.[5] In this paper, eighteen plants (arranged alphabetically by their English names) are discussed. These include only the *hapax legomena* and plants for which Solomon's usage is unique among biblical authors. I have drawn heavily upon earlier works on Bible plants, recent literature, and data from my work in the Middle East.

Algum Wood

Mentioned only in connection with Solomon's construction of the temple in 2 Chron. 2:8; 9:10–11; and 1 Kings 10:11–12, this tree and its timber remain the most mysterious of all Bible trees. Bible versions disagree on the translation of the Hebrew word *algum* or *almug*, using sandalwood, juniper, or some variation of algum.

From the above verse and context, it seems that the almug tree was native to Lebanon as the wood is mentioned with the better known Lebanese timbers, cedar and pine (more accurately, cypress as *Cupressus sempervirens* is assumed to be the tree translated pine in many verses). In 1 Kings 10:11, we read that the ships of King Hiram (King of Tyre) brought gold and "great cargoes of almug-wood and precious stones." So, some Bible students concluded that the almug tree was native to southern Arabia. Greenfield and Mayrhofer note that there is little textual basis for including "Ophir" with almug wood.[6] Furthermore, the fact that Hiram's ships brought gold and almug wood does not necessarily imply that almug wood came from Arabia, only that it was transported by Hiram's men, who brought other products from other countries as well.

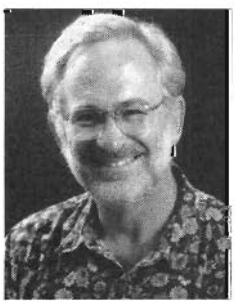
One possibility for almug wood is the box tree, *Buxus balearica* Lam. (=*B. longifolia* Boiss.) because large box trees were known from the Lebanon Range; its wood is mentioned in ancient documents.[7] Greenfield and Mayrhofer record a mountain called "Boxwood Mountain" in Lebanon. Boxwood was highly valued by Egyptians for furniture.[8] Hepper considers the box tree of the Bible (perhaps the tree mentioned in Isa. 41:19 and 60:13) to be *Buxus sempervirens* L.[9] but this species is unknown from Lebanon.[10] The Akkadian word for boxwood is different from that of almug weakening the argument that the box tree could be the elusive almug wood.[11]

What, then, is almug wood? Various scholars give *Juniperus*,[12] *Aquilaria*,[13] *Pterocarpus*[14] or *Santalum* or *Pinus*[15] as almug. Linguistically, the original word in several ancient documents is an Akkadian word and indicates a valuable timber from Lebanon.[16] To date, no one has offered *Taxus baccata* L. (Taxaceae) as almug wood although it grows in Lebanon/Syria[17] and is known from Egyptian carvings of the eighteenth dynasty.[18] Another possibility is that the almug tree is now extinct. 1 Kings 10:12 notes that exceptionally large quantities of the wood were imported. Was this the end of the almug tree?

Whatever its true identity, almug wood was obviously of high quality and durable as it was used for musical instruments. Could this wood from Lebanon be the wood used in King Solomon's carriage (Song of Sol. 3:9)?[19]

Almond

The motif of the almond, *Amygdalus communis* L., for the construction of the candlestick in the tabernacle is well known (Exod. 25) as is the resurrection symbolism in Aaron's almond rod that budded (Num. 17). Solomon, however, is the only author to allude to the masses of white flowers of the almond



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in one of the best-known soliloquies on old age and death (Eccles. 12:5).

Apple

The word translated apple in Prov. 25:11 (a proverb of Solomon); Song of Sol. 2:3, 5; 7:8b; 8:5; and Joel 1:12 is the Hebrew word *tappuah*. To meet the features described in these verses, the tree must be attractive and have a tasty, fragrant fruit. In describing the apple tree as growing among the forest trees (Song of Sol. 2:3), the author may be referring to the large, showy masses of flowers of this fruit tree in contrast to the forest trees. Or, the imagery may be similar to that of the Cedar of Lebanon when used to described prominent persons (e.g., Ezek. 31:2–3, Amos 2:9). By using this analogy, the Beloved is referring to the unique beauty and character of her Lover, a theme often repeated in this book.

The New American Standard Bible (NASB) translates *tappuah* as apricot, although this is not accepted by some students of Bible plants.[20] Moldenke and Moldenke citing older works also conclude that the apricot is *tappuah*.[21] Josh. 15:53 mentions a village called Beth Tappuah ("house of apples") as one of the associated settlements of Hebron. Today many apricots are grown in this region. Further evidence for apricots might be their link with raisin cakes (Song of Sol. 2:5). Both could be stored as dried food. However, as Zohary and Hopf point out, neither apples nor apricots are native to the region.[22] Since apricots were apparently not introduced to the Middle East until Roman times, it seems plausible that the plant described by Solomon is the common apple (*Pyrus malus* L.). Dried apples have been found in Kadesh Barnea (Negev region of Israel) from the tenth century BC indicating that apples were either grown in oases[23] or that dried apples were items of commerce from apple-growing regions further north. Apples are commonly grown at suitable sites in the Middle East today.

Calamus

Exod. 30:23–25; Song of Sol. 4:14; Isa. 43:24; Jer. 6:20; and Ezek. 27:19 are the only references to an unusual plant sometimes translated as "sweet cane," "calamus," or "sweet myrtle." The Hebrew word, *qaneh*, indicates a fragrant plant with an upright aspect. The above verses in the prophets clearly indicate the value of calamus and the fact that it was widely traded with nations in Asia. Two plants have been implicated.

The first, *Acorus calamus* L. (Araceae), is a widespread plant found in wetlands in the northern hemispheres of both the Old and New Worlds. The rhizome has a peculiar sweet, lingering aroma suitable as a "carrier" in a perfume. Motley suggests that *A. calamus* is the calamus mentioned in Exod. 30 used as the anointing oil applied to priests and objects in the tabernacle.[24] Milne and Milne state that *A. calamus* was found in the tombs of the Pharaohs but cite no reference.[25] *Acorus calamus* is not listed in the modern treatment of perfumery,[26] but it is still used in medicine and cosmetics.[27]

The second candidate is lemon grass. These are species of the genus *Cymbopogon* (Poaceae), most likely *C. citratus* (DC) Stapf. Several species are widely grown in tropical regions for their aroma and flavor. As the oil of lemon grass can be sensitizing to the skin, it seems a less likely candidate for the biblical calamus than *A. calamus*.[28]

Caper

The caper, *Capparis spinosa* L. (Capparaceae), is found in only one Bible verse, Eccles. 12:5, although the NIV translates the Hebrew *ab'ionah* as "desire." This chapter is a well-known allegory of old age with reference to sight, hearing, white hair, and, eventually, death. Included in the list of features of old age is when "... the caperberry is ineffective" (NASB)—likely a reference to the use of the caper fruit, technically a berry, as an aphrodisiac.

Gourd

All Bible scholars consider gourd or colycinth to be *Citrullus colycinthus* (L.) Schrad. (Cucurbitaceae), a common vine found in the drier parts of the Middle East. Colycinth creeps along the ground and has leaves that vaguely resemble those of the grape. Its fruit is about the size of an orange with a yellowish rind, greenish pulp that is extremely bitter, and light brown seeds. Figures of gourds were carved into the cedar wood in Solomon's temple (1 Kings 6:18a). It is the only poisonous plant displayed in the temple. Known in Arabic as *handel*, gourd is a common herbel remedy in Jordan today.

Henna

Henna, *Lawsonia inermis* L. (Lythraceae), is a much branched shrub that grows to a height of about ten meters. Its leaves are small and elliptic. The individual flowers, borne in the spring, are small but plentiful. They are extremely fragrant. Even when dried, they retain their heavy scent for a long time. The intense fragrance of henna is also suggested in Song of Sol. 4:13 where it is mentioned with spike-

nard. Probably not native to Israel, it may have been grown in the subtropical En Gedi oasis.[29] Solomon is the only Bible author to mention henna, another example of a Solomonic *hapax legomenon*.

Henna is mainly used as a cosmetic. Today the henna most in demand in the Middle East comes from Iran. The leaves are dried and crushed into a fine powder. This powder is mixed with water and allowed to sit for two days to make a paste that forms a reddish dye. It is then applied to the fingernails, hands, and feet as ornamentation—often with intricate designs. Henna is also used in hair dyes. Both uses are very common in several countries, most notably Sudan. In Bible days, its cosmetic use may also have been widespread. Deut. 21:12 may allude to the need for the colored hair and nails to grow out because the children of Israel were proscribed from any sort of tattoo or body marking.

Hyssop

Hyssop, one of the better known plants of the Bible, is mentioned ten times in the Old Testament[30] and two times in the New Testament (John 19:29,[31] Heb. 9:19). This plant, or a product of this plant, formed an important part of the Passover (Exod. 12:22), the ceremonial cleansing from skin disease (Lev. 14), and the red heifer offering (Num. 19). Perhaps when David mentions hyssop in Ps. 51:7, he is referring to Lev. 14. Heb. 9:19 refers to the ceremonial cleansing of the children of Israel with hyssop. Interestingly, the Old Testament does not mention the use of hyssop with this specific event, but hyssop may have been a common instrument for handling a sponge (see comments below on John 19:29). The only Old Testament verse that does not mention hyssop in a ceremonial use is 1 Kings 4:33. It is also one of the most puzzling verses dealing with this plant. Here Solomon gives us insight into the ecology of hyssop not found elsewhere in the Bible.

According to Scripture's usage, hyssop (*ezov* in Hebrew) must have the following features. It should grow on a "wall" (1 Kings 4:33) and the plant and/or its extracts should be useful for purgatives[32] (in both Lev. 14 and Num. 19, hyssop is associated with cedar wood implying a purgative use[33]). Moreover, it may have been commercially available perhaps in the same way it is today. This could explain its use by the children of Israel in the Nile Delta where its occurrence would be rare. It is not certain (as it might seem on first glance) that it can hold moisture, like a paint brush. Wool or another material could have been used as a sponge in the application of the blood of the Passover lamb to the door (Exod. 12), while the hyssop served as an instrument to handle the sponge, preventing loss of moisture during the application process. As other suffrutescent plants could be used in the same way, it seems likely that hyssop may have the combined characteristics of water retention, support, and aromatic constituents. For all of these uses, *Origanum syriacum* L. (Lamiaceae), a plant known in English as Syrian hyssop and a relative of the well-known kitchen herbs, oregano and marjoram, seems the most likely candidate.

[Hyssop], or a product of this plant, formed an important part of the Passover (Exod. 12:22), the ceremonial cleansing from skin disease (Lev. 14), and the red heifer offering (Num. 19).

Modern Bible scholars, however, still express uncertainty about the actual identity of hyssop. Some suggest that it could be caper (*Capparis spinosa*), a very common shrub in the Middle East.[34] The only evidence for caper is in 1 Kings 4:33 where it refers to hyssop (*ezov*) growing from a wall. Often this has been assumed to be a masonry wall,[35] similar to those commonly seen in old cities in the Middle East and Mediterranean region where caper is so common.[36]

A problem with caper is how it is used. The fruit, a soft berry-like structure when mature, was apparently used as an aphrodisiac (see caper above). There is little likelihood that Solomon confused these two plants. A further problem is its present use. Palestinians I have interviewed never use any part of the caper plant for food or condiment. Those who do use capers were introduced to them in Europe and purchase imported capers in local stores!

Just the opposite is true of *O. syriacum*. Known in Arabic as *za'atar* it is one of the most widely used and valued herbs of Arabs today. A typical Palestinian breakfast is bread dipped in olive oil and *za'atar*. It is available in dried form in almost any Arab market. I asked the Samaritans on Mount Gerizim which plant they use for sprinkling in their Passover rites. They answered, "*za'atar*" —further evidence to support the argument for Syrian hyssop.

How can the plant growing out of the wall be *O. syriacum?* It rarely, if ever, grows out of stone walls. The Hebrew word used in 1 Kings 4:33 is *qir*, and while it is the word frequently used for a wall, this use does not preclude reference to natural

ledges, such as are common in the mountains.[37] In this verse, Solomon is speaking of natural history, not manmade objects, thus reference to a masonry wall would be out of context. *Origanum syriacum* is most frequent on rocky ledges and outcrops in the mountains—rock formations which can reasonably be described as walls.

The word in John 19:29[38] is the same as that in Heb. 19 and there seems little doubt that hyssop is meant. The problem seems to be in how the hyssop was used. There are several possibilities. The first is that the sponge was put on a long stalk of the hyssop plant. This is unlikely due to the short stature of hyssop. The Greek words meaning "binding it to hyssop" might also suggest that the hyssop plant was a kind of holder for the sponge.[39] This is plausible because of the growth habit of the hyssop where a sponge could be put in the center of the much branched plant. Why this would be necessary is unclear. Perhaps there is also a connection with the use of hyssop as a broom (Heb. 9:19, in this case with scarlet wool, which would function very well for sprinkling of water).

Lily

The lily is mentioned only in connection with the ornamentation of the temple (1 Kings 7; 2 Chron. 4), the healing of Israel (Hosea 14), the Sermon on the Mount (Matt. 6; Luke 12), and eight references in the Song of Solomon. It is not possible to identify with certainty the plant referred to as the lily.[40] Apparently the word translated lily can be used to describe any attractive flower.

Solomon's prescription of lilies for decoration on the pillars and laver of the temple is problematical. Hepper has suggested that they are *Nymphaea* species—the large, showy water lilies the children of Israel saw in the Nile River in Egypt and which have an important place in Egyptian imagery.[41] Yet this seems incongruous as the imagery of Egypt had little place in either tabernacle or temple. All of the other plant images used in Solomon's temple—almond, gourd, palm, pomegranate—are plants of the land. Their use would be consonant with the deuteronomic blessings associated with the land.

Mandrake

The mandrake, *Mandragora officinalis* L. (Solanaceae), is mentioned in Gen. 30:14–16 and Song of Sol. 7:13 although it is a common plant in many parts of the Middle East. The small, yellow fruits have a very sweet, attractive odor.[42] These are the only references to mandrake fruits in the Bible.

Myrrh

Myrrh is the dried resin of several species of *Commiphora* (Burseraceae), shrubs or small trees of the arid and semi-arid regions of East Africa, Arabia, and the Indian subcontinent. Different species have different uses. Some are used medicinally[43] and others for their fragrance.[44] Recent work indicates that *C. myrrha* (Nees) Engl. has opiate qualities.[45] This helps us to interpret Mark 15:23 where Jesus, on the cross, was offered vinegar mingled with myrrh but he refused the drug.

[The scented myrrh] permeates the pages of Solomon's writings with more references than any other Bible author.

These two different myrrhs, medicinal and fragrant, are both translated from the same Hebrew word *mor*. The scented myrrh is probably *Commiphora guidotti* Chiov.[46] It permeates the pages of Solomon's writings with more references than any other Bible author. Song of Solomon has seven references to myrrh.

In the sole reference in Proverbs, the harlot refers to her bed as having been sprinkled with "... myrrh, aloes, and cinnamon" (7:17). Myrrh is used in a similar way in Song of Solomon, that is, as a personal perfume with erotic overtones (5:5; 5:13). A guild of plants is associated both with the harlot in Proverbs as well as with the lovers in Song of Solomon. These include cassia, aloes (not the bitter aloe of the New Testament), and myrrh. Myrrh is also linked with frankincense in other verses.

Sometimes people confuse myrrh with the plant known as balm or balm of Gilead (Hebrew *tesriy* or *tsoriy*) in the Bible. Zohary[47] and Hepper[48] consider balm to be a species of *Commiphora* while Stol[49] cautions against confusing *tsoriy* with *basem*. There is strong historical precedence for this confusion as Josephus suggests that the Queen of Sheba brought a plant of *Commiphora* when she visited Solomon.[50] However, myrrh was used much earlier in Israel as a component of the sacred anointing oil (Exod. 30). Myrrh oil has been found at En Gedi. And several years ago, some shrubs were planted there where they appear to be thriving.[51]

Other plants have been translated as balm that are not species of *Commiphora*. A handbook for Bible translators equates balm with *Balanites aegyptiaca* (L.)

Del. (Zygophyllaceae),[52] perhaps because the oil from the seed was used in embalming in Egypt.[53] However, the best candidate for balm of Gilead appears to be *Cistus incanus* L., including *C. creticus* and *C. villosus*, (Cistaceae). *Cistus incanus* is a common and widespread plant in the Mediterranean region.

The extract of *C. incanus* is *ladanum*, or *labdanum*. It was widely used in the Mediterranean for a variety of medicines. Recent research has documented the medical efficacy of some compounds in ladanum.[54] There is also strong biblical evidence that balm of Gilead is *C. incanus*. The weeping prophet, Jeremiah, refers twice to the balm from Gilead (Jer. 8:22, 46:11). While this could be *Commiphora* that had been transported there, a more natural explanation is ladanum. Stronger evidence is found in Ezek. 27:17 regarding trade in balm between Israel and Minnith.

Olive

There are about twenty-five references to the olive tree, *Olea europaea* L. (Oleaceae) and more than 160 references to its oil in the Scriptures. Olive oil had five main uses in Bible days: as food, for illumination, as ointment, for oiling the metal or leather of shields (and by extension as a preservative for other items), and in the manufacture of soap. It is probably safe to assume that when oil is mentioned in the Scriptures, it is always olive oil. Interestingly, we have no record in the Scriptures of olives themselves being eaten.

The olive tree does not grow very tall and lives for up to one thousand years producing fruit during its long life. Trunks often become gnarled, bent, and hollow inside, yet the tree continues to produce fruit. Because of the growth pattern, the wood, though hard with an attractive grain and beautiful color, is not suitable for building. (Small souvenirs are made from it today.) Olive wood is mentioned only in 1 Kings 6 in the construction of several temple articles. It would be difficult to find a piece of olive wood large enough to make a door. However, as these two articles, the seraphim and the doors, would be covered with gold, the imperfections in the olive wood could not be seen. This raises the question of the value of using olive wood for these items.

Palm tree

Perhaps the most distinctive tree in Bible lands is the date palm, *Phoenix dactylifera* L. (Arecaceae), with its towering, unbranched trunk crowned with immense spreading leaves several meters long. The imagery in Song of Sol. 7:7 is unique in the Bible. It likens the feminine charms of the lover to the features of the date palm both in stature and fruitfulness.

Solomon also used the motif of the date palm as ornaments for the temple doors and interior walls (1 Kings 6:29, 32; 2 Chron. 3:4). In the temple described in Ezekiel, the only botanical decoration is the palm tree inscribed upon the posts of the chambers, the gate, and the posts of various gates (40:26, 31, 34, 37).

Pomegranate

Of the six species of pomegranates in Deut. 8:8, *Punica granatum* L. (Punicaceae) may be the most beautiful. Pomegranates figure prominently in three places in Scripture: the garment of the high priest (Exod. 28:33), as a garland on the temple pillars, and in the Song of Solomon. Solomon's temple had two hundred pomegranates engraved on the capitals of the two pillars located at the front of the temple (1 Kings 7:42; 2 Chron. 4:13). These pomegranates are also mentioned in Jer. 52:22–23.

In Song of Sol. 4:3 and 6:7, the red interior of the fruit is likened to the temples of the Beloved. These are the only biblical references to the red, juicy seeds of the pomegranate. The unique seed coat in pomegranate is fleshy and is widely used in the Middle East to prepare a pleasantly sour, refreshing drink. This may be the meaning in Song of Sol. 8:2 while Song of Sol. 6:11 and 7:12 refer to the attractive bell-shaped flowers.

Saffron

Saffron, *Crocus sativus* L., in Song of Sol. 4:14 is another Solomonic *hapax legomenon*. Here it is in a garden, no doubt simply for its ornamental beauty as there is no indication in the Bible of it being used as a spice. Its leaves are grasslike and only a few millimeters wide; its flowers are showy and very fragrant, like the other plants with which it is associated. The most striking feature of the flower is the large, drooping stigmata.[55]

Spices

In English Bibles, three different Hebrew words are translated "spice," "spices," or "spicery." *Nekoth* is found only in Gen. 37:25 and 43:11. It was one of the gifts Jacob sent to the Egyptian ruler to curry favor in order to purchase grain during a famine. This spice is most likely a gum resin, probably from a species of *Astragalus*.[56] *Cam* is used only in Exod. 30:34 in the compounding of the sacred incense. The plant involved is unknown. The word in the remaining references, including all those in the Solomonic

writings, is *besem* or *bosem* and can be used for almost any fragrant or pleasantly pungent compound. All of the references in Song of Solomon deal with a pleasant fragrance except for 8:2 where spiced wine is mentioned and the spice plants (?) of 4:14 and 6:2.

One of the gifts the Queen of Sheba presented to Solomon was a large quantity of spices. In fact, "There had never been such spices as that the queen of Sheba gave to King Solomon" (2 Chron. 9:9). It is not possible to ascertain what kinds of spices these were, whether or not they were to be used for flavoring or incense.

There are two gardens in Song of Solomon. The first is a garden of spices and lilies (6:2). The second is a garden of nuts, located in the valley and associated with grapes and pomegranates (6:11). In the garden of spices, feeding (mentioned twice) is emphasized and in the garden of nuts, what is seen (also mentioned twice) is emphasized. Stol, citing others, indicates that the spices mentioned in Song of Sol. 5:1 may be a tree.[57]

Walnut

There is little doubt among Bible scholars that the nut trees mentioned in Song of Sol. 6:11, another *hapax legomenon*, are *Juglans persica* L. Like apple and apricot, walnut is not native to the Middle East. It first appears in palynological (pollen) remains about the second millennium BC.[58]

Wheat

Wheat, *Triticum* spp., is mentioned as one of the payments sent to Hiram, King of Tyre, in return for timber for the temple and possibly Solomon's personal house ("House of the forest of Lebanon") in 1 Kings 5:11. Unique in the Bible is the allusion of the Bride's waist as "... a mound of wheat encircled by lilies." (Song of Sol. 7:2b). While unseemly words for a modern suitor, this language obviously conveys poetic meaning lost in the twentieth century. It has been suggested that the color of the wheat is indicated although the strong suggestion of fruitfulness also seems obvious.[59] Barley, always valued at half the cost of wheat, is not mentioned in Song of Solomon perhaps because it is too plebeian.[60]

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Notes

[1]Unless noted, all quotations from the Holy Scriptures are from the New International Version.

[2]Bacon seems to have been familiar with this lost literature for his King Salamona tells Bacon "... we have some parts of his [Solomon's] works which with you are lost; namely, that Natural History which he wrote of all plants, from the cedar Libanus to the moss that growth out of the wall; and of all things that have life and motion" (Francis Bacon, *Advancement of Learning, Novum Organum, New Atlantis*, in *Great Books of the Western World*, vol. 30 [Chicago: Encyclopaedia Britannica, 1952]).

[3]J. J. Bono, "Ficino to Descarte," chap. 1 in *The Word of God and the Languages of Man: Interpreting Nature in Early Modern Science and Medicine* (Madison: University of Wisconsin Press, 1995) and C. Webster, *The Great Instauration: Science, Medicine and Reform 1626–1660* (New York: Holmes and Meier, 1975). Both volumes discuss "Solomon's House" and its relationship to the development of scientific societies. The literature on Bacon and his influence on modern science is vast and reviewed in these two books.

[4]Francis Bacon, *Advancement of Learning, Novum Organum, New Atlantis.*

[5]Plants and plant products used in the Solomonic writings include: almond, almug, aloe, apple/apricot, barley, calamus, caper, cedar of Lebanon, cinnamon, crocus, cypress, date palm, fig, flax, frankincense, gall, gourd, grape, henna, hyssop, lign aloe, lily, mandrake, myrrh, nard, olive, pomegranate, saffron, spices, sycomore fig, thornbush, walnut and wheat.

[6]J. C. Greenfield and M. Mayrhofer, "The 'Algumm'/ 'Almuggim' Problem Reexamined," *Supplements to Vetus Testamentum* 6 (1967): 83–9.

[7]Greenfield and Mayrhofer, ibid.

[8]R. Meiggs, *Trees and Timber in the Ancient Mediterranean World* (Oxford: Clarendon, 1982).

[9]F. N. Hepper, *Pharaoh's Flowers* (London: Her Majesty's Stationery Office, 1990).

[10]M. Zohary, C. C. Heyn and D. Heller, *Conspectus Florae Orientalis: Fascicle 2* (Jerusalem: The Israel Academy of Sciences and Humanities, 1983).

[11]Greenfield and Mayrhofer, "The 'Algumm'/ 'Almuggim' Problem Reexamined."

[12]Anonymous, *Helps for Translators: Fauna and Flora of the Bible* (New York: United Bible Societies, 1980).

[13]I. Löw, *Die Flora der Juden*, vol. I–IV (1928; reprint, Hildeshein: Georg Olms, 1967). Löw also discusses the tradition in the Mishna of the mineral coral being *almug*.

[14]M. Zohary, *Plants of the Bible* (Cambridge: University Press, 1982) and H. N. Moldenke and A. L. Moldenke, *Plants of the Bible* (New York: Ronald Press, 1952). Zohary's book is one of the most useful although designed for the nonspecialist. Moldenke and Moldenke's classic is an extensive compendium on Bible plants that draws heavily on traditions of the Christian church. However, the authors apparently had little firsthand experience with the Middle East flora.

[15]Discussed in Greenfield and Mayrhofer, "The 'Algumm'/'Almuggim' Problem Reexamined."

[16]Greenfield and Mayrhofer, ibid.

[17]G. Post, *Flora of Syria, Palestine and Sinai*, 2d ed., revised and enlarged by J. E. Dinsmore (Beirut: American University, 1932–1933).

[18]D. M. Dixon, "Timber in Ancient Egypt," *Commonwealth Forestry Review* 53 (1974): 205–9.

[19]King Solomon made for himself the carriage; he made it of wood from Lebanon (Song of Sol. 3:9).

[20]E.g., M. Zohary, *Plants of the Bible*.

[21]Moldenke and Moldenke, *Plants of the Bible*.

[22]M. Zohary and M. Hopf, *Domestication of Plants in the Old World*, 2d ed. (Oxford: Clarendon, 1994).

[23]Zohary and Hopf, ibid.

[24]T. J. Motley, "The Ethnobotany of Sweet Flag, *Acorus calamus* (Araceae)," *Economic Botany* 48:4 (1994): 397–412.

[25]L. Milne and M. Milne, *Living Plants of the World* (New York: Random House, 1967).

[26]R. R. Calkin and J. S. Jellinek, *Perfumery: Practice and Principles* (New York: Wiley, 1994).

[27]A. Y. Leung and S. Foster, *Encyclopedia of Common Natural Ingredients used in Food, Drugs, and Cosmetics*, 2d ed. (New York: Wiley Interscience, 1996).

[28]Leung and Foster, ibid.

[29]E.g., "My beloved is unto me a cluster of henna flowers in the vineyards of En Gedi" (Song of Sol. 1:14). En Gedi, an oasis between the Dead Sea and the precipitous cliffs of the Judean Desert is a place where many medicinal and cosmetic plants such as myrrh and henna were grown. The climate is tropical; there is an abundant supply of water.

[30]Exod. 12:22; Lev. 14:4, 6, 49, 51, 52; Num. 19:6, 18; 1 Kings 4:33; Ps. 51:7.

[31]M. C. Tenney, "John," in *The Expositor's Bible Commentary*, vol. 9, ed. F. E. Gaebelein (Grand Rapids: Zondervan, 1981), 1–203.

[32]A. Fleisher and Z. Fleisher, "Identification of Biblical Hyssop and Origin of the Traditional Use of Oregano-Group Herbs in the Mediterranean Region," *Economic Botany* 42:2 (1988): 232–41.

[33]N. Dudai, N. Putievsky, E. Ravid, U. Palevitch, D. and A. H. Halevy, "Monoterpene Content in *Origanum syriacum* as Affected by Environmental Conditions and Flowering," *Physiologia Plantarum* 84 (1992): 453–9.

[34]E.g., Moldenke and Moldenke, *Plants of the Bible*.

[35]L. J. Musselman and H. P. Medema, *Van U is ook de Aarde. De zwijgende maar machtige boodschap von planten in het heligdom (Yours (is) Also the Earth. The Silent Yet Powerful Language of Plants in the Sanctuary.)* (Vaassen, Netherlands: Uitgiverij H. Medema, 1993).

[36]There is a remarkable reference to the power of the caper in destroying masonry structures in S. A. Fairushina, "*Capparis spinosa* L., Destructor of Architectural Memorials in Uzbekistan," *Uzbekistan Biology Journal* 5 (1974): 39–42 (Original not seen).

[37]E.g., Lev. 14:37; 1 Kings 6:5 and many other places.

[38]There is a problem of textual criticism here, as one Greek minuscule reads *hussooi*, meaning "on a javelin"; cf. some older Latin translations which read *perticae*, "on a 'long' pole." Moffatt, New English Bible, and J. B. Phillips adopt this option, but even if it would be the most plausible composition of the facts (for which the traditional reading would allow room!), it is probably not what the Evangelist wrote. See Bruce Metzger, e.g., *A Textual Commentary to the Greek New Testament* (New York: United Bible Society, in loco) who quotes R. G. Batcher, "Basel," *Revue Internationale de la Traduction*, VII (1961): 61. See also M. C. Tenney, "John."

[39]F. G. Beetham and P. A. Beetham, "A Note on John 19:29," *Journal of Theological Studies* 41:1 (1993): 163–9.

[40]Musselman and Medema, *Yours (is) Also the Earth*.

[41]F. N. Hepper, *Baker Encyclopedia of Bible Plants* (Grand Rapids: Baker Book House, 1992).

[42]A. Fleisher and Z. Fleisher, "The Fragrance of Biblical Mandrake," *Economic Botany* 48:3 (1994): 243–51.

[43]A. Y. Leung and S. Foster, *Encyclopedia of Common Natural Ingredients used in Food, Drugs, and Cosmetics*, 2d ed. (New York: Wiley Interscience, 1996).

[44]R. R. Calkin and J. S. Jellinek, *Perfumery: Practice and Principles* (New York: Wiley, 1994).

[45]*Science News* 149:2 (1996): 20.

[46]M. Thulin and P. Claeson, "The Botanical Origin of Scented Myrrh (*bissabol* or *habak hadi*)," *Economic Botany* 45:4 (1991): 487–94.

[47]Zohary, *Plants of the Bible*.

[48]Hepper, *Baker Encyclopedia of Bible Plants*.

[49]M. Stol, *On Trees, Mountains, and Millstones in the Ancient Near East* (Leiden: Ex Oriente Lux, 1979).

[50]Flavius Josephus, *The Works of Flavius Josephus*, trans. William Whiston (Philadelphia: Winston, 1936).

[51]Hepper, *Baker Encyclopedia of Bible Plants*.

[52]Anonymous, *Helps for Translators*.

[53]Hepper, *Pharaoh's Flowers*.

[54]A. Danne, F. Peterett and A. Nahrstedt, "Proanthocyanidins from *Cistus incanus*," *Phytochemistry* 34:4 (1993): 1129–33.

[55]The crocus illustrated in Zohary, *Plants of the Bible*, does not have the large, drooping stigmata nor the grass-like leaves of *Crocus sativus* and appears to be a different species from saffron. Hepper in *Planting a Bible Garden* (London: Her Majesty's Stationery Office, 1987) suggests planting saffron from seed. However, this is not possible as saffron is a sterile triploid and does not produce seeds.

[56]Hepper, *Baker Encyclopedia of Bible Plants*; Musselman and Medema, *Yours (is) Also the Earth*; Zohary, *Plants of the Bible*.

[57]Stol, *On Trees, Mountains, and Millstones*.

[58]Zohary and Hopf, *Domestication of Plants*.

[59]D. F. Kindow, "Song of Songs" in *The Expositor's Bible Commentary*, vol. 5, ed. F. E. Gaebelein (Grand Rapids: Zondervan, 1991).

[60]L. J. Musselman and H. P. Medema, *Laat de Aarde het u Vertellen. De zwijgende maar machtige boodschap von planten in het land van de Bijbel (The Earth Shall Teach You: The Silent Yet Powerful Language of Plants in the Land of the Bible)*, 2d printing (Vaassen, The Netherlands: Medema, 1993).

Communications

Extrasolar Planets and Religious Responses

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One of the most important discoveries of 1996 involved the first clear evidence for extrasolar planets orbiting several sun-like stars. More than a dozen candidates for planets around nearby stars have excited the imagination of astronomers and nonprofessionals alike. If it can be demonstrated that planetary systems are a common occurrence among the billions of stars in our galaxy, then the possibility of extraterrestrial life may take on greater credibility. Indeed, the idea that intelligent civilizations might exist on other planets could become more compelling. Early reactions to extrasolar planet discoveries jumped at the possibility that they might contain water and thus harbor life.[1] However, a closer look at the accumulating data suggests that our solar system may be unique in its life-supporting planetary arrangement.

Both the possibility of life in other planetary systems and the apparent uniqueness of our solar system have interesting religious implications. Even if the possibility of extraterrestrial life were to increase, Christian thinking should be able to accommodate such ideas with perhaps some theological adjustments concerning the singular nature of the Incarnation. Roman Catholic theologian Father Theodore Hesburgh states: "It is precisely because I believe theologically that there is a being called God, and that he is infinite in intelligence, freedom and power, that I cannot take it upon myself to limit what he might have done ... Finding others than ourselves would mean knowing him better."[2] Protestant astronomer Owen Gingerich of the Harvard-Smithsonian Center for Astrophysics agrees: "In Genesis there's a sacred story being told that focuses on us. But there is nothing that precludes intelligent life elsewhere in the universe."[3] However, if the evidence continues to point toward the uniqueness of our solar system, many current assumptions of popular culture would be challenged.

For many scientific devotees, extraterrestrial intelligence has become an article of faith, following the postmodern trend to demote humans from any unique place of significance in the universe. Carl Sagan,who believed that every sun-like star would have planets,[4] was one of the most vocal exponents of this view. The movie based on his novel *Contact* expresses this faith that something out there is "greater than ourselves" and "none of us are alone," repeatedly telling us, "if we are alone in the universe, there sure is a lot of wasted space." However, growing evidence suggests the possibility that the entire universe was necessary to produce the conditions for intelligent life on a single planet.[5]

Extrasolar Planet Background

The history of extrasolar planetary searches suggests that some caution is needed in assessing recent evidence. Early in the twentieth century, astrometric evidence from Barnard's star, a nearby red dwarf one-seventh the mass of the Sun, indicated a slight wobble which seemed to imply gravitational inter-

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action by one or two Jupiter-mass planets in decade-long orbits. However, by 1980 further work showed that the wobble of Barnard's star was more likely the result of a companion star too small to observe.[6]

Double-star systems like Barnard's tend to rotate around each other in larger orbits than the tiny wobble of a star with a planetary system. The mass of an unseen companion is estimated from the amount of wobble detected from a visible star. Masses between about forty and eighty Jupiter masses usually qualify as brown-dwarf stars, defined as objects that form like other stars by gravitational collapse of a dust cloud rather than from a stellar disk, but are too small to sustain the nuclear fusion processes that energize most stars.

Planets condense from materials in the disk produced by the collapse and rotation of a newly forming star, and are believed to have masses less than about ten Jupiter masses. In standard theories of planetary formation, matter in the protoplanetary disk collides and coagulates into planetesimals ranging up to ten kilometers in size. The planetesimals attract each other by gravity to trigger a sequence of mergers that produces the inner rocky terrestrial planets, and the outer rock-and-ice cores that seed the giant gas planets.

Because giant planets require such a large amount of material, they should form only in regions several astronomical units (AU = Earth-Sun distance) from their host star. Only in these outer expanses of the disk (greater than about five AU) is it cool enough for ice to form out of water molecules, roughly tripling the amount of solid material available for planet making. When the ice-and-rock core reaches about ten Earth masses, it begins to attract huge amounts of hydrogen and helium gases and expands to about one Jupiter mass (318 Earth masses) until its gravity can begin to tear a gap in the disk that feeds it, thus stopping its growth. With this model, theorists were successful in accounting for the solar-system sequence of inner rocky planets (Mercury to Mars) and outer gas planets (Jupiter to Neptune) beyond five AU, but were completely surprised by the orbits of the new Jupiter-size extrasolar planets.[7]

Planet discoveries around sun-like stars began in 1995 and proliferated in 1996 with a new generation of computers and optical instruments. Since planets are about a billion times fainter than their host star, they are virtually impossible to see by direct methods. An indirect method involves searching for a tiny wobble in the motion of a star as it and any companions it may have orbit about their common center of mass. Although the gravitational interaction between a star and planet is too small to observe directly, the radial velocity (back and forth along the line of sight) alternately increases and decreases the wavelength of light from the star, causing an alternating Doppler shift toward the red and blue end of its spectrum.

The amount of a star's Doppler shift determines its velocity. The shift in the wavelength due to a Jupiter-size planet is only one part in ten million. In the Doppler shift, the periodic variation reveals the period of a planet's orbital motion. The velocity of the star and the period of its motion can be analyzed to determine the radius of the orbit (from Kepler's laws) and the minimum mass of the planet (from Newton's laws), but the unknown inclination of its orbit allows for a larger wobble than its apparent radial motion and, thus, a larger possible mass—up to a factor of about two. The shape of the periodic variation curve reveals the shape of the orbit. A circular orbit produces a perfect sine wave while an eccentric orbit produces an irregular variation which can be analyzed by computer to determine the orbital shape.

Extrasolar Planet Evidence

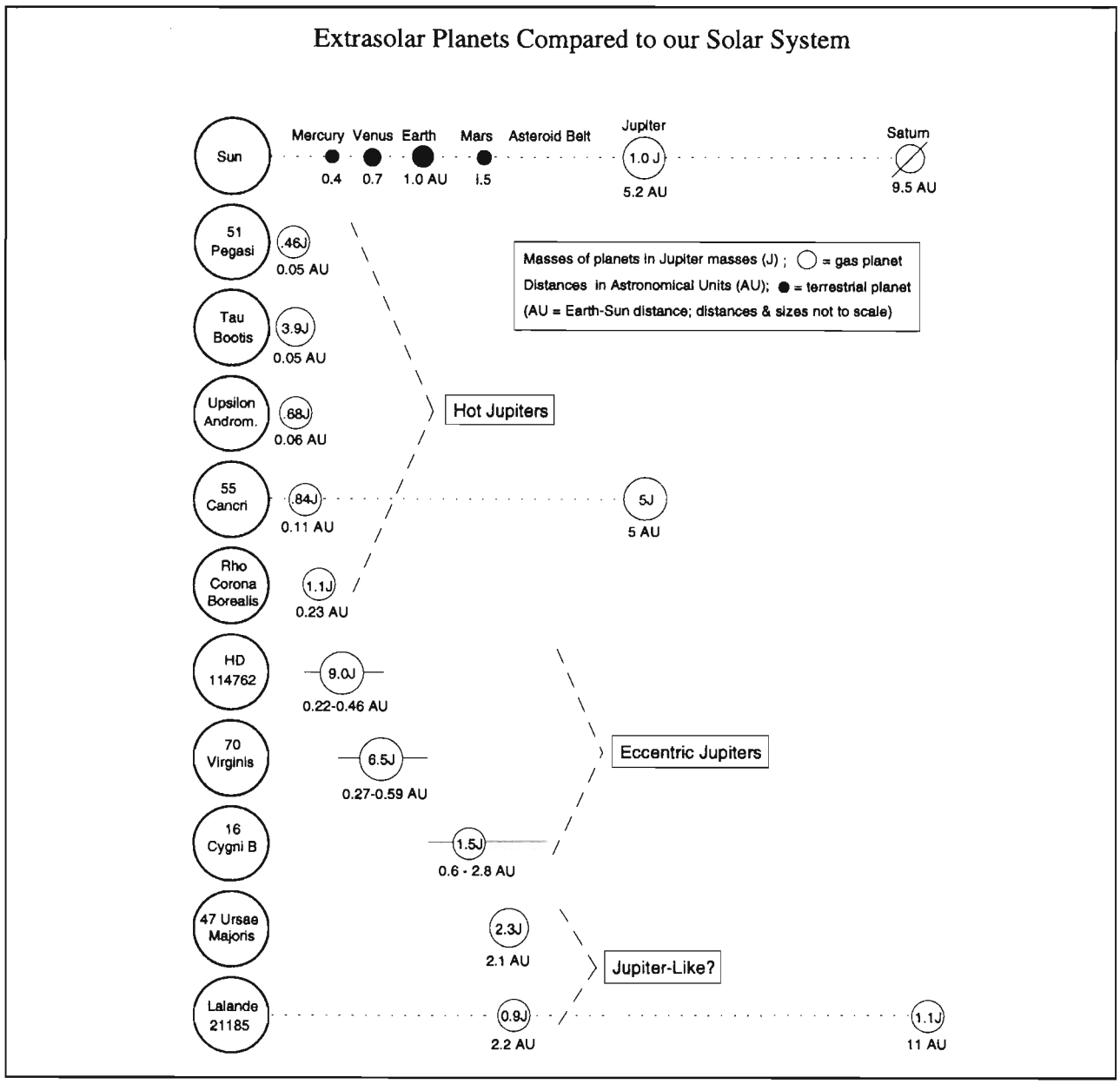
Extrasolar planet discoveries around sun-like stars have revealed two new and unexpected types of planetary objects: hot-Jupiter planets with small circular orbits and eccentric-Jupiter planets with elongated orbits. In October 1995, Swiss astronomers, Michael Mayor and Didier Queloz, announced evidence of a companion object orbiting the star 51 Pegasi about forty light years away. New computer techniques revealed a periodic Doppler shifting of the light from the star, suggesting a tiny wobble of up to eighty m/s caused by a planet of at least 0.46 of Jupiter's mass and a period of only 4.23 days in a circular orbit of just 0.05 AU radius. At this tiny distance from the sun, the 51-Pegasi planet has a surface temperature of about 1800°C, making it the first of several "hot-Jupiter" planets.[8]

During 1996, Geoffrey Marcy and Paul Butler of San Francisco State University announced the discovery of six new Jupiter-size planets in a survey of 120 nearby sun-like stars over a period of about ten years. Using a refined form of the method of Mayor and Queloz, they achieved a three-fold improvement in accuracy, detecting radial motions to about three m/s. Since Jupiter, which contains more mass than all the other planets combined, causes the Sun to move at speeds of up to 12.5 m/s, Jupiter-size planets can be readily detected. With these accuracies, however, Earth-size planets cannot be detected.

Even Jupiter-size planets with periods of several years require that data be collected over a long enough time to determine their orbital periods.[9]

Three of Marcy and Butler's new planets were hot Jupiters with nearly circular orbits at distances of only 0.11 AU or less from their host stars (55 Cancri, Tau Bootis and Upsilon Andromedae), having periods less than fifteen days and minimum masses ranging from 0.68 to 3.87 Jupiters. Another planet discovered in 1997 around the star, Rho Corona Borealis, has a minimum mass of 1.1 Jupiters and a circular orbit at a distance of 0.23 AU and period of 39.6 days. Since it is much closer than Mercury to the Sun, it also appears to qualify as a hot Jupiter. These discoveries showed that the 51-Pegasi planet was not as unusual as it first seemed.

Marcy and Butler also found an eccentric-Jupiter planet around the star 70 Virginis with a 117-day elongated orbit ranging from 0.27 to 0.59 AU and a mass of at least 6.5 Jupiters. This discovery led David Latham at Harvard to suggest that an object found in 1988 with a mass of at least nine Jupiters orbiting the star HD 114762 in an 84-day elongated orbit that varies from 0.22 to 0.46 AU was also an eccentric-Jupiter planet rather than a small brown dwarf as first assumed. A third eccentric Jupiter was



discovered in 1997 orbiting the star 16 Cygni B in a triple star system. It has a mass of at least 1.5 Jupiters and a 2.2 year orbit varying widely between 0.6 and 2.8 AU.

A few of the recent extrasolar planet discoveries appear to be a little more like Jupiter, but still rather puzzling. Two of Marcy and Butler's first six planets included a second one around 55 Cancri, having a period of about twenty years, an orbital radius of about five AU, and a mass of at least five Jupiters. Another one around 47 Ursae Majoris has a minimum mass of 2.3 Jupiters, a period of 3.0 years, and a nearly circular orbit at a distance of 2.1 AU, still less than the expected distance for a giant planet. At this distance it would have a surface temperature of about 85°C, low enough to allow for liquid water but with a huge surface gravity that would be problematic for life.

Two other Jupiter-like planets, both orbiting the star Lalande 21185, were announced in 1996 by George Gatewood of the University of Pittsburgh.[10] Analyzing data from fifty years of photographic observations and eight years of photoelectric measurements, he detected one planet with about 0.9 of a Jupiter mass at 2.2 AU and a period of about 5.8 years, and another with about 1.1 Jupiter masses at eleven AU and a period of about thirty years.

An objection to extrasolar-planet interpretation of the Doppler evidence has been raised by David F. Gray, who claims that the perceived periodic motions of some stars may be the result of their pulsations rather than planetary interactions. Gray claims that oscillations in the star's atmosphere could reshape spectral lines by Doppler shifting and gives evidence that the spectral lines for 51 Pegasi vary in shape with a 4.23 day period. This objection has been countered by Mayor, Queloz, Marcy and Butler by pointing out that pulsations should change the brightness of 51 Pegasi, but it has a constant brightness to one part in five thousand. They also point out that only one period has been detected, with none of the other overtones or oscillation modes that should accompany pulsations.[11]

Extrasolar Planet Implications

The discovery of extrasolar planets around sun-like stars may at first seem to offer new hope for the existence of planetary systems like ours that would support extraterrestrial life. But the unexpected nature of these planets has raised new doubts about the possibility that any of them might harbor life. Hot-Jupiter planets and eccentric-Jupiter planets have initiated a new generation of theories about planetary formation and the uniqueness of our solar system. Evidence so far seems to indicate that our solar system is highly unusual in its life-supporting planetary arrangement.

The strangest of the new planets are the hot Jupiters with minimum masses ranging from 0.46 to 3.87 Jupiter masses and orbital radii less than 0.23 AU. They all are most likely gas planets with surface temperatures well above the boiling point of water. Revised theories suggest that they might have formed beyond five AU from their host stars in a dense protoplanetary disk, which then slowed them down and caused them to spiral inward. Such a process would obliterate any small, inner terrestrial planets congenial to life as we know it on Earth.[12]

The eccentric Jupiters have longer periods (84 days to 2.2 years) and larger orbits, but with huge eccentricities (0.35 to 0.67) and larger distances from their host stars out to as much as 2.8 AU. New theories suggest that two or more super-Jupiters forming from a dense protoplanetary disk might then interact with each other gravitationally, causing some to be thrown into eccentric orbits or even tossed free of the star (as seen in May 1998 in the first photo of a possible extrasolar planet). Such eccentric giants would gravitationally disturb and eventually collide with smaller inner planets, again precluding life-supporting planets like Earth.

The Jupiter-like planets are a little more like those in our solar system but still diverge from ideal conditions for life. Even though they have nearly circular orbits and are further from their host stars than the hot Jupiters, their huge mass (0.9 to 5 Jupiter masses) suggests that they are lifeless gas planets like Jupiter with stormy, violent winds and intense gravity. Those that are near the habitable zone (about two AU) would also tend to upset the orbital stability of any smaller Earth-like planets. In cases where systems of two planets have been identified (55 Cancri and Lalande 21185), the outer ones are most like Jupiter, but each has an inner hot Jupiter that would again preclude terrestrial planets.

Although current methods can only detect Jupiter-size planets, the orbits detected so far appear to reduce the possibility of smaller life-supporting planets. Most of the 120 stars surveyed by Marcy and Butler do not appear to have Jupiter-like planets at all (in either size or period), but they could have smaller undetected planets. However, such Jupiter-like planets may be necessary for the development of complex life forms on smaller planets. Earth is struck by asteroids large enough to cause mass extinctions of species about once every fifty to a hun-

dred million years. Computer simulations by George Wetherill show that without Jupiter in its present stable orbit beyond Earth, sweeping up most killer asteroids and comets (as seen with comet Shoemaker-Levy 9 in July 1994), this Earth-collision rate would be about a thousand times greater, too large to permit the development of higher forms of life, if any at all.[13] Thus none of the 120 sun-like stars surveyed so far appear to offer much hope for life, greatly decreasing the probability factors that Sagan and others have presumed as the basis for the existence of extraterrestrial civilizations.

Religious Responses

The possibility of extraterrestrial civilizations has become almost an article of faith for many contemporary scientists, despite the lack of any evidence for their existence, and the discovery of extrasolar planets has not added much hope. Just as ancient civilizations looked to the skies for their deities, many modern materialists hope for radio signals from space to confirm their faith in higher intelligences on extrasolar planets. Such blind enthusiasm offers a naturalistic substitute for faith in God, and can easily lead to alternative religious innovations. Such influence is evident in three, nineteenth-century religious movements that incorporated extraterrestrial life into their religious thought: the New Jerusalem or Swedenborgian Church, the Mormon Church, and the Seventh-Day Adventist Church.

The Swedish scientist and sage Emmanuel Swedenborg (1688–1772) claimed to have had conversations with extraterrestrials and worked out a theology that included them. The Swedenborgian Church was organized in London (1787) and now has about 40,000 members. Besides the *Book of Mormon*, Joseph Smith (1805–44) provided his Church of Jesus Christ of Latter-Day Saints with other Scriptures, including *Doctrine and Covenants* and *The Pearl of Great Price*, which taught that there are many inhabited worlds in the universe. This doctrine is given considerable emphasis in the theology of the Mormons, who now number some eight million members. Beginning in 1846, Ellen G. White (1827–1915) began having visions involving extraterrestrials. When she and her associates founded the Seventh-Day Adventist Church in 1863, White developed a theology involving extraterrestrials in which sin occurred only on Earth. In *The Story of Patriarchs and Prophets*, she taught that Christ passed from star to star to superintend the sinless intelligences of other worlds. This cosmic conception of Christianity has spread to a worldwide membership of about 4.4 million.[14]

Most scientific interest in extraterrestrial intelligence today is based on naturalistic arguments concerning the probability of life arising on extrasolar planets, but it is often closely associated with religious themes, such as a yearning for meaning, wisdom, and even immortality which is presumably possessed by extraterrestrial higher intelligences.[15] Although plausible arguments are used to further this faith, no evidence has yet been found to support it. If the evidence for the lack of Earth-like extrasolar planets that can support intelligent life continues to accumulate, the only saving hope for many naturalists will fail. It is too early to say for sure, but the most important lesson that might emerge from such evidence is the uniqueness of our solar system with its life-sustaining planetary arrangement as a special gift from God to his creatures on Earth. ✣

Notes

[1]R. Cowen, "Two Extrasolar Planets May Hold Water," *Science News* 149 (January 27, 1996): 52.

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

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

[4]I. Shklovskii and C. Sagan, *Intelligent Life in the Universe* (San Francisco: Holden-Day, 1966), 410–413.

[5]For a summary of the evidence before 1993, see Hugh Ross, *The Creator and the Cosmos* (Colorado Springs: NavPress, 1993), 123–35.

[6]D. Mammana and D. McCarthy, *Other Suns: Other Worlds?* (New York: St. Martin's Press, 1996), 43–59.

[7]New planet formation theories are outlined by James Glanz, "Worlds Around Other Stars Shake Planet Birth Theory," *Science* 276 (30 May 1997): 1336–9.

[8]M. Mayor and D. Queloz, "A Jupiter-Mass Companion to a Solar-Type Star," *Nature* 378 (1995): 355.

[9]A good summary of recent discoveries is by Robert Naeye, "The Strange New Planetary Zoo," *Astronomy* (April, 1997): 42–9. Marcy and Butler maintain a good website for current information on extrasolar planet discoveries at http://cannon.sfsu.edu/~williams/planetsearch/planetsearch.html.

[10]G. Gatewood, "Lalande 21185," *Bulletin of the American Astronomical Society* 28 (1996): 885.

[11]D. Gray, "Absence of a Planetary Signature in the Spectra of the Star 51 Pegasi," *Nature* 385 (1997): 795 and Joshua Roth, "Does 51 Pegasi's Planet Really Exist?" *Sky and Telescope* 93 (May 1997): 24–5.

[12]D. Mammana and D. McCarthy, *Other Suns: Other Worlds?*

[13]G. Wetherill, "How Special is Jupiter?" *Nature* 373 (1995): 470 and Ken Croswell, *Planet Quest* (New York: The Free Press, 1997), 161–73.

[14]M. Crowe, "A History of the Extraterrestrial Life Debate," *Zygon* 32 (June 1997): 147–62.

[15]See, for example, Drake and Sobel, *Is Anyone Out There?* 159–62.

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Pain, Pleasure and Evolution: An Analysis of Paul Draper's Critique of Theism

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In April of 1997, Paul Draper of Florida International University presented a paper, "God, Evil and Evolution," at the annual regional conference for the Society of Christian Philosophers held in Boulder, Colorado. This was a preliminary study presenting three arguments for a cumulative case against theism to be developed in a forthcoming book.

Arguments that relate evolution to the existence of God will always be of special interest to *Perspectives on Science and Christian Faith* readers. So before his book comes out, it will be of value to look at some of Draper's basic claims.

In his first two arguments, Draper hoped to show a greater probability for naturalism over theism by arguing that we should expect certain known facts to obtain on the assumption of naturalism more than on theism. His third argument is that naturalism is more intrinsically probable than theism.

Evolution as Evidence Against Theism

In the first part of his paper, Draper looks at the notion of theistic evolution and comments that while evolution does not disprove theism, he believes it does give evidence against it. He claims that with the assumption of the falsehood of special creation, and because special creation has some probability given theism and none given naturalism, "evolution is ... more probable on naturalism than on theism." ("*Special creation*" means that complex living things did not descend from simpler ones but were created independently.)

Even this first meager step in Draper's argument, however, can be questioned. If the assumed falsehood of special creation can be used in this way to count against theism, then it would not be hard to think of a naturalistic myth (if I might call it that) that could count against naturalism and to the same degree. A naturalistic myth would be the alternate of a supernaturalistic myth, like special creation. In this case, our naturalistic myth would need to have a creation account that does not involve intelligent agency.

Imagine that a great cosmic tree once grew in a cosmic ocean and dispersed its seeds upon the earth. Each seed essentially became a species of plant or animal and populated the earth. Intelligent agency is specifically excluded in this myth, just as it is specifically included in special creation. Intelligent agency can be plugged into or removed from such myths and accounts very easily. For example, all we would need to do to make special creation a naturalistic myth would be to say that each species developed independently from inorganic matter but with no creator to do the work. We recognize today that the probability of such a chance event is infinitesimal, but that does not make it any less a naturalistic explanation.

Following Draper's reasoning, since our naturalistic myth has some probability given naturalism and none given theism, and since this myth is known to be false, evolution would be more probable on theism than on naturalism. But since we also assume that the falsehood of special creation makes

evolution more probable on naturalism than theism, we would have to conclude that evolution is no more or less likely given naturalism or theism. (That is, it is no more or less likely if no other evidence is being considered.) Obviously, just coming up with naturalistic or supernaturalistic myths will not affect the probability of naturalism or theism.

Draper next critiques Christian evolutionists, like Diogenes Allen, Ernan McMullin, and Howard Van Till, who argue that God's transcendence or God's power and wisdom preclude not only special creation but even the creation of the first life form. God, being so incomprehensibly great in wisdom and power, simply set the universe going so that it would produce life on its own. Draper at one point responds—and this is possibly his best response on this issue—that it is difficult to imagine that a religion that professes the claim of an incarnation must in *principle* reject any direct divine activity in the creation.

But speaking more generally, to argue from what God should or should not do seems to me to be a method that can too easily be grounded in subjectivity. Duane Gish sometimes complains when scientists try to give any scientific explanations at all for certain phenomena. He appears to think it inappropriate of God to use physical processes in such cases. God should just miraculously and inexplicably "make it so." Augustine thought even six days of creation was gratuitous. What God should do, he thought, was to create everything instantly. Maybe it is our idea of what God should do or how God should do it that is mistaken. Perhaps waiting billions of years does not bother God like it does us. But maybe intervening at certain points in the origin and evolution of life does not bother God either.

Christians should have no difficulty accepting the possibility of theistic evolution in principle. I would accept it if I believed that the scientific evidence warranted it. I think that evangelical exegetes like Henri Blocher have shown us that there is certainly no good biblical grounds to reject at least the more conservative forms of theistic evolution. And possibly all forms can be accepted exegetically.

My greatest concern is simply that theistic evolutionists not reject other scientific possibilities merely because of their philosophical and less than certain theological assumptions. To follow methodological naturalism without being open to non-naturalistic explanations seems to me to be unscientific. We should certainly seek naturalistic explanations. But we also need to be open to non-naturalistic explanations, particularly as we increasingly fail to find naturalistic ones. For example, we must never cease looking for nonintelligent causes for the origin of life. God might have created as the above theistic evolutionists say, but as we continue to fail to find such explanations, we should consider the possibility of direct activity by an intelligent agent. It is simply unscientific to presuppose that there cannot be such an agency discoverable by science. Methodological naturalism closes us off from legitimate hypotheses that we need to consider.

Draper's next claim is that if methodological naturalism is as successful as some believe (he thinks it is not), then its "... success would obviously be ... much more likely on naturalism than on theism." But this is not at all obvious. Wes Morriston, philosophy professor at the University of Colorado, responded to Draper's claim by pointing out that we simply have no reason to believe that God would not usually use such naturalistic processes rather than intervene more directly in nature. Thus we still have found no greater likelihood for naturalism over theism.

From his assumed proof that evolution is more probable on naturalism than on theism, Draper goes on to attempt to show that it is *significantly* more probable on naturalism. He does this by trying to show that we do have strong reasons to believe God would carry out special creation. Using the old design argument he says:

> Since we know antecedently that present day organisms are produced only by reproduction and yet such organisms have not always existed, it is, independent of the evidence for evolution, quite likely that the resemblance between the causes of complex machines and complex living things consists in the fact that both are specially created, machines by human beings and organisms by God.

But this does not follow at all. God might create living things like one creates a machine, using, however, chance processes to originate life and an evolutionary mechanism to change from one species to another. Or God might specially create only the first life forms and then allow evolutionary processes to carry out the further development of life. Or God might specially create the first life forms and then be more directly involved in the changes from one major life form to another (progressive creation). *All* of these possibilities are compatible with Draper's definition of evolution and none fit his definition of special creation (given earlier). (He defines "*evolution*" as "'descent with modification' of all complex organisms" with *one* mechanism for such change being "natural selection operating on random genetic mutation.")

The Distribution of Pleasure and Pain as Evidence Against Theism

Draper presents a second major argument against theism by looking at the distribution of pleasure and pain in the world under evolutionary naturalism as compared to evolutionary theism. He says that under evolutionary theism "it would not be at all surprising" that the driving mechanism of evolution would be goal directed and that pleasure and pain would be given special treatment to be respectively expanded and limited for moral purposes.

But it also would not be at all surprising if pleasure and pain were *not* given special treatment. God might use an apparently very nongoal-directed mechanism like natural selection as long as it can be foreseen to achieve the desired final goal, namely, the production of an organism with sufficient mental capacity to become human. And, of course, simply producing the lower organisms might also be a goal in itself. On the prehuman level, God's goals might have nothing to do with pleasure and pain. Pleasure and pain as they are found in the animal world are just a part of the mechanism to allow survival of the individual and species.

But then, why is so much pain allowed in the animal world? Could not God have achieved this goal without so much pain? Let's consider three possible answers.

First, consider that the existence of sentience, awareness, is such an enormous problem for naturalistic evolution that it is difficult to imagine that any animal could possess sentience unless it were uniquely given by God or a similar supernatural source. Thus, whether animals actually feel pain can seriously be questioned. With advances in our understanding of microbiology, the purely mechanistic character of life has become increasingly prominent. From what we see of them, animals are, more than anything else, essentially complicated machines. Such machines can be programmed to survive by avoiding harm and this will appear to us as pain responses. But it is unimaginable that a complicated machine made of nonconscious matter can *in itself* feel anything at all. We readily recognize that the simplest life forms probably lack sentience and thus the awareness of pain. If this is true of higher animals, then there is no animal pain.

Secondly, from a theistic world view, it might seem to be more likely that the higher animals would be sentient than not. But it also seems likely that animals might possess only enough awareness of pain to fulfill its survival value. An animal is programed to avoid such pains even though it would not be fully aware of pain as we are.

Thirdly, if animals do in any way feel pain like humans do, then God would surely provide compensation for such. And compensation does not mean simply giving pleasure in an afterlife to make up for past suffering. It would have to be something much deeper and worthy of the notion of compensation or redemption. But animals are not free to refrain from doing evil, they cannot develop moral character, and they are not deserving of punishment or reward. Thus there would be no reason for any special arrangement of pleasure or pain in the nonhuman animal world even on the assumption that they are sentient and as aware of pain as we are. The purpose of prehuman life is fulfilled and the problem of animal pain is answered: Animal pain occurs for survival purposes, animals must survive so that humans will come into being, and the pain that must occur is negated by its compensation or redemption.

Of these three possibilities, only the second seems to me to be adequate. Here, too, we must include the notion of compensation mentioned in the third scenario. On the one hand, it is difficult to imagine that the higher animals feel nothing at all. On the other hand, even with full compensation for any undeserved pain, it is hard to imagine God allowing such animals to live for millions of years with excruciating pain just so that we might come into being.

More should now be said about the distribution of pleasure and pain on the human level. Draper insists that for the evolutionary theist, pain and pleasure must have some (presumably perceivable) moral goal and not just a survival value. Yet the pain and pleasure we perceive usually only incidentally has moral value; usually it is only what you would expect assuming evolutionary naturalism.

One response might have something to do with the Fall, the first entrance of sin in the human race. Unfallen man and woman might have had pain of a kind, though, like their prehuman ancestors, not (normally) of the type that could produce the anguish it can create in an individual today. And then pain would only have been enough to prevent harm to a person. Or perhaps there was no pain at all before the Fall. Humans were protected as they obeyed God's commands ("Do not step over that cliff," "Do not touch that fire," "Do not eat that fruit," etc.) and as God would give special protection.

Having said all of this, I feel very sure that if there had been no Fall, there would still have been some instances of pain fully as horrible as we know it

today. These would have been tied to a spiritual purpose, such as in Job's case, but not necessarily under any perceivable pattern.

With the Fall, we find pain and pleasure more clearly present and tied to survival purposes. Perhaps humans had to return to something more of their prehuman nature. No longer would they have the direct communication and presence of God to protect them. They would need the motivation of natural pleasure and pain to keep them alive and reproducing. Yet with their fully human mental capacities, and possibly as part of God's punishment or curse, their pain would not be mitigated as it is with the other higher animals.

Although other theodicies apply as well, certainly the Jobian theodicy applies to such apparently random pain. Everyone must suffer pain in order to answer Job's question: "Will I remain true to the God who deserves my commitment though I'm drawn emotionally (not rationally) to reject God for allowing this?" It is also important that we notice that even if the first sin had no effect on human nature, a random distribution of pain and pleasure will be inevitable to the degree that people are free to inflict or bestow them on others.

Concerning theodicies generally, Draper objects that they might explain some facts but they mystify others. But is not it possible that several theodicies might answer what one alone cannot? Jesus pointed out that some pains are punishments. When questioned about some who died in recent catastrophes, he warned some of his listeners that unless they repent they will perish as well. Other pains, he said, were meant simply to bring glory to God by their results. It was not anyone's sin that caused one man to be born blind. Being blind all of one's life is indeed a small price to pay when such honor and esteem is brought to God with its removal, especially in lieu of the fact that God promises compensation or redemption for all pain that we undeservedly endure in this life.

During the question and answer period, Draper admitted that a multiple theodicy approach might have potential, his only qualification being that these theodicies would have to exhibit coherence. It is not difficult to think of such "gap-filling" theodicies, though I am sure Draper would question their adequacy when we look at individual examples.

It is interesting that Draper thinks that pleasure should greatly exceed what is "biologically necessary" on an evolutionary theistic view. Christian theism would make it an important point to claim that in our normal secular existence we should not find much satisfying pleasure. We will only have psychological anguish and discontent as we are separated from God. Our greatest pleasure is to come from relationship with God. If pleasure in our normal secular existence were to "greatly exceed what is biological necessary," we would be too anesthetized to our need for God.

I have succumb to the temptation to answer Draper by presenting theodicies, though I could only touch on a few. I think that to do so shows more clearly that there are good reasons to believe that God has morally sufficient reason for allowing the evils and the arrangement of evil and good Draper is concerned about. But I would also claim that if God has morally sufficient reasons for allowing evil, we should not expect to know what they are. "It might ... be logically impossible to bring about certain goods without at least the existence of the evils we find in our world," Draper comments. But if this is true, then, contra Draper, no finite amount of evil in this life can provide any "evidence favoring naturalism over theism." Those achieved goods might sufficiently outweigh the evil in the world and they might be too significant to do without. We simply have no way of knowing this is untrue or likely untrue.

It is like a child undergoing a painful surgery. The child thinks that because the parents allow this, they cannot be good and they must not really love her after all. The child simply does not have the mental capacities to comprehend a parent's knowledge. What the child takes as good, probabilistic evidence should not be considered such at all.

Intrinsic probability

Draper closes his paper with some thoughts about how plausible or intrinsically probable (probable independently of grounds for belief or disbelief) theism is to naturalism. He begins by saying that "it is obvious to me" that with the lack of any evidence for or against supernatural beings, we should consider that it is not likely that such highly specified beings exist. Interestingly, while reading this portion of his paper during his lecture he interjected a comment by Alvin Plantinga. "What's obvious is not obvious," Plantinga said. In no other portion of this critique will the truth of Plantinga's observation be more certain.

Draper says that the more specific a claim is, the lower its intrinsic probability and the higher the intrinsic probability of its denial. Belief that an all knowing, powerful, and good person who created

but is not part of the natural world ("*theism*") is more specified than the mere belief that something which is not physical nor emergent from the physical can affect the physical universe ("*supernaturalism*"). Theism, he says, entails but is not entailed by supernaturalism. If theism is true, then supernaturalism must be true, but not vice versa. There might be spirits or other nonphysical beings that can affect our world without God existing. Since naturalism is not less likely than supernaturalism, and theism is more specified than supernaturalism (see Fig. 1), it follows that naturalism is more likely than theism, Draper claims.

If it is true that the more highly specified an existential claim the less likely its intrinsic probability, then the theist might find this quite valuable in confronting some contemporary nontheistic claims. A multiple universe argument to explain the apparent "fine tuning" of our universe to account for life—and even more so intelligent life—would be one of the first casualties. If our universe did not just happen to possess the precise parameters of many of the laws and other characteristics it happens to have, then life would never have begun. Because it is so extremely unlikely that our universe should possess these precise parameters, it is extremely unlikely that life could ever exist. But if we conjecture that there are a large number of actual existent universes, the probability increases as that number increases that we will eventually run into one that does by chance have the needed characteristics. Because one happened to eventually work, the hypothesis says, here we are.

The many universes claim is a highly specified claim. If Draper's principle is correct and if this claim is pure, unverifiable conjecture, then as more universes are conjectured, the claim becomes more and more unlikely. But what about Draper's claim itself? Does intrinsic probability correspond inversely to specificity? As we will see shortly, I believe Draper has not adequately unpacked the notion of specificity and is mistaken in some important points.

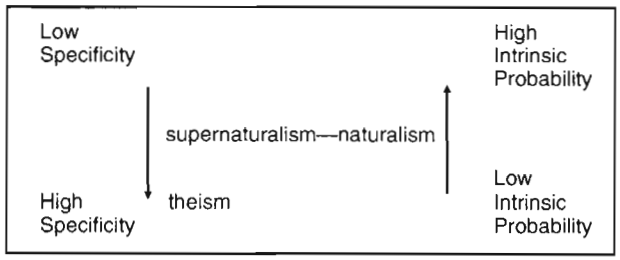

Fig. 1. We might summarize the important features of Draper's claims: As specificity decreases, intrinsic probability increases, and vice versa. Supernaturalism and naturalism are equally unspecified and theism is more specified.

In the question and answer period following Draper's presentation, Dr. Michael Tooley (University of Colorado, Philosophy Department) and Draper appeared to agree that unverifiable or unverified conjunctive claims decrease in probability and disjunctive ones increase in probability as claims are added to the conjunction or disjunction. It is less likely that there is a ghost in this corner *and* that corner than that there is a ghost in just this corner. (Any other term for a factual but unverifiable or unverified entity—*insofar* as it is unverified—could be used in the place of the term "ghost.") But it is more likely that there is a ghost in this corner *or* that corner than in just this corner. (Notice that the statement, "there is a ghost in this corner" is equivalent to "there is a ghost in this corner and there either is or is not a ghost in that corner.")

The claim that there is no ghost in this corner is at least as unwarranted as the claim that there is one. Both claims assume grounds for belief when no evidence is present to provide it. Likewise the claim that there is no ghost in this corner and in that corner is a stronger claim than that there is no ghost in this corner. It is less likely than that there is no ghost in just this corner. "There is no ghost in this corner *or* there is no ghost in that corner" is more likely than "there is no ghost in this corner."

"There is a ghost in this corner" is more likely than "there is a ghost in this corner who has power .18." (No power to all possible power would be 0 to 1.) "There is no ghost in this corner" is less likely than "there is no ghost in this corner who has power .18." To say that there is no ghost in this corner with power .18 is a weaker claim requiring less warrant.

Let's symbolize the statement, "there is a ghost in the corner" with G and the power of this ghost we can indicate by affixing the numbers from .00 to 1.0. Thus G.03 would mean there is a ghost in the corner with power .03. To say that there is no ghost in the corner, ~G, is the same as saying ~(G.00 v G.01 v G.02 ... v G.98 v G.99 v G1.0) which is the same as saying (by DeMorgan's Theorum) ~G.00 · ~G.01 · ~G.02 · ... · ~G.98 · ~G.99 · ~G1.0. So to say that there is no ghost in the corner is to make a number of conjunctive claims; namely, that there is no ghost in the corner who has one particular power and there is no ghost in the corner who has another designated power, and there is no ghost in the corner who has another designated power, etc. And the more claims that are made without warrent, the less likely is the claim to be true than a simpler claim.

Supernature is a disjunction of a myriad of possible entities. Thus it is much more probable that

there is this entity or that one or that other one, rather than just this one alone. It is more likely that at least one of these possible entities exists than that only one exists with the existence of any others being unstated. (A v B v C) is more probable than A · (B v ~B) · (C v ~C). For example, if ghosts are defined as nonmaterial beings, then the existence of ghosts, or of God, or of gods, or of Buddhas (appropriately defined) would be more likely than the existence of only one of these (for example, God) with the existence of all the others being unstated. So, supernaturalism is more intrinsically likely than theism.

Naturalism is the denial of *all* these entities. If it were to deny only one, like atheism denies theism, then we should think that naturalism is as likely as its alternative. But because naturalism makes such a strong claim, because it says there is no God, *and* there are no Buddhas, *and* there are no ghosts, etc., it must be far less likely than supernaturalism. Without evidence to support it, it is less likely as the number of conjunctive claims increases. To be wrong in just one of these conjunctive claims is to negate the whole of naturalism.

If supernaturalism claimed a conjunction of specified entities, then it would be as antecedently unlikely as naturalism. Furthermore, because naturalism denies so many specified existentials, it is far less likely than atheism which denies only one specified existential claim. Likewise naturalism is far less likely than theism to the degree that theism makes only one specified claim.

Now Christian theism and the theism of many other religions do deny the existence of some of the supernatural entities enumerated earlier. Early Christians were often called atheists because they denied the existence of the Greek/Roman gods. Most forms of theism affirm the existence of usually a number of other supernatural entities like angels, demons, spirits, etc. To the degree any form of theism is conjunctive in its affirmation of the existence of certain supernatural entities and in its denial of the existence of others—to that degree it is closer to naturalism in plausibility. Most forms of theism would be a little more likely than naturalism because they would leave open the question of whether certain entities exist, neither affirming nor denying them; they would not make a definite denial of their existence like naturalism does.

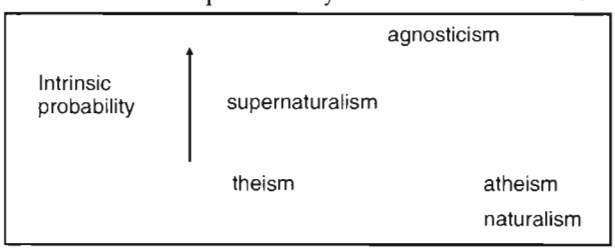

Fig. 2. A more accurate depiction of the relative intrinsic probability of categories of religious belief and disbelief than that depicted in Fig. 1.

Because theism is definitely less intrinsically likely than agnosticism (because agnosticism makes essentially no claims at all), does not that count for something? Does not it at least count against theism? Not if theism was never meant to be ascribed any probability before consideration of evidence. Not if the probability for theism is rather the conclusion of an evaluation of evidence of some kind. Now to say that we have no probability for a belief or no reason to believe it is not to say that there is reason to disbelieve it. There is a difference between saying that there is no probability available to us to know that it is true and saying that there is zero probability that it is true. (In this latter sense we usually speak of probability as being 0 to 1; that is, having no possibility of being true to being absolutely certain. A probability of .5, or 1 in 2, or ½, would mean that it is as likely as not.) Before we have any evidence, any reason to believe or disbelieve, agnosticism is the appropriate position.

Theism is more intrinsically improbable than the above might suggest, but only to the degree that it is made up of a number of necessary and thus conjunctive claims. And of course, as we have noted earlier, highly specified conjunctive claims like the multiple universe view are likewise highly intrinsically improbable until some evidence is provided to support them.

If the existence of something is highly intrinsically improbable, then it still should not take an excessive amount of evidence to make it probable. Before there was any evidence for the existence of quarks, say, the fact that their existence was highly intrinsically improbable had no effect upon scientists' later evaluation of the evidence for their existence. We should remember that every entity is highly specified. It is only unspecified to the degree we lack knowledge about it. Evidence makes it more specified and more probable.

I should mention that, if looked at within a causal context, I think a good case can be made for the claim that theism is *significantly* more intrinsically probable than naturalism (though I question whether this should any longer be called intrinsic probability). Is it more likely that this universe should exist on its own, in the various forms it has existed in through time, or that a comparatively very simple Being is the source of this universe? I think

that this intuition is one of the very basic reasons many (most?) people who believe in God do so.

At the close of the conference professor Draper joked that his position, agnosticism, should be the winner among those presented since the other two major speakers, William Rowe and Stephen Wykstra, an atheist and a theist, both presented such good cases. It might be said that the entirety of this paper has been essentially a case for agnosticism since our main concern has been only to refute atheistic arguments and to put us at a kind of level playing field. Evidence for theism has only incidentally been included. In the last section especially, I pointed out that it is agnosticism above all other positions that has the highest intrinsic probability. Dr. Draper might very likely disagree with my arguments but I can only hope that he would be attracted to these conclusions, if he does indeed finds agnosticism attractive.

Professor Draper calls himself a hopeful agnostic. I would hope that some of my comments might support his hopefulness to reject what I think are some mistaken arguments for atheism and with that to better reevaluate some of the very strong arguments for theism and Christianity. ✣

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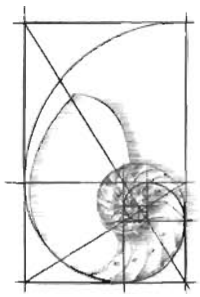

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Chuk-lam Yuen
Fred Zeisler
Elizabeth Zipf

Book Reviews

THE SCIENTIFIC REVOLUTION by Steven Shapin. Chicago: The University of Chicago Press, 1996. 218 pages. Hardcover; $19.95.

Shapin is a professor of sociology at the University of California, San Diego. He has established himself as a reliable historian in his previous two books, *Leviathan and the Air-Pump* and *A Social History of Truth*. Using insights from social science, he enriches the traditional history and philosophy of science.

The Scientific Revolution, a term coined in the early twentieth century, was considered as a watershed that surpassed everything since the rise of Christianity, and as the real origin of the modern world and its mentality. This book tries to explain the Scientific Revolution as a continuation from its medieval past: there was a diversity of understanding; there was no sudden and clear break from the past; and there was no immediate essence of the revolution. Although there may not have been a single revolutionary event, there is no doubt that key players, such as Boyle, Bacon, Galilei, and Descartes, were studying nature in a new way. Shapin describes this period of history as a social process. This book has three chapters that deal sequentially with what, how, and why.

The first chapter, "What Was Known," discusses the mechanization of nature and the depersonalization of natural knowledge. Shapin states that philosophers of the mid-seventeenth century used a mechanical metaphor to describe nature in contrast to the older school that ascribed to nature the capacities of purpose or intention as in anthropomorphism and animism. Some Christian philosophers also worried about "Renaissance naturalism" which projected supernatural power onto things to the detriment of Christian belief. Another characteristic of this Revolution is the mathematization of natural philosophy, which used mathematics to describe natural phenomena. This came from the ancient root of Greek geometry. Its practicality was fully demonstrated by Kepler's law about planetary distances. It culminated in Newton's *Principia* which unified mathematics with both heavenly and earthly mechanics. However, there was and still is the debate of whether this mathematization of the universe describes or truly explains nature's causes.

The second chapter, "How Was It Known," discusses the attempted mechanization of knowledge. Shapin describes science in the making, rather than science as static and disembodied belief. He points out that Copernicus argued that heliocentrism was an ancient view. Flemish anatomist Andrea Vassals saw himself as reviving the pure medical knowledge of the Greek physician Galen. Many natural philosophers (Bacon, Kepler, Newton) claimed that the ancient sources were pure, but had become corrupted over time. They followed the tradition of Renaissance humanism which reinspected the original Greek and Latin sources to reclaim cultural knowledge. However, the Scientific Revolution was new in its empiric principle of epistemology because it relied on environmental evidence and reason rather than on tradition. To increase empiric knowledge, artificially and purposefully contrived experiments were used in addition to natural observation. The scientists also recognized the boundary of natural knowledge by excluding theological, moral, metaphysical, and political discussions. They spoke only in mechanical terms. However, the difference still existed between theorists who explained through mathematical certainty versus experimentalists who recognized the limits on certainty.

The third chapter is entitled "What Was the Knowledge For?" and discusses the aspiration to use reformed natural knowledge to achieve moral, social, and political ends. First, different scientific societies and academies encouraged the collective effort of obtaining new knowledge, and regulating the rules of proper behavior in making and evaluating natural knowledge. Second, natural knowledge was used to support and extend broadly religious aims. Science was used in the argument from design for the existence and intelligence of a deity. In general, scientists acknowledged God's miraculous exercise of divine will as well as recognized his creative wisdom. Boyle even described experimental research as a kind of worship. Regarding the place of mystery in a world of science, different views between Newton and Descartes were described.

Shapin has demonstrated the heterogeneity of natural knowledge in the seventeenth century. Just as the beginning of Christianity, the beginning of science was not monolithic. Both took a long time to establish a central essence, method, and dogma. This book is very concise, but full of ideas and facts, and can serve as an authoritative bibliographical essay on the Scientific Revolution. It would be an excellent text for a history and philosophy of science course.

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

GOD, REASON AND THEISTIC PROOFS by Stephen T. Davis. Grand Rapids, MI: Eerdmans, 1997. 204 pages. Paperback; $26.00.

Davis, professor of philosophy at McKenna College, has written papers dealing with theistic proofs, as well as books in the field of philosophy of religion. In this book, which is simultaneously published by Edinburgh University, he exposes and evaluates the major theistic proofs, and tackles the issue of their relationship to the theistic faith.

Davis' book begins with a few basic notions of logic and philosophy. It seems to be intended for those without

any prior knowledge of philosophy. In the following chapters, however, he fails to introduce all philosophical terms, which may produce some difficulty for the reader. Davis alternates chapters dealing with specific proofs with chapters devoted to a metadiscussion about the proofs. This is possibly done to be more entertaining instead of boring the reader with long discussions on the same topic. For reasons of clarity, I would have preferred a more orderly fitting of the chapters. In this review, I will not follow his order.

Davis first tackles Anselm's ontological argument and devotes a chapter—disproportionately too long—to its defense. Even if the argument is correct, it is very difficult for me (possibly because of my scientific background) to see in it anything more than a tricky word play. I do not think that it would have much appeal to scientists as a proof for God's existence. Concerning the cosmological argument, he briefly defends Aquinas' versions and his own hierarchical version. He mentions Richard Taylor's defense of the principle of sufficient reason, but unfortunately omits Norman Geisler's vital defense of the principle of existential causation, which is strongly defended in Geisler's book, *Philosophy of Religion*.

The third argument Davis defends is the teleological argument and he does it quite well. Concerning the argument from religious experience, he argues that it constitutes a proof that naturalism is false, but that it cannot vindicate one religious view more than another. He does not seem to know about Keith Yandell's book, *The Epistemology of Religious Experience*, where Yandell convincingly argues that numinous experiences (of the same kind as those in the Bible) provide valid evidence and that enlightenment (Eastern) experiences do not. The moral and Kalaam arguments are too briefly treated. Davis made a mistake here by giving a counterexample that is actually irrelevant to the first argument about the impossibility of actual infinities.

Davis criticizes the nonrealist view of religion and deals with Plantinga's critique of classical foundationalism. He objects that such a critique leads to relativism. He could have shown that Plantinga himself uses classical foundationalism for making his critique, and therefore begs the question. Neither did he point out that classical foundationalism is not self-referentially incoherent, as Plantinga thinks, because unlike the Verification Principle, classical foundationalism allows for self-evident beliefs and can therefore refer to itself as self-evident. I miss James Sennett's *Modality, Probability, and Rationality: A Critical Examination of Alvin Plantinga's Philosophy* in Davis' bibliography. Davis ends by defending Pascal's wager and James' argument in cases where one cannot make a rational choice between one's religion and atheism.

The book ends with a discussion on the importance of God's existence and a general evaluation of the proofs and their role. I can recommend this book to those who want to read a good, well-documented introduction to theistic proofs before reading more specific works, such as J. P. Moreland's seminal book, *Scaling the Secular City*, or those by Norman Geisler, William Craig, and Richard Swinburne. This book might be of interest to those who are already versed in the subject and want to read a comprehensive view and meditation about it.

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

ISAAC NEWTON: The Last Sorcerer by Michael White. Reading, MA: Addison-Wesley, 1997. 402 pages. Hardcover; $27.00.

Most of us have heard about Newton, the genius, who worked out the laws of motion, the inverse square law of gravity and the calculus. But of Newton, the human being, we know much less. This situation is not accidental. Newton was quite a private individual, and he was obsessed with his image. For a good many years, his biographers chiefly portrayed the image Newton created.

White is a British science writer and biographer. He has collaborated with John Gribben on biographies of Stephen Hawking and Albert Einstein and has served as a science editor. Using papers from Newton's library, some of which did not come to light until this century, White endeavors to round out our picture of Newton.

As did many of his contemporaries, Newton dabbled in alchemy. White aims to answer the question of what relationhsip existed between Newton's alchemy and his science. He gives us a picture of the curious mix of tensions and contrasts that played in Newton's life. Though Newton was fiercely competitive and supremely confident in his abilities as a scientist, he frequently responded to criticism by suppressing publication of his results for years. This tendency nearly led to Liebniz being credited with developing the calculus. His Arianism led him to avoid for years taking the holy orders required by his professorship. Eventually, when his longtime reluctance to subscribe to Anglican theology threatened to attract unfavorable attention, he prevailed on an influential friend to obtain an exemption for him. Yet when King James II tried to infiltrate Catholics into the universities, ordering them not to require the Protestant oaths normally administered, Newton defended the oaths, reasoning that they were required by law. Despite his frequently stormy relationships with colleagues and his tendency to be a loner, he could be an able administrator, as he demonstrated during his tenure as Warden of the Mint, and as president of the struggling Royal Society.

White deals in some detail with Newton's long running rivalry with Robert Hooke, which may have been intensified by the contrast between the two men's lifestyles. White relates that "Hooke loved the coffee house, the gossip of his friends over a bottle of port, and the attentions of at least one mistress at a time ... Newton lived a life of austerity and isolation within the walls of Trinity College ..." Certainly their very different investigative styles contributed to their rivalry. Hooke was an experimentalist who flitted from one project to another, nevertheless showing considerable genius and ingenuity in his work.

Newton tended to stick at a subject for years, until he had derived all the learning he believed was possible from it.

White believes Newton's interest in alchemy had a significant effect on his scientific work. In an age when the concept of force between two bodies not in contact was thought to be occult, alchemy may have provided the philosophical support Newton needed to investigate gravity.

While White's views on the influence of alchemy in Newton's science are quite reasonable, he may be stretching when he speculates on a possible homosexual relationship between Newton and the Swiss mathematician, Fatio De Duillier. His primary evidence is the warmth of Newton's letters to Fatio. Yet he remarks elsewhere on the extreme cordiality common in the correspondence of Newton and his colleagues—even when they were enemies. Perhaps too much is being read into letters which may only be examples of the extravagant politeness of seventeenth century correspondence.

While writing about Newton, White gives us a fascinating look at academic life in the era of Charles II, Oliver Cromwell, William of Orange, James II, Liebniz, Halley and Huygens. The book should be of great interest to anyone desiring to understand Newton and his times. In addition to being informative, the book makes pleasurable reading.

Reviewed by William E. Hamilton, Jr. General Motors Research and Development Center, Warren, MI 48090.

WILLIAM HARVEY AND THE USE OF PURPOSE IN THE SCIENTIFIC REVOLUTION: Cosmos by Chance or Universe by Design? by Emerson Thomas McMullen. Lanham, MD: University Press of America, 1998. 252 pages, index. Paperback.

McMullen is historian of science, technology, and medicine at Georgia Southern University. He has taught at the Air Force Institute of Technology, Indiana University, and the University of Oklahoma. This book reads very much like materials from his academic lectures. Basically, it is a summary of history and philosophy of science with a main theme on the use of purpose as a driving force in scientific discoveries. That is, in their study of nature, many scientists would often ask the question of not only how things work, but also why they were created that way. William Harvey's discovery of blood circulation is used to illustrate the main theme in this book.

The book starts with a brief history of England in the sixteenth and seventeenth centuries, setting the background to Harvey's life and time. A short biography of him follows. Then, his work on blood circulation is discussed at length, with an emphasis on his purpose-based method of probing the function of the heart and circulatory system. The author cites numerous examples of other scientists who also used purpose or value judgment in making their discoveries or formulating their theories. These scientists, like Harvey, believed that God created nature with specific purposes and efficient purposes ("God does nothing in vain."). Thus, the use of purpose in science would favor a universe by design over a cosmos by chance. The author notes that this practice was dominant during the Scientific Revolution but seems to be waning nowadays. I wonder how many members of the American Scientific Affiliation use purpose and value judgment in their scientific work today?

About one third of the book consists of a collection of notes and references, glossary, bibliography, and index. There is a total of 486 notes in such a small volume, an average of 2.7 notes per text page. Most of these notes could be incorporated into the main text to make it convenient to read. The bibliography is also quite extensive. Its 433 references are divided into primary and secondary sources, obviously for the benefit of serious readers of history and philosophy of science, including McMullen's students.

Reviewed by James Wing, 15107 Interlachen Drive, Unit 1014, Silver Spring, MD 20906-5635.

SCIENCE AND THEOLOGY: The New Consonance by Ted Peters, ed. Boulder, CO: Westview Press, 1998. 247 pages, index. Hardcover; $45.00.

Peters is professor of systematic theology at Pacific Lutheran Theological Seminary and the Graduate Theological Union in Berkeley, California. He is the editor of *Dialog*, a journal of theology, and the author of several books on the interaction between theology and natural science. He also directs the Templeton Foundation University Lectures associated with the Center for Theology and the Natural Sciences at the Graduate Theological Union in Berkeley. Five of the essays included in this book were previously published in *Dialog*, while three others were adapted from recent CTNS-Templeton Foundation University lectures.

The first chapter of the book, written by Peters, identifies eight different ways in which science and religion are currently thought to be related. Peters and the other contributors to this book align themselves with a "hypothetical consonance" approach. The term "consonance" indicates that these writers are seeking areas of correspondence between what can be said scientifically about the natural world and what theologians understand to be God's creation. By including the term "hypothetical," the consonance approach encourages both scientists and theologians to be willing to subject their own assertions to further investigation and possible confirmation or disconfirmation. Peters is also an advocate of an "ethical overlap" approach which asserts that our present ecological crisis "poses a spiritual issue, namely, the crying need of world civilization for an ethical vision." This ethical vision focuses upon the attainment of "a just and sustainable society that lives in harmony with its environment and is at peace with itself." Three of the chapters provide examples of this ethical overlap approach. They include Nancey Murphy's essay on cosmology and ethics,

Francisco Ayala's chapter on evolution and ethics, and Audrey Chapman's contribution entitled "The Greening of Science, Theology, and Ethics."

The remainder of the book is divided into two large collections of essays. The first group, which consists of five chapters, includes essays which are centered upon the intersection between "Physics and Faith." Four of the five contributors to this section are individuals with extensive backgrounds in physics. In chapter two, Charles Townes argues against a "two-language" approach to science and religion by suggesting many ways in which these two disciplines are quite similar, despite the great differences assigned to them by our culture. In the next chapter, John Polkinghorne provides a condensed autobiography which summarizes his pilgrimage from professor of mathematical physics to Anglican priest. In chapter four, Paul Davies addresses the question, "Is the Universe Absurd?" which he believes can only be answered through the ongoing process of scientific investigation. In the chapter which follows, Robert John Russell raises the question, "Does the God who acts really act in nature?" He answers this question by providing a new understanding of the doctrine of providence, a concept he calls "noninterventionist objective special divine action."

The second collection of essays, which consists of chapters seven through fifteen, is brought together under the heading, "Evolution, Ethics, and Eschatology." Four of these essays center upon the relationship between the process of biological evolution and the appearance of the human soul. The authors of these four essays include Wolfhart Pannenberg, Pope John Paul II, George Coyne, and Anne Clifford. In chapter twelve, Philip Hefner explains the concept of human beings as "created co-creators" who actively participate in God's ongoing creative activity. In the chapter which follows, Arthur Peacocke argues against reductionism and replaces it with a holistic hierarchy of the sciences. In the final chapter of the book, John Haught brings evolutionary theory into conversation with Christian eschatology. He argues against an attitude of "cosmic pessimism" by presenting an understanding of God as both "kenotic love" and the "power of the future."

In the introduction, Peters uses a stimulus-response analogy to describe the present pattern of interaction between science and theology. He states that most of the authors included in this book take science to be the stimulus and theology the response. While this is certainly the case in the essays written by scientists, those authored by theologians tend to seek consonance between the two disciplines by placing theology in the leadership role. Unfortunately, most of the essays by theologians include little interaction with biblical texts. Reading this book gives one the impression that scientific discoveries and theories are the driving forces behind the present search for consonance. Peters clearly states in his introduction that "science alone is not enough. Revelation from God casts nature in a new light and leads us toward a more adequate understanding of its reality." Yet the overall tone of the book seems to be that while science alone is not enough, any bridge that is built between the two disciplines must originate from the science side of the divide.

Those who are already familiar with contemporary issues in science and theology will not find much that is new in these essays. However, this book serves as a wonderful introduction to the consonance approach and to many of the scholars who are its present proponents. The topics discussed in these essays are quite varied and the notes at the end of each essay provide many opportunities for further reading. All of the authors are excellent writers who know how to cover a lot of intellectual ground within the space of a few pages. In spite of the fact that there is little interaction with biblical theology, this book is recommended to anyone who has an interest in and a commitment to the hypothetical consonance approach to science and theology.

Reviewed by J. David Holland, Biology Instructor, Springfield College in Illinois, Springfield, IL 62702.

MOLECULES AT AN EXHIBITION: Portraits of Intriguing Materials in Everyday Life by John Emsley. Oxford, UK: Oxford University Press, 1998. xiv + 250 pages, index. Hardcover; $37.00 (Canadian).

This book about chemistry for a general, nonspecialist audience is organized as a series of accounts of nearly one hundred chemical species. Emsley, a university science writer in residence and a winner of several prizes for science communication, has had a long career as a lecturer and researcher. Much factual information is presented in a readable, entertaining way, but links to religious faith are outside the book's scope, which is entirely secular. No chemical formulas, equations, or diagrams are included; however, a bibliography of forty-six books and articles is provided for anyone who wants to learn more.

Like a visitor to an art exhibition moving from one gallery to the next, the reader finds "portraits" of different chemicals grouped into eight "galleries," which are the chapters. The first three galleries exhibit some substances important in our bodies: inorganic and organic compounds, metallic ions, and drugs or pharmaceuticals. The reader learns many facts about nutrition and what foodstuffs provide essential elements. Several concerns about danger from chemicals in our food are shown to be groundless. Lack of one essential nutrient at an early stage of an unborn baby's development can cause serious disability, but Christians may be troubled by Emsley's suggestion that if tests show this to be likely, then the pregnancy could be terminated.

Two galleries are devoted to substances useful mostly around the home: small molecules and polymers. The reader discovers that the stonework of historic cathedrals can be protected against deterioration by spraying it with perfluoropolyethers. Zirconium and titanium are called "elements from heaven," with zirconium being identified as a constituent of the biblical jacinth (Rev. 9:17; 21:20). Two more galleries discuss substances important in the environment, such as atmospheric gases, and compounds used for transportation in diverse ways. The final gallery, "elements from hell," reports on various poisons, toxic heavy metals, and radioactive elements.

The book has a positive, upbeat attitude toward the portrayed chemicals—unlike the more common negative reception often received. The world appears as an enlightened community in which these chemicals are extracted, processed, used, and disposed of, wisely and in environmentally benign ways, so that their benefits can be fully enjoyed with few unpleasant consequences. True, mistakes were made in the past, but with modern knowledge bad effects can be avoided. Unfortunately, this attitude ignores the sinfulness of human nature and the limitations of humankind's knowledge.

Scientists looking for a nice gift for a nonscientific friend or relative could well consider this book. It is a fascinating store of trivia, historical lore, and interesting facts useful for brightening up a sermon or lecture. The eclectic choice of topics makes the book unsuitable as a reference; it is not a systematic treatment of classes of chemical compounds. All the information appears to be highly accurate, although some of the abbreviations for units of measurement are unconventional or obsolete, such as mcg (microgram) or cc. This book will tell you much that you did not know, pleasantly and enjoyably.

Reviewed by Charles E. Chaffey, Professor of Chemical Engineering and Applied Chemistry, University of Toronto, Toronto, ON M5S 3E5.

GEOGRAPHY AND WORLDVIEW: A Christian Reconnaissance by Henk Aay and Sander Griffioen, eds. Lanham, MD: University Press of America, Copublished with the Calvin Center for Christian Scholarship, 1998. 177 pages. Hardcover; $40.00. Paperback; $19.50.

Aay, geography and environmental studies professor at Calvin College, and Griffioen, social philosophy professor at the Free University, Amsterdam, organized an international "Reconnaissance" meeting, including fourteen geographers and one philosopher, in Grand Rapids, Michigan, August 1996, to "map" geography for prospective Christian scholarship. Consequently, these eight essays present views from within the Netherlands, Northern Ireland, Canada, and the United States—but with a decidedly Dutch and neo-Calvinist (or Reformed?) accent.

Appropriately, concern is with approach rather than data. Physical geography seldom intrudes beyond its environmental periphery, with human aspects occupying the core. Here past and present trends disclose undercurrents of "Worldview," innocently or boldly diverging from any thought of "the Christian mind." Several essays, marking the waning influence of "positivism," note Marxism's ethical appeal, and focus particularly on "postmodernism" with its repudiation of "God's eye views." Relevant literature discloses an un-postmodernistic unease in matters of morals, logic, and recourse to "better" evidence, matters suggesting some division between epistemological principles and practice.

Too often, however, this Reconnaissance uses an in-house "jargon" likely to baffle all but the initiated, and half-conceal the real depth of thought presented for the diligent. Given the absence of a needed glossary, readers would be well advised to keep dictionary, Bible, and Bible Atlas handy—the "rival" map-divisions of Joshua and Ezekiel exchange captions—and must remain alert to subtle philosophical distinctions. With these provisos, the rewards are rich.

As in most symposia, inputs vary from paper to paper, and the introduction seeks to differentiate those working "implicitly" from within a field to those working "normatively" from without. The first four articles qualify as "implicit" in approach, and the last four as "normative," though the individuality of authors may seem more salient.

David N. Livingstone's paper, written with characteristic verve on geography and natural theology, is followed by David Ley's involved (but very probing) analysis of postmodern epistemologies. Countering widespread "relativism," he proposes instead a "relationalism" which varies with situation but avoids intellectual closure, remaining open to the Truth claims inherent in Christ. Iain Wallace takes a sobering look at socio-economic globalization, noting challenges evident in feminism, social divisiveness, environmental concerns, and the surfacing of hitherto submerged cultures. A balanced response to "an enlarged sense of God's purposes" is advocated for global and local geography. Janel M. Curry-Roper also stresses the embedding of covenantal relationships within place, as she surveys tensions between the reductions of positivistic law and regional diversity as shaped by nature and humanity in interaction.

Opening the "normative" essays with "God's Own Countries?" Gerda Hoekveld-Meijer challenges "establishment" stereotypes in her intriguing reinterpretation of biblical history. "Models" and historical "cycles" manifest degeneration or regeneration as justice is denied or embarrassed. Neither human rights nor environment evoke awe, but rather fire "dominion over pagan Nature-gods, with Nature" part of the biblical juridical system envisaged as contemporaries, Joshua and Ezekiel express judgment and grace in territorial divisions, with borders and negative "externalities" to match. Likewise the Kingdom of God shifts conceptually between Paul and subsequently-written Gospels. Gerard A. Hoekveld further explores "externalities" and "just" borders in his essay on Christian citizenship, where a "thin" but all-embracing morality "thickens" into regional citizenship.

Aay's paper on Netherlands' Christian Schools is carefully researched, shrewd in evaluating past trends and prospects, but sobered by failure to link expansion (despite favoring educational foundations) to essential philosophical depth. In conclusion, Griffioen rounds out the discourse by reflecting on the nature of perspectives and worldviews, underlining distinctions between those that reflect and those that positively shape research. Noting barriers and opportunities for Christian scholarship in a postmodernistic era, he expresses tentative hope.

One may also hope that unfamiliar phrases will not deter any from pursuing these thought-provoking ideas

which have implications ranging well beyond the bounds of any single discipline.

Reviewed by Gordon Lewthwaite, Professor Emeritus of Geography, California State University, Northridge, CA 91330.

THE REASONABLENESS OF CHRISTIANITY by John Locke. Edited by George W. Ewing. Washington, DC: Regnery Publishing, 1998. 228 pages, indexes. Paperback; $12.95.

The Puritan physician John Locke (1632–1704) is one of the greatest philosophers and possibly the one who most influenced American civilization. Locke's life and the context in which he wrote this book are presented in Ewing's introduction—however, without serious philosophical considerations. Ewing still mentions Locke's willingness to defend Christianity against the intellectual attacks lead by the deists, and how much opposition Locke's *The Reasonableness of Christianity* received, in particular from the revivalist clergyman Jonathan Edwards, who accused him of atheism. Since Locke's book had no divisions or chapters, Ewing has numbered the paragraphs and compiled an outline.

Locke first deals with the need for salvation and the content of the Gospel preached by the apostles and Jesus. He then proceeds to a very lengthy analysis of the Gospels. (As someone said: "Locke has no mercy on the patience of his readers.") Locke defends the Christian truth with the miracles and the resurrection of Jesus, his indirect declarations of Messiahship and his fulfillment of messianic prophecies. I was surprised to learn so much from Locke's sharp analysis of the Gospels, for example, why Jesus did not reveal his identity directly during most of his ministry. Locke then answers some general objections (about the salvation of the unevangelized, etc.). In the last part of the book, Locke points at some insufficiencies in the general divine revelation in nature (although Locke believed in the truth of such a revelation) and argues for the necessity of special revelation.

Locke's arguments may have been convincing in his time. But Locke wrote before the attacks of Hume against miracles or before the attacks of the liberal theologians based on the historical-critical method. Locke's argumentation would be incomplete for modern readers. Modern apologetic books are more helpful. However, those interested in an analysis of Jesus' ministry may benefit from Locke's book, provided they are motivated enough to endure his lengthy style. Those interested in Locke's philosophy may benefit more from the book, *The Reasonableness of Christianity With a Discourse on Miracles and Part of a Third Letter Concerning Toleration* by I. T. Ramsey, ed., (Stanford: Stanford University Press, 1958). Ramsey has brilliantly introduced and outlined the book, has abridged the text, and also introduced and edited some of Locke's arguments about miracles.

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

THE SACRED BALANCE: Rediscovering Our Place in Nature by David Suzuki with Amanda McConnell. Amherst, NY: Prometheus Books, 1998. 272 pages, notes, index. Hardcover; $25.95.

Suzuki is an internationally acclaimed geneticist and host of the popular television show, *The Nature of Things*. He is the author of more than twenty books, including *An Introduction to Genetic Analysis*, the most widely used genetics text in the world. He has been a professor at the University of British Columbia since 1963 and is recognized as a leader in the field of sustainable ecology. He has been involved in protecting the environment and the rights of aboriginal peoples in many countries around the world.

The book begins with an indictment of the overconsumption and consumerism that permeates western culture. Suzuki argues that as a result of our devotion to consumerism, the movement into cities, and the loss of an appropriate worldview, our connection to the rest of the living planet has been severed. The challenge which modern society faces today involves the creation of a new worldview that will enable us to rediscover our connections with the natural world. Suzuki suggests that this new worldview can be generated by combining the descriptive knowledge of modern science with the ancient wisdom of native peoples.

In chapters two through six, Suzuki introduces a number of basic ecological concepts by weaving them together in the form of a story. The belief of the ancient Greek philosophers that the physical universe is divisible into just four elements—air, water, earth (soil), and fire (energy)—serves as the story's foundation. After presenting their origins and biological importance, Suzuki discusses some contemporary environmental problems associated with each "element." In chapter six, he adds a fifth fundamental element essential for the maintenance of a healthy planet: the element of biodiversity. Suzuki discusses three important aspects of biodiversity (genetic diversity, species diversity, and human cultural diversity) before ending the chapter with a brief analysis of the present worldwide extinction crisis.

After spending five chapters dealing with physical needs, Suzuki moves on in chapters seven and eight to discuss our social and spiritual needs. In chapter seven entitled "The Law of Love," two different categories of social needs are presented. One category focuses on the need all humans have: the need for positive relationships with other people. The second category centers on the concept of biophilia, the emotional affiliation that human beings have for other forms of life. According to Suzuki, both types of social needs must be met in order to live rich, fulfilling lives. In chapter eight, the need for spiritual connections with the natural world is stressed. Suzuki believes that theologians and ecologists can find much common ground as they explore the need to recognize the sacred in the here-and-now, rather than in the hereafter. The last chapter of the book entitled "A New Millennium" provides answers to the question, "What can we do?" After a number of practical suggestions are discussed, the

book concludes with several examples of individuals who have enhanced the momentum of the modern day environmental movement.

Just as in many of his other books, Suzuki writes in a manner accessible for readers with limited backgrounds in science. When technical terms are introduced, they are clearly explained. The book contains a variety of figures that help to illustrate foundational ecological concepts. Tables are also included to support statements made in the text itself. Quotes from a variety of sources are scattered throughout the book. While these quotes are interesting and appropriate, they tend to disrupt the flow of the text when placed between paragraphs. The notes, which are presented at the end of the book, can be located by page number and a wide variety of source material is cited.

While readers of this journal will appreciate the book's ecological emphasis and may even agree with many of the proposed solutions to present day environmental problems, they will be disappointed by the author's concept of spirituality. Several Old Testament passages are quoted in the book, but so are a number of texts from other sacred writings. Although Suzuki uses the term "creation" throughout the book, there is little mention of the Creator. The term "Earth" is capitalized wherever it is used and the concept of "Gaia" emerges in several chapters. Matter appears to be sacred only in a pantheistic sense, and living by the "Spirit" simply involves making ethical choices based on sound ecological principles. Suzuki also makes it very clear that this "sacred" matter, which is to be treated with respect, is the product of an evolutionary process based upon chance. He speaks of "propitious" levels of oxygen and the "propitious" molecules of water vapor and carbon dioxide in the primeval atmosphere. Suzuki includes the following statement: "What a lucky chance it was that this particular planet coalesced at the right distance from our star" (p. 116). On page 114, while discussing the process of evolution, he writes of the "extraordinary ability of living things to seize a chance and build on it." Statements like these cannot be reconciled with the biblical understanding of a creation process that was initiated and guided by an omnipotent and omniscient Creator. Christians who have an interest in environmental ethics may be impressed by Suzuki's understanding of ecology, but they will likely be depressed by his understanding of theology.

Reviewed by J. David Holland, Biology Instructor, Springfield College in Illinois, Springfield, IL 62702.

THE WAY: An Ecological World-view by Edward Goldsmith. Athens, GA: The University of Georgia Press, 1998. 438 pages. Paperback; $16.95.

The book cover states that Goldsmith is the founding editor of *The Ecologist*, coeditor of *The Case Against the Global Economy*, author of fifteen books and international campaigner on environmental issues for over thirty years. My impression from reading this book is that he is a genuine Luddite. He is anti-progress and development, antiscience and technology, and, I believe, he would be delighted if modern civilization were destroyed, bringing a return to a simple subsistence type of lifestyle of the earliest human civilization. For example, Goldsmith writes:

> Ecologically, the temporary settlements of nomads are the most desirable, because, among other things, they have the smallest impact on their environment. It is not surprising that the sites once occupied by most of the great cities of antiquity are now deserts. The impact of our modern industrial cities on their environment is, of course, very much greater and correspondingly more destructive.

While being decidedly opposed to modern science and technology, Goldsmith is a Darwinian evolutionist. For him, evolution is the Gaian Process; Gaia is central to his world-view and the Way is evolution. Since evolution can be equated with the Way, serving as it does to maintain the critical order and hence the stability of the ecosphere, progress or anti-evolution can be equated with the anti-Way, serving to disrupt the critical order of the ecosphere and to reduce its stability. Goldsmith, however, rejects the general notion that evolution is purposeless or undirected. He asks: "How can the absurd notion of the randomness of life processes have been raised to the elevated status of the central concept of modern biology?" He suggests that the concept of randomness was essential to rationalize the reductionist nature of modern science and that randomness was postulated as an argument against unacceptable supernatural principles.

While Goldsmith believes that the evidence for the purposiveness of life processes at every level of organization within the hierarchy of the ecosphere is so great that its denial seems inconceivable, his concept of purposiveness has to do with Gaia, not a belief in any kind of designer or creator. In fact, he is quite opposed to the "revealed religions of today," like Christianity, Islam, or Judaism which "have desanctified society and the natural world, leaving them open to exploitation and destruction." Goldsmith essentially blames Christianity for making science and technology possible because it severed man emotionally from nature. As religion becomes increasingly "otherworldly" and society disintegrates, humans are severed from the Gaian hierarchy and cease to fulfill their "true social, ecological and cosmic role," moving, in effect, along the anti-Way.

Goldsmith has written this book like a collection of short essays, 66 chapters of usually 2–4 pages in length, each of which explains or elaborates on the title. Examples of chapter titles are: "Ecology is holistic," "Ecology is teleological," "Ecology is faith," "Gaia is alive," "Gaia is the source of all benefits," "Gaian life processes are purposive," "The vernacular economy is localized and hence largely self-sufficient," "Progress is antievolutionary and is the anti-Way," and "The great reinterpretation requires a conversion to the world-view of ecology."

Why read this book? Goldsmith has clearly stated what he believes to be the underlying principles of an ecological world-view. In his opinion, the critical order of the cosmos must be preserved by following the Way and that two

fundamental principles are necessary: (1) "the living world or ecosphere is the basic source of all benefits and all wealth," and (2) "the overriding goal of the behavior pattern of an ecological society must be to preserve the critical order of the natural world." This book represents the culmination of decades of work and Goldsmith's inspiration has been from "the world-view of vernacular societies, in particular from the chthonic world-view of the earliest period," when people knew how to live in harmony with the natural order.

At times I found this book to be almost painful reading. Goldsmith's understanding of modern science appears to be very limited and, at times, incorrect. I would say the same about his understanding, rather lack of understanding, of biblical Christian faith. Most of his extensive references and bibliography are old, pre-1980. Finally, I found it frustrating to read a whole book about "The Way" written by an author who does not know the One who said, "I am the way" (John 14:6).

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

BY CHANCE? Landscapes from the Canvas of the Creator by John MacMurray. Sisters, OR: Multnomah Publishers, 1998. 77 pages. Hardcover; $19.98.

This is not a book about science, but it is a book scientists can appreciate. MacMurray has collected in this volume some of his photographs to illustrate the beauty of nature. Accompanying the pictures are appropriate quotations, some from the Bible, but most from well-known writers.

MacMurray, after observing the Grand Canyon, came to the conclusion that nature's beauty comes from a Creator. He believes science supports this conclusion and quotes Lord Kelvin: "With regard to the origin of life, science ... positively affirms creative power."

This book could appropriately be placed on a coffee table to share with guest. Its price is especially reasonable considering the large size of the pictures. The photographs evoke agreement with John Dryden's observation that the world "is a piece too fair to be the child of Chance and not of Care. No atoms casually together hurl'd could e'er produce so beautiful a world."

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

WHAT ARE THEY SAYING ABOUT ENVIRONMENTAL ETHICS? by Pamela Smith. Mahwah, NJ: Paulist Press, 1997. 91 pages. Paperback.

Sister Pamela Smith is the Director of Lay Ministry Programs and assistant professor of systematic theology at SS. Cyril and Methodius Seminary in Orchard Lake, Michigan. This book is the twenty-second in a series with the common title beginning *"What Are They Saying About ...?"* In the spirit of the title, the book is a summary of the positions advanced by seven different environmentally-concerned groups, quoting extensively from representative authors, with twenty-one pages of notes and an eight-page bibliography.

Deep Ecology. Biocentric, radically egalitarian, and sometimes polemic. Humans can no longer consider themselves members of a species which makes them ends-in-themselves. *Deep Ecology* is "stridently non-anthropocentric." Advances an eight-point platform emphasizing the equal intrinsic value of all beings, the decrease in human population, and "life quality" rather than "standard of living." Nonhuman beings and habitats have "rights." A reaction must be developed against the "consumerist, materialist, mechanistic, technocratic mindsets" characterizing much of modern life and culture.

Ecofeminist. Sees the "desacralization" of the natural world as one of the main causes in the Western industrial nations' abuses of the environment. The blame for current problems can be laid on a patriarchal, dualistic, hierarchical system of thought, and to the corresponding technocratic, consumerist social order. Proposes a metaphor for the world as "God's body." Extends the doctrine of incarnation beyond Jesus the Christ to a cosmic Christ, to the universe of beings that "incarnate" God in their own ways. Other ecofeminists advance the description of the Earth as Gaia, a living, energetic, creative system named after the Earth goddess of the Greeks.

Animal rights. "Specieism," like racism, sexism, and other prejudices needs to be overcome. Animals have "intrinsic value" and "inherent worth"—lives that have meaning apart from human connections. Practices to be forbidden include the use of animals for scientific research and cosmetic testing, as well as any actions that "partake of cruelty, infliction of nontherapeutic pain, the creation of artificial living conditions, and deprivations for the mere sake of scientific curiosity." In addition, attention must be paid to ecological claims made by flora, land forms, and systems.

Naturalist. Holistic, ecocentric environmental philosophers and ethicists committed to "ecosystemic interdependence, reverence for all creation, the perception of the interactive mix of intrinsic and instrumental values in nonhuman beings, an active probiodiversity stance, a broad extension of 'moral considerability,' a commitment to sustainable living, a concern for Earth-restoration, a pursuit of the 'natural,' and an esteem for the 'wild.'"

Liberationist. The ruin of ecosytems is linked with oligarchic, demagogic oppression—the enforcement of power over the poor, landless, and voiceless. Concern is expressed for how enforced poverty and the subjugation of peoples are connected with an assault on the natural environment.

Interreligious and Ecumenical. The "sustainability" of the Earth is a moral imperative. The "Declaration Toward a Global Ethic," from the Parliament of the World's Religions in 1993, is "spiritual in tone but decidedly not theocentric." This view might more properly be described as "biocentric," emphasizing the intrinsic value of all living things. Judaism can be understood as environmentally friendly, but ambivalent. The Christian tradition has been criticized for being both ambiguous and ambivalent with regard to the natural world. A helpful view for many Christian groups might be called "concentric," coordinating theocentrism, anthropocentrism, and ecocentrism. "Many of the world's religions seem to be concluding that the good life must be nonviolent, nonexploitive, nonabusive, biota-reverent, life-restorative, and ecosystemic." The author does not refer to evangelical Christian authors such as C. B. DeWitt and others, who have written effectively on a Christian view of the environment as defined in the New Testament.

Catholic Magisterial. A growing trend toward environmental pronouncement and prescriptions. Much of what has been said may be considered by other groups mentioned above as "hopelessly insensitive and irretrievably shallow" ecologically. However, a consideration of his pronouncements indicate that Pope John Paul II "advocates an ethic of environmental responsibility, reverence, and restraint." Recent trends in thinking indicate a movement to "develop and detail a theology of creation, an anthropology which understands the human in relation to the 'web of life,' and a visional ethic which is more profoundly aware of animals and ecosystems than earlier Catholic moral thinking has been."

The book concludes with a brief "Conclusions" chapter, reflecting the author's reaction to these various perspectives. She notes the "virtual unanimity about the worthiness of the pursuit and promotion of environmental 'sustainability'," and "an obligation on the part of present humans to hand on to future generations of humans and other living beings a world capable of sustaining life and providing for some degree of flourishing." But she also points out that it is difficult to find many specific prescriptions which would meet with general acceptance, and that "there is considerable disagreement ... about whether or not any hierarchy of value of preferential treatment should be allowed on the basis of species, place on the food chain, sentence, or capacity for reason." Major stumbling blocks for agreement are issues of population growth and its limitation, or "deliberate choices for lower income, a lower standard of living, and less environmental impact."

Although "no approach to environmental ethics seems altogether capable of negotiating these complexities," the author expresses her hope for "the expansion and further describing of a visional environmental ethic and an exploration of solid and salutary environmental virtues."

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

VICTORIAN SCIENCE IN CONTEXT by Bernard Lightman, ed. Chicago: University of Chicago Press, 1997. 489 pages, index. Paperback; $22.50.

Victorian Science in Context is a collection of twenty essays grouped into three sections. Part 1 focuses on "Defining Knowledge"—the Victorian equivalent of differentiating between science and pseudoscience. Part 2, "Ordering Nature," analyzes stereotypes, particularly race and gender, in the audiences that followed science. Essays in Part 3, "Practicing Science," expose the subtleties involved in performing science in less than ideal conditions, with instruments whose reproducibility sometimes made scientists skeptical about the uniformity of creation (p. 409).

One beauty resulting from a collection of essays is a range of styles, some of which are sure to resonate with the reader. Essays cover issues of race, feminism, economics, satire, science writing, and science fiction—to name but a few. Generally the essays are framed in a technical style, being written largely by scholars in history and philosophy, although most are readable by a nonspecialist.

Part 3 is probably of most interest to scientists, and represents something of a series of case studies that demonstrate how a particular aspect of science developed in the Victorian period. For example, chapter 15 is a case study of the development of cable telegraphy, and describes how Britain exploited this technology to maintain trading partners and colonies all over the world. The need for rapid contact led to a close relationship between the British government and a cadre of scientists and business people who developed transoceanic communication. The result was a British-dominated cable industry that allowed Britain "up-to-the minute news of foreign markets, oiling the operation of the global trading system that sustained Britain's wealth and power ..." (p. 320). Bruce Hunt builds a case for an industry that grew by solving scientific problems that in turn influenced the growth of a new area of science. "Why did electrical theory follow such different paths in Britain and on the Continent? ... To state the point baldly and a bit too simply, the British did field theory because they had submarine cables, and the Germans did not because they had none" (p. 326).

This collection of essays was written largely for people in the humanities field but also will appeal to scientists interested in the Victorian period. These articles personalize science with vignettes of the practitioners and detailed descriptions of workplace and instrumental limitations—even to the effect of vibrations from street traffic. Global issues of politics, gender, and funding further serve to place "Victorian science in context."

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

THE RETURN OF CREDIBILITY: Scientific Discoveries Support Belief in the Bible's Creation Account by Joe T. Ator. New York: Vantage Press, Inc., 1998. 102 pages, index. Paperback; $9.95.

This book is another entry in the growing list of works that analyze recent scientific discoveries in the framework of the first chapter of Genesis. Ator, a retired engineer who spent most of his career managing aerospace projects, has taught astronomy at the university level and is a member of the Astronomical Society of the Pacific.

This book has three major sections: a description of the creation account in the Bible (chap. 1), a survey of the changing views of scientists over time (chap. 2 and 3), and a summary of evidence for a created universe (chap. 4–7). Although the book has no bibliography, endnotes are provided for each chapter. The material is thoroughly cited, but few of the references are from primary or peer-reviewed sources. The author writes in an informal, nontechnical style.

Ator's thesis is that "scientists have discovered clear evidence that the universe ... is the result of a creation event" (p. 99). The subtitle of the book suggests a similarity to the books of Hugh Ross. However, where Ross attempts to show how the statements in Gen. 1 are scientifically accurate, Ator contends that the passage is primarily religious and relatively silent on scientific matters. Thus, there is nothing after Gen. 1:1 for science to affirm or contradict. The quotations used to support this interpretation are all from 1973 or later. This section would benefit from more of a historical perspective that recognizes alternative viewpoints.

The survey of the views of scientists over time includes the usual suspects, beginning with Aristotle and ending with Darwin. Very little space is devoted to Darwinism, in part because the author believes it was merely an inevitable extension of Lyell's uniformitarianism. Some ASA members might be surprised to learn that "modern day scientists have concluded not only that a primeval soup couldn't have existed, but even if it did, such a self-formation of life forms ... is *impossible* in terms of probability" (p. 40, emphasis in original). Ator makes this statement matter-of-factly, without any supporting evidence. A reader with little scientific background will not be equipped to engage a materialistic evolutionist in discussion or treat a theistic evolutionist with grace and respect.

Ator expends about as much energy dealing with Young-Earth Creationism (YEC) as he does with Darwinism. He says that people who want Young-Earth Creationism taught in schools imply a dishonest God because they hold to an appearance-of-age explanation (p. 84). This argument ignores the fact that not every Young-Earther relies on the appearance-of-age theory. Ator would strengthen his case by including a more detailed account of biblical evidence for long creation days. Except for his addressing the definition of *yom*, Ator offers his readers little reason to believe that he has not read into Genesis the meaning his science demands.

Ator's descriptions of how the universe is measured and what evidence supports the hot Big Bang theory are very good. His discussion of the measurement of distances to stars should prove particularly effective for novices. He does not assume too much background knowledge in his readers, but he does not write down to them, either. The closest he comes to a mathematical equation is a description of the relationship between distance and gravitational force between two objects. A reader with little background in science might find Ator's approach more appealing and less intimidating than that of Ross.

The author succeeds in his goal of making a scientific case for a creation event that would satisfy most people (the Stephen Hawkings of the world notwithstanding). However, the typical ASA member will not find anything of significance in this book that has not already been written elsewhere. On the other hand, the ASA is probably not the author's target audience (the book has no preface or introduction in which Ator could identify the readers he seeks). Given the minimal treatment of Darwinism and YEC as well as the lack of a gospel presentation, the book cannot serve as an evangelistic piece. The book should be encouraging to Christians who have little scientific background and who are unlikely to enter science.

Reviewed by George D. Bennett, Assistant Professor of Chemistry, Millikin University, Decatur, IL 62522.

EVOLUTION'S HAND: Searching for the Creator in Contemporary Science by John Cafferky. Toronto: East End Publishers, 1997. 200 pages, index. Paperback.

Cafferky holds degrees from Trinity College in Dublin and currently teaches mathematics in Toronto. However, prior to that, he spent eight years as Chief Geologist at the Agnico Eagle Mines, Joutel site, in northwestern Quebec. His team worked on Archaean rocks over two billion years old that were unusual due to their pristine condition. These rocks did not suffer from the typical deformations seen in other deposits. This discovery played an important role in determining that the rock's metal sulfide deposits were contemporaneous with the rocks themselves. Because of the rarity of the Joutel site deposits, the author hosted over a thousand visiting geologists during his eight years at the site, and the consequences of the syngenetic origin of the metal sulfide deposits ultimately inspired this book. Cafferky realized that the Archaean waters of the earth must have been saturated with metals and other minerals posing serious problems for the conventional Darwinistic origin of life scenario. To Cafferky, it seemed highly unlikely that the sequestering of pure chemicals required for the origin of life could occur in what appears to be the highly contaminated Archaean environment of earth. Cafferky concluded that the current mainstream ideas for the origin of life had been "sanitized to form an allegiance with Darwinian thinking that finally reduces to its own form of blind faith." This book is the result of Cafferky's own personal search and discovery of the theological implications that modern-day science has

uncovered regarding the evolutionary processes at work in both the physical and biological realms.

Evolution's Hand contains an introduction, conclusion, and six chapters. The first chapter provides a cursory treatment of the creation and evolution of the physical universe pointing out that the Big Bang and "cosmic coincidences" (as Cafferky terms it) lead inescapably to the conclusion that the evolution of the physical universe is purposeful and has an underlying "Intelligence" behind it. The remaining five chapters argue that this same purposeful evolution is seen in the biological realm on earth. In spite of being written for the lay person, *Evolution's Hand* contains no charts or illustrations, nor does it have a bibliography. The endnotes at the conclusion of each chapter are not extensive, and point only to general scientific texts and popular scientific works. The fact that the author has chosen not to cite original scientific research papers or review articles makes it very difficult for the more ambitious reader to pursue the author's points in more scientific detail.

While Cafferky's ultimate purpose in writing *Evolution's Hand* is to address the question, "Does God exist?" the central theme is the assertion that biological evolution is the tool that the Creator has chosen to bring about earth's diversity of life with the ultimate goal being the creation of *Homo sapiens* and the production of human intelligence. To support this position, the author seeks to demonstrate from the evidence found in the living world and fossil record that biological evolution is not characterized by contingency, but is a nonrandom directed process. Cafferky focuses much attention on: (1) the idea that organisms are perfectly adapted to their environment as evidenced from both the living world and the absence of evolutionary failure in the fossil record; (2) the high frequency of convergence seen in nature indicating that similar solutions have been used to solve related problems of survival throughout the history of life on earth; (3) the idea that many evolutionary changes do not seem to have immediately imparted the organism with an improved capability to survive, but were anticipating the needs of future organisms; and (4) the hierarchical nature of life that is universally characterized by non-overlapping groups. All of this indicates an underlying "Intelligence" in the living realm. To cement this position, Cafferky seeks to demonstrate the improbability of life originating spontaneously as a result of naturally occurring events. The author strives to point out the problems with the reductionist Darwinian scenario for the origin of life. He also identifies what he believes are several examples in which the Darwinian scenario contradicts established tenets of biology, such as the Principle of Biogenesis (Life begets Life). Toward this end, the author also addresses the creative symbolic language of the genetic code and the transduction of information between the genes and proteins, both of which are independent chemical systems.

Much of *Evolution's Hand* is a restatement of the classic nontheistic and creationist arguments designed to refute Darwinian evolution. However, Cafferky's experience working with Archaean deposits does add valuable perspective into the conditions of the early earth and the extent of contamination of the Archaean waters, and the problems this poses for a reductionist origin of life scenario. Cafferky also uses a somewhat unusual, but effective, approach to segue from the evidence pointing to an "Intelligent Designer" operating in the physical universe to an "Intelligence" directing the evolutionary processes in the living world through a discussion of the unlikely development of human intelligence solely by natural processes. The author links evolution in the physical and biological realms by developing the position that the intelligence that we use to perceive the physical universe (and the "Intelligence" responsible for it) has the appearance of being deliberately brought into being through the process of biological evolution, and therefore, must be directed by an Intelligent Designer.

Cafferky's discussion on the evolution of human intelligence, in which he takes the stance that hominid evolution has preceded according to a pre-planned sequence, is engaging. According to Cafferky, the excessive brain capacity of apes and extinct hominids has never been fully utilized, and as such, does not represent a selective advantage, but actually has detracted from these organisms' ability to survive. Maintenance of large brain capacity is an energy intensive proposition and is of no value to the organism if not used to its full capability, which has been the case for nonhuman hominids. Excess brain capacity appears to be a pre-adaptation that anticipated the emergence of human intelligence and could not fully develop until the de-animalization (loss of the acuity of the sense of smell, the loss of brute strength, loss of a tail, loss of fur, etc.) of humans took place. As Cafferky points out, de-animalization of humans results in decreased capacity to meet environmental, predatory, and competitive challenges and cannot be explained from the traditional Darwinistic standpoint. These changes appear to have been orchestrated to force the development of human intelligence. A requisite pre-adaptation for this is the existence of a large brain with excess capacity.

As a whole, *Evolution's Hand* presents a strong case for an "Intelligence" underlying life on earth and does an effective job at presenting a serious challenge to reductionist Darwinian theory. Towards this end, Cafferky has done an admirable job at moving toward answering the question of God's existence. However, Cafferky does not weave a convincing argument for the necessity of evolution operating in either the physical universe or the biological realm to produce changes culminating in human intelligence. Evolution by natural processes does occur in nature. However, demonstrating that a change in nature has occurred solely based on the laws of physics and chemistry requires a physicochemical mechanism capable of producing the observed changes under the conditions at hand and time available. Rather than showing this to be the case for biological evolution, the author defaults to the theistic evolutionary position by regarding evolution as a fundamental characteristic of life. Cafferky does not consider nor present evidence to refute the proposition that the Creator may operate by divine fiat or direct intervention in the course of the natural history of the earth. Based on what Cafferky has presented in this work, one could as easily arrive at the progressive creationist view.

In fact, one could argue that the evidence Cafferky offers up to refute Darwinism and support biological evolution directed by a Creator actually provides more support for progressive creation than theistic evolution.

This book is targeted largely to a popular audience with a modest scientific background. Overall, I found *Evolution's Hand* easy to read and often enjoyable. I recommend it to my nonscientist friends, who would like an accessible exposure to the theistic evolutionary position or who might be interested in exploring the relationship between the Christian faith and modern-day science. For ASA members, *Evolution's Hand* is not a "must read" work. However, it may be of interest, since it represents the testimony of a fellow scientist who rediscovered the legitimacy of the God of his childhood in the facts and record of nature.

Reviewed by Fazale (Fuz) R. Rana, 9769 Placid Dr., Cincinnati, OH 45241.

A CASE AGAINST ACCIDENT AND SELF-ORGANIZATION by Dean L. Overman. Lanham, MD: Rowman & Littlefield, 1997. 245 pages. Hardcover; $24.95.

From your seat in the jury you look out at the prisoners: Accident and Self-Organization, accused of fraudulently taking credit for forming life from nonliving matter, and for forming a universe compatible with life. The attorney for the prosecution rises to present the case against them. He is Dean L. Overman, senior partner in the Washington office of a large international law firm, with numerous publications on banking, commercial, corporate, tax, and securities law. His arguments are stated in this book.

The introductory Parts I and II review errors in logical and mathematical reasoning, the sort of mistakes undergraduates are taught to avoid. Sadly, the research literature too is seen as prone to these faults. Circular reasoning is also condemned, but with examples that some will view instead as illegitimate attempts to relate incompletely proved concepts.

Parts III and IV argue that life could not have arisen from nonliving matter. The experiments of Urey and Miller, in which simulated natural processes yielded some amino acids, are dismissed because they were no accident but were done intelligently, nevertheless attaining a level of complexity nowhere close to that in life. Evolutionists, however, still see these experiments as strong support for a natural origin of life, since they contradicted the prior idea that amino acids could only be synthesized by a carefully crafted sequence of chemical manipulations. Next, the author reports five probabilistic calculations for the impossibility of an enzyme, protein, or bacterium forming randomly. Scientists agree that these did not assemble themselves spontaneously, and claim that natural selection directed their evolution. The author criticizes this idea by ridiculing a somewhat exaggerated analogy in a popular science book, but he does not discuss modern work on selection of identified units of gradually increasing complexity in successive stages of the origin of life. In a concluding argument, the generation of the information content in living things is stated to be inconsistent with the second law of thermodynamics. Perhaps the focus should be not on the isolated organism, but on its adaptation to its environment, so that the question becomes "How was the match generated between the information contents of organism and environment?"

Part V (with five diagrams), on the formation of a universe compossible with life, opens with an account of cosmology beginning with the Big Bang, continuing on to "Grand unified extra dimensional theories." However, in this clear and readable description, speculative ideas are not distinguished from well-established theories. With this as background, the author cites eleven examples of precision of values in particle astrophysics such that life would be impossible if these values differed even slightly. Because a universe with these features cannot be an accident, design by an intelligent Creator is indicated. Part V concludes with a brief and rather negative discussion of anthropic principles.

A 2½-page discussion of ethical implications follows, making the point that if the origin of the universe was accidental, then there can be no basis to distinguish right from wrong. Finally, a summary and conclusions recapitulate all the arguments made throughout the book, highlighting each in one sentence in bold print. Overman's closing words are: "If life transcends the laws of physics and chemistry, then a rational conclusion is that a Person, not chance and the laws of physics and chemistry, caused and is causing life."

The writing is very clear, with a hierarchic organization of numbered sections and subsections. However, a reader should be aware that natural processes (a friendlier name than accident) and self-organization have many able defenders of their claim to be responsible for the origin of life; indeed, this is the only side of the case that mainstream science normally presents. Although Overman writes for the intelligent layperson, making this fine presentation of the argument for Design accessible to a wide audience, he will not convince those who keep supernatural causes separate from science.

Reviewed by Charles E. Chaffey, Professor of Chemical Engineering and Applied Chemistry, University of Toronto, Toronto, ON M5S 3E5.

CONCEPTUAL ISSUES IN MODERN HUMAN ORIGINS RESEARCH by G. A. Clark and C. M. Willermet, eds. New York: Aldine de Gruyter, 1997. 508 pages. Paperback; $44.95.

It is somewhat ironic that the most vigorously debated issues surrounding the study of human origins are not those concerned with our earliest beginnings—where the comparative scarcity of evidence would serve to fuel such debate—but center instead on a comparatively recent chapter in human prehistory for which we appear to pos-

sess a relative abundance of evidence. Specifically, those issues concerning the origin of *modern* humans (*Homo sapiens*) have fueled what is currently the "hottest" debate in the study of human evolution. While there appears to be a growing consensus among scientists that the emergence of anatomically modern *Homo sapiens* marks an evolutionary development that probably occurred between 100–200 thousand years ago, there is little consensus regarding the wheres, hows, or *precise* whens of that event. The controversy surrounding the origin of modern humans reflects the contrasting interpretive positions of the two dominant camps in this field: the replacement camp and the regional continuity camp. Between these two explanatory models lies an apparently unbridgeable gulf.

Those adhering to the replacement paradigm maintain that *H. sapiens* evolved in Africa—and only in Africa—between 100–200 thousand years ago, and from this point of origin migrated throughout Europe, and Asia, "replacing" local hominid populations in the process. In contrast, the continuity model assumes multiple origins of *Homo sapiens* from existing populations in Africa, Europe and Asia. Clark and Willermet contend that these positions reflect radically different assumptions about the human past and the nature of "modernity." They also reflect significant differences of opinion regarding how the evidence pertaining to modern human origins should be interpreted, and therein "lies the rub," so to speak. Contributing to the entrenchment of opinion on both sides are the personal and professional biases, as well as the influences of "regional research traditions" on data selection and analysis. *Conceptual Issues in Modern Human Origins Research* serves as a multidisciplinary and multinational forum for those engaged in this debate to outline their positions and defend their arguments. A variety of disciplinary perspectives are included: paleoanthropology, archeology, molecular biology, genetics, linguistics, and philosophy. The twenty-nine essays which comprise the collection reflect the interpretive stances of researchers from Australia, Canada, China, France, Germany, Great Britain, and the United States. It is this diversity of participants and paradigms that constitutes the major strength of the book.

Given the relative abundance and diversity of evidence that those involved in modern human origins research have at their disposal, it would seem that some sort of resolution to this debate would be imminent. That such a consensus has not emerged is an obvious and perhaps rather mundane point. Why it has not, and why it probably will not, constitute the really compelling questions here, and it is to these concerns that *Conceptual Issues in Modern Human Origins Research* is directed. The reader will gain a clearer understanding of the range of scientific opinion on this subject, as well as a keener appreciation for the fact that the scientific process can never be completely disentangled from its cultural context.

As would be expected in so eclectic a collection, writing styles and article accessibility vary considerably. Many of the essays will be accessible to the curious but non-specialist reader. Others of a more esoteric nature will have a more limited appeal. I would recommend *Conceptual Issues In Modern Human Origins Research* as a timely and comprehensive reference for students and teachers of upper-level/graduate courses in human evolution and for those with an epistemological interest in "how we know what we think we know" about our origins.

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

ETHICS IN MEDICINE by Milton D. Heifetz. Amherst, NY: Prometheus Books, 1996. 264 pages. Paperback.

Heifetz is the former chairman of the Department of Neurosurgery at The Cedars-Sinai Medical Center in Los Angeles. As such, he comes to the field of bioethics from the perspective of a practicing physician. He also comes to this topic from a studiedly non-religious position. Although he occasionally notes we can learn much from religious traditions and that our lives would "be colder, more detached, and less humane" without them, he still feels he must approach medical ethics free of religious dogma. "The persistent attempt to invoke religious concepts in the ethical dilemmas of our secular society ... has added to the confusion."

From this standpoint, he seeks to derive his concept of ethics. Dismissing religion or reason as his framework, he finds what he describes as the most basic of universal attributes—that of harm avoidance. He detects this in subhuman animals, unaffected by culture, and believes this is the best starting point. From there he develops four basic factors: harm avoidance (non-maleficence), autonomy, common good, and beneficence, and he argues that they should be applied to medical ethics in that order of hierarchy. Since he has derived his moral factors from "biological reality," he thinks this concept of medical ethics should be applicable to all people, bypassing cultural traditions.

The author then deals with eight topics using these derived factors. In four of these areas ("The Doctor-Patient Relationship," "The Right of Self-Determination," "Suicide," and "Abortion"), he argues that the overriding factor is autonomy. He discusses and obviously supports the patient's increased involvement in decisions that affect health. He also discusses the patient's right to reject therapy. Here the experience of the compassionate physician surfaces. At times a patient will reject therapy that may be lifesaving for a poor reason (such as avoiding minor, transient pain). In such cases, he thinks the physician must strongly push the patient, even with sedation, into the right choice (i.e., beneficence sometimes trumps autonomy). He deals with the problem of the incompetent patient and the need, at times, for "substituted judgment." In the area of physician-assisted suicide, Heifetz thinks there should be no laws concerning this, but that doctors should use their best judgment. They should encourage, relieve pain, and provide support but at times may decide the best course is to assist with the suicide. In the area of abortion, he sees six arguments against it, all of which he disputes, and thirteen in favor of it, none of which he disputes. Clearly, in his view, autonomy and privacy win out over "religious self-righteousness."

In chapters entitled "The Tragic Newborn," "Euthanasia," "Human Experimentation," and "... Medical Triage ...," he describes the necessity of balancing the four factors, realizing that sometimes personal rights conflict with societal rights. He avoids hard and fast rules, opting for open-minded discussions between patients, relatives and doctors and at times for involvement of hospital ethics committees and national organizations of neonatologists and pediatricians.

The book has an extensive bibliography and an index, and Heifetz uses six appendices to discuss mastery, privacy and the foundation of human rights, to give an example of a Durable Power of Attorney, and to record governmental guidelines on fetal research and human experimentation.

Those interested in a Christian approach to medical ethics will not find it in this book because of the author's stated approach. In such a case, I'd recommend Gilbert Meilaender's book, *Bioethics*, reviewed in this journal (September 1997: 207). He comes to this topic with a distinctly Christian vision.

Reviewed by Edward M. Blight, Jr., Professor of Surgery (Urology), Loma Linda University School of Medicine, Loma Linda, CA 92354.

PHILOSOPHICAL PERSPECTIVES ON BIOETHICS by L. W. Sumner and Joseph Boyle, eds. Toronto: University of Toronto Press, 1996. 299 pages. Paperback; $19.95.

The essays in this volume were presented at a 1993–1994 seminar series on "Philosophical Perspectives on Bioethics," jointly sponsored by the Centre for Bioethics and the Department of Philosophy at the University of Toronto. It consists of an Introduction and thirteen papers by fifteen different authors. Most of the authors are professors of philosophy at universities in Canada or the United States. It is a totally secular work directed toward the definition of public policy without any actual connection between ethical policy and perspectives related to Christian faith. The next-to-last page of the book has a representative phrase, "Public policy should not be based on specific religious beliefs that many do not share."

In rounding out a total picture on these issues for the professional philosopher, this book certainly plays a significant role, but its strong concern with theoretical issues and the limited specific treatments of actual bioethical issues make its reading a somewhat abstract intellectual exercise. This characteristic is fully recognized by the editors of the book, who state from the beginning that the purpose of the book is not to "advance public discussion of one or another substantive bioethical issue ... [but] to raise questions about the nature of bioethics itself as a normative discipline. The questions pertained to "proper methods for bioethical thinking" (seven papers), "distinctively feminist perspectives on the present state of bioethics" (four papers), and "the political and institutional contexts of bioethical thinking," especially with regard to how bodies formed to propose public policy on bioethical issues should proceed (two papers). Five of the authors are women, with chapter titles such as, "Good Bioethics Must Be Feminist Bioethics," and "Theory versus Practice in Ethics: A Feminist Perspective on Justice in Health Care."

The book is heavily oriented toward academic theorizing about bioethical theorizing, rather than proposing in any detail the appropriate approaches to specific bioethical issues of public concern today. Specific issues discussed to some extent include the conduct of clinical trials, euthanasia, justice in health care, the care of children, cosmetic surgery, and reproductive technologies.

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

FREUD VS. GOD: How Psychiatry Lost its Soul and Christianity Lost its Mind by Dan Blazer. Downers Grove, IL: InterVarsity Press, 1998. 233 pages, notes, index. Hardcover; $22.99.

Blazer, an academic psychiatrist specializing in geriatric psychiatry and depression in late life, makes an argument from personal experience that "both psychiatry and Christianity have abandoned discussion of critical issues most relevant to emotional suffering" (p. 97). The title of his book, *Freud vs. God*, is a metaphor for the tension between psychoanalytic theory and Christian theology that was inevitable due to Freud's anti-religious stance. Today, neuropsychiatry has largely displaced depth psychology and little tension exists. Blazer's thesis is that this relief is not due to resolution of important issues but is based on the willingness of both psychiatry and Christianity to "accept uncritically, to a large extent, the biological reductionism of psychopharmacology" (p. 97).

In a refreshingly personal manner, Blazer describes his walk as both Christian and psychiatrist. Blazer's roots are in fundamentalist, evangelical Christianity and he remembers thoughtful grandparents who were an inspiration to him as a thinking Christian. Blazer recalls his discovery of Freud who, although anti-Christian, appealed to his perception of the nature of man. Blazer, M.D., Ph.D., who once doubted whether he should pursue psychiatry as a Christian, is today Dean of Medical Education and J. P. Gibbons Professor of Psychiatry at the Duke University School of Medicine; and is an elder at Brooks Avenue Church of Christ, Raleigh, North Carolina.

Freud vs. God begins with "Stories and Questions" of three clients who approached Blazer because he was a Christian psychiatrist. In each case some measure of successful treatment for specific psychiatric disorders was accomplished via medication, and yet nagging questions remained in Blazer's mind.

In "Conversation and Debate," Blazer describes the initiation of the conversation between Christianity and psychiatry by Freud and later psychoanalysts. In this and future chapters, Blazer surveys a wide range of authors

and works, placing each in its historical context, and provides a valuable resource for further reading in the bibliography and notes. Blazer documents the rise of clinical pastoral education and the theologian's concern regarding "whether the psychological goal of mental health was equivalent to the spiritual goal of growth and salvation" and the spiritual reality that "true self-realization required self-denial" (p. 83).

In "Psychiatry Loses its Soul," Blazer relates how psychiatry has shifted away from "concerns about wholeness, meaning, and the transcendent" (p. 137) during the emergence of psychopharmacology and neuropsychiatry. Today "designer drugs" can be used not to treat psychiatric disorders but to alter personality and mood. Although operational psychiatry investigates the relevance of measurable religious behavior such as Bible reading and church attendance, a reductionistic psychobiology of religion is assumed over against the possibility that properties of mind cannot be reduced to the underlying neural mechanisms. The specialization and medicalization of psychiatry makes it easier to label and medicate emotional suffering than to explore it in depth. Blazer is comfortable with "common-sense psychiatry" such as cognitive therapy and interpersonal psychotherapy, but uncomfortable practicing in the context of "the American belief in individualism, self-sufficiency, pragmatism and realism" (p. 135).

In "Christianity Loses its Mind," Blazer reiterates Mark Noll's thesis of a lack of rigorous scholarship among evangelicals (especially in the sciences), rooted in the fundamentalist reaction against biblical criticism, the social gospel, and evolutionary theory. ASA members will find particularly interesting Blazer's comments regarding the similarities and differences between the evangelical counseling movement and the creation science movement, both reactions against secular scholarship. As Blazer describes the popularization, professionalization, and politicalization of Christian counseling, he points out the lack of commitment to community evident in Evangelicalism. An emphasis on the resurrected as opposed to the crucified Christ presumes the goal of a "revitalized rather than suffering self" and neglects the necessity of pain. "Evangelical Christian counseling does not so much derive from biblical theology as use biblical inerrancy to validate its predominantly cognitive, rational, self-sufficient, positivistic message" (p. 149).

In the next chapter, Blazer touches upon the new age movement, writers such as M. Scott Peck and Thomas Moore, and self-help groups such as Alcoholics Anonymous, all of which to some extent "Fill the Vacuum" of the care of the soul. Blazer himself appears inclined toward narrative theology, the belief that the "story of the individual" and the "narrative of the community in which the individual resides" can bring "meaning to otherwise meaningless suffering" (p. 203). For example, during Blazer's initial attraction to psychiatry "learning to tell one's life story seemed central to healing, and hearing that story seemed central to doctoring" (p. 92). While throughout *Freud vs. God*, Blazer points out faults shared by both psychiatry and Christianity, in "The Care of Souls and Minds" he lists shared assumptions as a means of promoting dialogue. Blazer closes with a personal account of a helping relationship with Richard, a man presenting late life depression, and Richard's son, Tom, a computer systems administrator who suffers from schizophrenia. Like the three stories at the outset of the book, this final narrative leaves its own unanswered questions. However, in this case, Blazer, Richard, and Tom are able to transcend the doctor-patient relationship.

According to Blazer, psychiatric illness is "at once brain dysfunction, psychological conflict, and spiritual crisis" (p. 12) and the neglect of the whole person in the community is a failing of both Christian counseling and psychiatry. Anti-intellectualism "pervades both psychiatry and Christianity" (p. 97) and as Christians we must choose between critical thinking about emotional suffering and a "comfortable spirit of accommodation" (p. 94), between Christianity and psychiatry.

Reviewed by Gregory D. Smith, IRTA Fellow, Mathematical Research Branch, NIDDK, NIH, Bethesda, MD 20814.

MIND GAMES: Exposing Today's Psychics, Frauds, and False Spiritual Phenomena by Andre Kole and Jerry MacGregor. Eugene, OR: Harvest House Publishers, 1998. 309 pages. Paperback.

This book is rather unusual in that its two authors are both magicians and Christians. Kole's magic shows have appeared before millions of people in seventy-six countries of the world. He is also a consultant to several famous magicians, advising them on innovating magic presentations. MacGregor, a senior editor at Harvest House Publishers, is known by his series of popular lectures, also entitled *Mind Games*, that purportedly demonstrate the trickery used by many psychics. Both authors are now engaged in investigating claims of supernatural powers, superhuman mystics, psychic frauds in the church, and other mind games.

At first, this book reads like merely an exposure of deceptions in magic tricks and mysterious illusions. Indeed, in the early chapters of the book, the authors explain what mind games are, why people believe in them, and how some of them are performed to deceive the audience or followers. These chapters will draw those readers who are interested in how magic tricks work. However, as both authors are Christians, the latter part of the book warns us against heresies, false prophecies, and sordid manipulation of people's minds by Satan in mind games, and provides guidelines that are based on biblical teachings for resisting them. This artful approach in writing the book is sensible because many readers, even Christian readers, may not want to read a book that starts right off with sermons on false spiritual phenomena and deceptions in the name of God.

The mind games here include magic tricks, false prophesies, psychic healing, extrasensory perception, psychokinetics, precognition, premonition, seances, unidentified flying object sighting, extraterrestrial alien visitation,

fire walking, hypnotism, New Age religion, astrology, shamanism, divination, and theosophy. The authors cite numerous references to specific examples of these mind games. The bibliography is extensive. In many of the examples, the authors explain in detail how the performers played tricks to the unsuspecting audience or believers. In all cases, the authors point out that these mind games are just tricks, hoaxes, misguided visions, frauds, fantasies, fallacies, fabrications, deceptions, or demonic work of the devil.

It is interesting to note, especially for members of the American Scientific Affiliation, that the authors think that Christians and scientists are easily fooled by mind games. They point out that some Christians either are misled to believe or do want to believe that humans can perform miracles with supernatural power from God. (The truth according to mainline Christianity is: only God can do miracles; he performs miracles directly, never through a human being; and he performs miracles at his own discretion, not in any scheduled exhibition.) Scientists can be deceived because they are conditioned to think logically. The performer of a mind game knows exactly how and what logical thinkers conceive, and so can easily outwit them. This book also offers steps to check frauds in mind games. Thus, this book, besides being enjoyable to read, is a useful guide for Christians and scientists alike on safeguarding against being taken in by mind games.

Kole and MacGregor also caution us on the exaggerated claims of alternative medicines which include faith healing, biorhythms, applied kinesiology, chiropractic, homeopathy, acupuncture, and hand waving healing. I believe that some of these alternative medicines, such as chiropractic and acupuncture, are strictly not mind games. However, excessive claims of any medical treatment are truly false advertisements.

On the issue of extraterrestrial intelligent life, the authors state that there are theological problems with the existence of intelligent beings on other planets. Their belief is in contrast to that of David Wilkinson, a Methodist chaplain. In his book, *Alone in the Universe? The X-Files, Aliens, and God*, Wilkinson wrote that extraterrestrial life, if and when found, should enhance and enrich our Christian faith in God. See my review of that book in *Perspectives on Science and Christian Faith*, Vol. 50 (March 1998): 61. I will let the readers choose sides on this issue.

Reviewed by James Wing, 15107 Interlachen Drive, Unit 1014, Silver Spring, MD 20906-5635.

THE ARCHAEOLOGY OF EARLY CHRISTIANITY: A History by William Frend. London: Geoffrey Chapman, 1997. 412 pages.

This book is a history and discussion of archeological research into the earliest years of Christianity. From the auspicious beginning of the first archeologist locating "the cross," Frend takes the reader on a fascinating survey of the history of Christianity in North Africa. He shows that large areas of Algeria (Numidia) and neighboring countries had extensive churches, cathedrals, cemeteries, and other Christian structures. When the Christian era was superseded by the Islamic, a tremendous change took place in the ecology of the former Christian regions. I was aware of this but not the reason until I read this book. With the Muslims came nomads whose animals overgrazed the territory where the sedentary Christians had planted olive trees and grew grains. Villages decayed and people left through environmental degradation rather than warfare. Degraded steppe and desert now predominate.

Accounts of discoveries in the catacombs of Rome are spellbinding. Discoveries in the Middle East are also included. Frend was involved in many of the excavations in the Mahgreb and Nubia and so is able to provide first person accounts. He discusses more than capitals, tesserae, pillars, plinths, and papyri. He discusses the people involved in archaeology. For example, Napoleon was keenly interested in archeology. When his forces came to Egypt at the end of the eighteenth century, professional archaeologists accompanied them. This trend continued with the expansion of the French Empire. Recent attention to the delay of the publication of the Dead Sea scrolls is more understandable after reading Frend's account of problems in international archaeological cooperation. Extensive footnotes and references accompany each chapter. The index is especially complete. Those interested in archaeology, the early church, and history will find this volume useful.

Reviewed by Lytton John Musselman, Department of Biological Sciences, Old Dominion University, Norfolk, VA 23529.

ALIEN OBSESSION: What Lies Behind Abduction, Sightings, and the Attraction to the Paranormal by Ron Rhodes. Eugene, OR: Harvest House Publishers, 1998. 252 pages, bibliography. Paperback.

Ron Rhodes is a popular Bible teacher on the radio and has authored books such as *The Complete Book of Bible Answers, Angels Among Us, and What Your Child Needs to Know About God.* He holds a doctorate from Dallas Theological Seminary and is president of Reasoning From the Scriptures Ministries. Thus, he is well qualified to address the popular phenomenon of UFOs and alien abductions from a biblical perspective. The book begins with several chapters about the "wild popularity of UFOs" and proceeds to analyze evidence from UFO researchers, government reports, and anecdotal stories. The author then shows the strong connection between UFOs, the New Age movement, and the occult. He closes by examining how the "doomsday shivers" increase as we approach the turn of the millennium. Four appendices examine such issues as "Who is Satan?", "Who are demons?", "The Christian's Defense Against Fallen Angels," and "If you're not a Christian."

Rhodes does a good job of showing that most UFOs are actually "identifiable" in that they can be explained by other phenomena (e.g., secret government tests with bal-

loons at Roswell, New Mexico). Those that remain truly "unidentified" and every abduction incident can be explained by examining the connection between UFOs, New Age, and the occult. Close examination of the messages given by alleged aliens to abductees reveals similar themes with New Age spirituality and occultism. Among these messages are: (1) Replace exclusivistic Christianity with a religious universalism; (2) Never affirm the Bible as God's word; (3) Never mention sin and the need for redemption; (4) Offer blasphemous interpretations of the incarnation of Christ such as Mary being impregnated with alien sperm; and (5) Consistently contradict Scripture (e.g., a counterfeit rapture and false utopia).

Rhodes points out that people who have abduction experiences are typically people involved in the occult. Whitley Strieber, who wrote *Communion*, admitted his occultic involvement and disillusionment with his Catholic faith prior to his abduction experience. Furthermore, the abduction experiences frequently resemble those of occultic shaman initiates who report being torn apart or probed by demons with long needles. The ghostly appearance of some UFOs and aliens suggests a parallel with the spiritual nature of demons. Rhodes concludes that those truly "unidentifiable" UFOs are actually demonic manifestations passing messages to subvert the good news about the kingdom of God in the world.

The book sets forth its points very simply and clearly for a general audience. I would recommend this book for a popular audience but not for those who are looking for more depth about this topic. It is also clearly written for a Christian audience even though it contains an appendix for unbelievers. Rhodes states that "with so many Christians undiscerningly buying into the UFO craze hook, line, and sinker apologetic answers on the UFO phenomena are much needed today. That is why I wrote this book." The book assumes the reader is sympathetic to a biblical worldview.

I would not recommend it for unbelieving friends because in some cases, he does not *demonstrate* a point, he only raises a question. For instance, at the end of a chapter discussing the New Age and UFOs, Rhodes quotes Christian UFO researcher William Alnor:

> Could it be that the similar end-times scenarios being spewed in the form of messages from the space brothers are deliberate attempts to fool humankind about Bible prophecy in the very era of Christ's return? Could the benevolent space brothers that the New Agers talk about actually be some of the 'angels of light' deliberately sent by Satan to deceive mankind whom the apostle Paul warned the early Christian church about (2 Corin. 11:14)?

Such questions are similar to those used by UFO enthusiasts to support conspiracy theories about government cover-ups. To reach an audience which may not be Christian, it would be better to point out the similarities and allow the reader to make his own conclusions.

Youth groups or college student fellowships may find the book useful to counteract the culture's fascination with aliens and to examine this phenomenon from a biblical worldview.

Reviewed by David Condron, Aerospace Engineer, 11678 Melcombe Ct., Woodbridge, VA 22192.

THE FAITH FACTOR: Proof of the Healing Power of Prayer by Dale A. Matthews with Connie Clark. New York: Penguin Group, 1998. 322 pages, index, footnotes. Hardcover; $24.95.

The question is simple, "May a person expect that religious involvement will contribute to health, well-being and long life?" Answers to this question have traditionally been anecdotal—stories many of us have grown up with—and sometimes stories, which have been proven misleading, false, or even fraudulent.

It was with a skeptic's eye, therefore, that I selected this volume at the Durango public library in May 1998. I was hoping to find something of value, but I was expecting, at best, a few pious anecdotes. I was surprised. This is an important book. Although written in a popular style, copious footnotes point the way to a great many scholarly studies aimed at bringing scientific rigor into the faith process.

Matthews does not try to "prove God," nor does he make any claim that such can be done. He does assert, however, that something he calls the "faith factor" can, and does, play a key part in matters of health, living well, and long life. As I read through the book, I became more and more impressed with it, so much so that half-way through I ordered a copy for my own library, with the intent of teaching a Sunday School class based on it.

Does God heal illnesses? Matthews insists that this is a matter of faith and is not a question science can answer. But, he says, "The question before us, rather, is this: Does belief in God aid in healing?" (p. 64). This is a scientific question, and from the evidence presented in this book, the answer appears to be, "Yes."

The evidence (so far) does not support a claim that one denomination, or even "Christianity" generally, is superior to other faith communities. The data does appear to show that one's devotional and participative intensity affects the faith factor's value, and, hence, one's well-being, more than anything else. Are all faiths the same then? Matthews is quick to answer this question: "I believe that the choice of a particular faith tradition is a matter of utmost consequence, and should be based on one's perception of what constitutes truth, not what will give better health" (p. 284).

Besides the footnotes, many resources, such as books, web sites, organizations, etc, are listed. On page 81, Matthews summarizes his thesis as follows: (1) There is evidence for a broad spectrum (not just a few stories) of

healing experiences; (2) There are observations that there is a wide range (not just a specific action or two) of spiritual healing practices which accompany these healings; (3) It appears obvious that the type and degree of healing through spiritual means is not within our control. God remains sovereign; (4) Yet, some factors appear to lie within the realm of scientific investigation.

This book is recommended to my fellow ASA members, friends, and family with enthusiasm. It ought to spark a number of scientific research projects to extend and refine the claims.

Reviewed by John W. Burgeson, 6731 County Road 203, Durango, CO 81301.

THE ANIMAL CREATION: Its Claims on Our Humanity Stated and Enforced by John Styles. London: Edwin Mellen Press, 1997. 226 + xiv pages, index. Hardcover; $89.95.

This reprint of an 1839 edition—the original publisher is not given—is part of the current publisher's *Animal Rights Library Series*, including four contemporary volumes and six historical ones. The historical list goes back as far as 1776, and as far forward as 1903. The 1997 edition of *The Animal Creation* has a fourteen-page introduction by Gary Comstock, a professor of philosophy from Iowa State. Comstock rightly says that the strength of the book is Styles' emphasis on cruelties to animals. He also briefly analyzes the theological and philosophical underpinnings of the work. Comstock closes with some criticisms. Styles is repetitive, his quotes are often too long (the forty-two pages of notes by Styles are mostly long quotes), and he does not carefully attribute his sources. Some of his scientific views are seriously out of date. He condescends to other cultures. I agree on all points, but, of course, most of these faults are because the book was written at a different time, and to a different audience.

Why should an individual, or a library, spend $90 on this book? (I would not argue that they should, unless they have a serious and definite interest in the religious aspect of the history of the animal rights movement in Great Britain.) For two reasons. First, Styles was probably representative of many people of his time and place. The book has some historical importance. Styles argues that being kind to animals is the Christian thing to do, and many others believed this, too. (Not everyone, now or then, agreed with Styles, of course.) Secondly, it is impossible to read the book without asking repeatedly, "Did people really do these horrible, cruel, and senseless things? Are they still doing them?" If you have never understood what is meant by vivisection, you will understand it after reading this book. The vivisection that Styles describes is what the term suggests—cutting on an animal that is not only alive, but conscious, and for no clear purpose except to demonstrate what a live conscious animal does when you cut it open. Unfortunately, the same term is still used for an operation on an anesthetized animal, for clearly defined and achievable scientific purposes, by persons sensitive to animal pain. The reason it is used thus is to evoke an emotional reaction, I suppose. Well, Styles was also doing so. He still can evoke one.

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

ON GOD AND DOGS: A Christian Theology of Compassion for Animals by Stephen H. Webb. New York: Oxford University Press, 1998. 222 + xii pages, index. Hardcover; $29.95.

Your eyes did not deceive you. You read the title and subtitle correctly. You also read the publisher's name correctly. Is the book really about the theology of dogs? Well, yes and no. As far as I know, it is the only book about this subject. However, it is also about animals more generally, and especially about the theological reasons for being a vegetarian. The first page of the first chapter sets the tone for this strategy:

> I will argue that the Bible does display surprising sympathies for animals, that, in fact, the biblical tradition includes a hidden history of vegetarianism. Nevertheless, any animal-friendly interpretation of the Bible must read it against the grain of traditional interpretations, so that the first strategy must be willing to challenge and transform traditional understandings of Christian faith (p. 17).

Webb, therefore, assumes that an "animal-friendly" view of the Bible must interpret it in favor of vegetarianism, and he wants to transform traditional understanding.

It seems to me that any Christian argument for vegetarianism must contend with at least these Scriptures: Noah and his descendants were given the animals to eat after the flood (Gen. 9:2–3); The Passover and other religious celebrations included consumption of meat; Jesus' last Passover included meat (Ex. 12:3–10; Luke 22:7–13); Although certain meats were forbidden, many were allowed (Lev. 11); Jesus gave the disciples fish to eat after his resurrection (John 21:13); When Peter had his vision, he was not repulsed by eating meat, but by eating meat that was unclean by Jewish dietary standards (Acts 10:13–15); The church conference allowed meat to be eaten, so long as it had not been strangled or offered to idols, and so long as it had been bled (Acts 15:20); It is not intrinsically wrong to eat meat offered to idols (1 Corin. 8); No food is intrinsically wrong to eat (1 Tim. 3:3–5).

These Scriptures do not require Christians to eat meat, nor do they prohibit Christians from refusing to eat meat, but they seem to make an almost completely airtight case that Christians should be allowed to eat meat. Webb deals with less than half of these Scriptures. He is an advocate. That is, he is willing to accept almost any argument, however far-fetched, on the side of the case he is trying to make. This reviewer was not convinced.

Leaving aside vegetarianism, what did Webb accomplish? He discusses relationships with animals as examples of covenants and of grace. He examines the early

church fathers' thoughts about animals. He examines the meaning of the language used to describe meat and meat eating. He considers the theology of sacrifice and the language describing it. He occasionally writes well, and insightfully, as in:

> Two images come to mind. In one, God is like a dog, waiting at the door, but instead of guarding the threshold, God always lets everyone in, eagerly welcoming those who want to enter into God's abode and become part of God's family. Likewise, God treats us like one who has adopted a dog—extending kinship lines in unexpected and extravagant directions, quick to comfort and care, and never counting the cost (p. 127).

> Surely it goes without saying that dogs can be merely the repositories of our surplus feelings, all that is alienated during the workday, all the emotions that could be channeled into social change or into bettering human relationships. But good dog relationships ... do more than this; they offer us more than we could ever find within, take us further than we knew we could go, and make us more than ourselves ... dogs are like a gift, a grace undeserved,... that is actualized only as we give it away, and in giving we see something that we could not see before. In this way, dogs are part of the anti-economy of giving, generosity, and grace (pp. 103–4).

The book, however, could have been better organized. Webb usually comes at his material more than once, rather than developing it thoroughly. The index is sparse—only four pages long. It did not include vegetarianism, for example. There are sufficient notes and bibliography.

This unique, worthwhile, and occasionally infuriating book is written for theologians and philosophers, but accessible to ASA members. The author is a professor of religion and philosophy at Wabash College.

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

UNHOLY ALLIANCE: Religion and Atrocity in Our Time by Marc H. Ellis. Minneapolis: Fortress Press, 1997. 194 pages. Paperback; $18.00.

In this thought-provoking book, Ellis offers a powerful and often disturbing examination of how it is possible for us to conceive of God in the face of the multitude of historical and contemporary atrocities that have been perpetrated with the tacit or express approval of religious authorities. Drawing on events as seemingly diverse as Pizarro's exploits in Peru in the early sixteenth century and the massacre of twenty-nine Palestinian Muslims at prayer during Ramadan by Baruch Goldstein in 1994, Ellis explores, rather than constructs, a theodicy that takes the Holocaust as its primary point of departure. The author is trying to determine whether Jewish and Christian responses to barbarism are substantive and efficacious, or whether they serve to perpetuate a cycle of violence and inhumanity. As part of his response, Ellis argues that to bring an end to atrocity is also to bring an end to traditional Christianity and Judaism.

To support his argument, Ellis examines the ideas of a group of what he refers to as progressive Christian and Jewish theologians, such as, Richard Rubinstein, Gustavo Gutierrez, Elie Wiesel, and Joan Casañas. While representing diverse perspectives, from feminism to liberation theology, all of these individuals share a conviction that issues of social injustice must be faced squarely by religious leaders and adherents, rather than being swept under the carpet or treated as anomalies. For their part, in light of recent events in Israel and elsewhere, Jews must address more directly their role as perpetrators of violence, within the context of their history as its victims. Christianity, on the other hand, must take into account the fact that the majority of Christians in the world today, those of Africa, Asia, and Latin America were "evangelized at gunpoint." Christians and Jews alike must come to recognize their complicity in the perpetuation of ethnic, racial, and "religious" violence. A new world order that exists without vengeance, repression, and war is one in which Christianity and Judaism take on a new form.

After Auschwitz, Emil Fackenheim posited a 614th commandment for Judaism, arguing that: "The authentic Jew of today is forbidden to hand Hitler yet another, posthumous victory." In other words, out of anguish, the Jews must be vigilant and mobilize against future atrocity. Ellis interprets this as an effort to reconstruct Judaism in a way that reflects the historical experience of the Jewish people and moves beyond the traditional and firmly set canon of 613 commandments established in the Babylonian Talmud. For his part, Ellis advocates the creation of a 615th commandment of hope and healing based on an effort to establish a "future beyond atrocity" that must start with a sharing of Jerusalem, both literally and symbolically.

Readers of this journal are all too aware of the symbiotic relationship that exists between religion and science, in spite of the much-publicized opposition between these two that is supposedly characteristic of the modern world. Ellis makes us aware of how, in this modern world, Christianity and Judaism are perhaps more closely linked than they have ever been, each needing to rely on the other for its continued existence to be meaningful. I highly recommend this book to those who might have become complacent about their faith, or who want to understand on what basis it might be possible for some people, scientists among them, to call into question the truth and universality of the Christian message.

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

GOD-TALK IN AMERICA by Phyllis A. Tickle. New York: The Crossroad Publishing Company, 1997. 258 pages, no index. Hardcover; $24.95.

As contributing editor in religion to *Publishers Weekly* and editor-at-large for its *Religion Bookline*, Phyllis Tickle is well-situated to sketch out the likeness of America's religious face, at least as it is discernible in the publication market. The image that appears, though—even under the

brush of her able and hopeful pen—may be more disturbing than encouraging, more our own dim reflection than the face of God.

God-Talk in America consists of twelve manageable chapters interspersed with four quite delightful "interludes"—autobiographical stories which are to be taken together as a "developing narrative for which the other chapters stand as argued proofs" (xii). Following these first 175 pages are the extensive "Notes" (more than eighty pages) which offer not only bibliographical references for but also further reflections on much of the material discussed in the chapters. So while the book is quite readable in parts (the chapters, the interludes, the notes), its case is more cohesive if read integratively, i.e., if the chapters and interludes are read through in order, and the notes are referenced as they arise.

The principal thesis of the book is that "god-talk" is not only alive, but is thriving in America. No argument here. No longer the domain merely of the Academy or the Institution, "god-talk" is taking place on the street corners, in the restaurants, in the homes, on the computers of the American people. Contributing to this proliferation of populist theologizing, as well as affecting its direction and content, are such modern phenomena, she notes, as "cumulative literacy," a "pervasive nostalgia," and the "democratization of theology."

By "cumulative literacy" Tickle means both the foundation and the consequences of the information explosion—the "acceleration, diffusion, and obligation" (p. 13) of information that accompanies the proliferation of data and its availability through a myriad of media. By a "pervasive nostalgia" she means this quasi-religious yearning for the stability of once-upon-a-time and for spiritual connection that is, she thinks, the principal emotion coloring god-talk in America (p. 81). And by the "democratization of theology" she means both the development of a theological *lingua franca*—a hybrid, common language necessary for interfaith theological discourse to occur—and the eventual intellectual pluralization of religion as a result.

But surely it is a question whether the availability of data and fact, however readily accessible and expertly annotated (p. 121), really is literacy. Certainly this profusion of information is impacting the "big questions" at the popular level, but this phenomenon does not necessarily mean that the public-at-large has entered the discussion with understanding and insight. It may simply mean that truth is drowning in a sea of trivia.

Arguably, "nostalgia" is a prominent player on the current religious field. It seems that Tickle is correct in assessing much of that as a desire to return to "the small-town ethos of less-rural, less-agricultural but not-yet-urban America" (p. 95)—to the time of community fellowship, unlocked doors, and Judeo-Christian consensus. She also sees the trouble with that sort of simplified and romanticized thinking. And she seems to hear the larger cry within this "pervasive nostalgia" for a unity embracing the diversity. It is just here, though, that she misses what and how great the need is. It is not Woman (as she spends considerable space trying to show), nor Home, nor even Religion that will meet the longing of this hour, but God and the truth concerning God. Tickle's language of "nostalgia," though she does not see it, is really Augustine's doctrine of "longing," arising from the *imago Dei* in which we all are created. So, *contra* Tickle, it is not pluralism (which, by definition, fragments) but the civil and charitable discussion and establishment of truth that is the answer to our misdirected nostalgia.

Finally, Tickle's remarks on the "democratization of theology" are both penetrating and troubling. That such a process is underway is undeniable. That it has the most stupendous implications for doing theology (or for "god-talk") in our culture is inescapable. But that the American "god-talk" can be joined only by those who have accommodated themselves to a homogenized/standardized/vulgarized theology is questionable. It is all very postmodern, but not by any means inherently necessary to disallow normative claims to truth, and raze the distinctions of the various traditions in favor of some as yet undefined foundational commonality.

Tickle's goal is admittedly descriptive—a word portrayal of the "dance" that is life and religion in America. From this point of view, *God-Talk in America* is essential reading for every pastor facing both congregations and communities deeply and unavoidably involved in the "god-talk" of our culture. Read with discretion and discernment, it is an informative guide to the language, the issues, the methods, and even the postmodern understanding of "preferential" theology in America. But as a prescriptive response to the current religious situation, the book is both overly optimistic about the nature of the changes occurring and far too theologically naive to do much to deepen contemporary religious superficiality.

Reviewed by B. Spencer Haygood, Pastor, Kosmosdale Baptist Church, Louisville, KY 40272.

SEVEN MYTHS ABOUT CHRISTIANITY by Dale & Sandy Larsen. Downers Grove: InterVarsity Press, 1998. 156 pages. Paperback.

The authors are freelance writers in Duluth, Minnesota. They have written over thirty books and Bible study guides. This book is the result of conversations with Christian students who attend a private college and who were confused by anti-Christian statements coming from their professors and fellow students. The book examines seven accusations that are commonly leveled against Christianity, is end noted, and has a brief list of further resources.

Chapter one addresses the topic of Christians "forcing their morality on others." Examples include issues such as abortion, the teaching of creationism (as a balance to scientific naturalism) in public schools and Christians crusading against perceived moral declension in the media and the culture in general. What is unfortunately missing in this chapter is a treatment of the "natural law" argument, which has the advantage of being "religiously neu-

tral." This theory has antecedents in Aristotle as well as Thomas Aquinas and John Locke. It was used by Clarence Thomas in his battle to be confirmed a justice to the U.S. Supreme Court. A good example of this approach can be found in *Written on the Heart: The Case for Natural Law* by J. Budziszewski (IVPress, 1997) and in a forthcoming work, *Legislating Morality: Is It Wise? Is It Legal? Is It Possible?* by Norman Geisler & Frank Turek (Bethany Publishing House).

Chapter two discusses the question: "Does Christianity suppress women?" A brief history of the place of women in the church is given, including the fact that the prevailing cultures at the time the Bible was written were patriarchal and this shaped the message concerning male vs. female relationships. It would have been helpful if the authors had contrasted the two prevailing views on this issue: the traditional hierarchical view and the newer egalitarianism. The former holds that men and women are equal in worth but have different roles and functions. The newer view—egalitarianism—believes in mutual submission between husbands and wives and that women as well as men exercise all of the prophetic and priestly functions in the church. I consider the best treatment of this subject (which unfortunately is not mentioned in the book under review) to be Stephen B. Clark's *Man and Woman in Christ*, (Servant Press).

Chapter three deals with the "ecological crisis" and Christianity. Although I claim no special expertise in this area, my sense is that much of criticism leveled against Christianity on this issue comes from a religious viewpoint which is informed by pantheism and "new age" formulation. The end result of this approach is described by Paul: "They exchanged the truth of God for a lie, and worshipped and served created things rather than the Creator ..." (Rom. 1:25).

Chapter four addresses an issue which has a special interest for readers of this journal: "Are Christians Anti-scientific?" A number of different topics are mentioned including the possibility of life on Mars, creation vs. evolution and the Galileo incident. Unfortunately, the subjects are addressed in a cursory fashion and an opportunity to present a rational alternative to secular naturalism is lost. Discussion (and perhaps a chart?) of the differences between naturalistic evolution, naturalistic creation and the three views found within Christian orthodoxy—namely theistic evolution and old and young earth creationism—would have been helpful.

Chapter five deals with the criticism that "Christians have done terrible things in the name of Christ." This is perhaps the best chapter in the book. The authors treat most of the historical situations that the critics of Christianity usually bring up. These include the Crusades, the Inquisition, and the Salem witch trials. While attempts have been made to moderate the culpability of those involved in these events, no modern Christian should fail to see the inappropriateness of these actions and the blot they have caused on the name of Christ. However, "there is another side to the condemnation of terrible things done in the name of Christianity" (p. 101). Communism (informed by Marxism) and Nazism (built on the formulations of Friedrich Nietzsche and raw paganism) were responsible for millions of deaths during their reigns of terror. Indeed, "religious researchers believe there have been more Christian martyrs in the twentieth century than in any other" (p. 105).

Chapter six addresses the charge that Christian missionaries destroy native cultures. The authors examine the motivation and goals of the early missionaries. There is good material here concerning what needs to be addressed as unbiblical in particular cultures and what is spiritually "indifferent" and should be left alone.

The last myth addressed is the notion that Christians are arrogant because they believe in absolute truth. This topic has been addressed by a number of evangelical scholars including a forthcoming work by fellow ASA member Paul Copan entitled *True For You But Not For Me* (Bethany).

Despite the aforementioned limitations, this book can be a useful tool. It will be helpful for "breaking the ice" and leading to further discussion of the subjects reflected in its title.

Reviewed by Ralph E. MacKenzie, Adjunct Professor of Church History, Biola University and Trinity University West, 5051 Park Rim Dr., San Diego, CA 92117.

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Books. ASA titles such as *Teaching Science in a Climate of Controversy* and the *Membership Directory* are sent to all new members when available. Other books and resources are sometimes available for purchase through the home office. We now offer the books, *God Did It, But How?* by Robert B. Fischer that suggests we separate Who? and Why? from What? and How? and *Being A Christian in Science* by Walter R. Hearn that looks at what scientists do and addresses the hard questions Christians face as scientists. We also offer the leaflet, *God and the Big Bang* by Michael Poole

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Science Education

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The American Scientific Affiliation (ASA) is a fellowship of men and women of science and disciplines that can relate to science who share a common fidelity to the Word of God and a commitment to integrity in the practice of science. ASA was founded in 1941 and has grown significantly since that time. The stated purposes of the ASA are "to investigate any area relating Christian faith and science" and "to make known the results of such investigations for comment and criticism by the Christian community and by the scientific community."

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

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

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American Scientific Affiliation

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

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

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

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