PERSPECTIVES on Science and Christian Faith

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

In this issue . . .

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

VOLUME 56, NUMBER 2 **JUNE 2004**

Perspectives on Science and Christian Faith

Perspectives on Science and Christian Faith (ISSN 0892-2675) is published quarterly for $35 per year by the American Scientific Affiliation, 55 Market Street, Ipswich, MA 01938-0668. Phone: 978-356-5656; Fax: 978-356-4375. E-mail: asa@asa3.org; www.asa3.org

Periodicals postage paid at Ipswich, MA and at additional mailing offices. POSTMASTER: Send address changes to: *Perspectives on Science and Christian Faith*, The American Scientific Affiliation, PO Box 668, Ipswich, MA 01938-0668.

Manuscript Guidelines

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

1. Address all manuscripts (except Book Reviews) to: Roman J. Miller, Editor, 4956 Singers Glen Rd., Harrisonburg, VA 22802. E-mail: millerrj@rica.net Submissions are typically acknowledged within 10 days of their receipt.
2. Authors must submit **3 paper copies** (double spaced) for review purposes (an original and two copies) and **1 electronic copy** submitted on a DOS formatted floppy disk or as an email attachment. Typically 2–3 anonymous reviewers critique each manuscript submitted for publication.
3. Use endnotes for all references. Each note must have a unique number. Follow *The Chicago Style Manual* (14th ed., sections 15.1 to 15.426).
4. If possible, include graphics (electronic file preferred) that enhance the theme of the paper. Figures and diagrams not in electronic format should be clear, black and white, line ink drawings or glossy photographs *suitable for direct reproduction*. Provide captions separately.

ARTICLES are major treatments of a particular subject relating science to a Christian position. Such papers should be at least 8 manuscript pages in length, **but not more than 6000 words**, excluding endnotes. An abstract of 50–150 words is required. Publication for such papers normally takes 9–12 months from the time of acceptance.

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

NEWS & VIEWS are short commentaries on current scientific discoveries or events, or opinion pieces on science and faith issues. Lengths range **from 200 to 1500 words**. Submissions are typically published 3–6 months from the time of acceptance.

EARLY CAREER SCIENTISTS' CORNER contains varied autobiography submissions as well as notices of special interest to science undergraduate and graduate students and young science professionals who are entering the workforce. Submissions are encouraged and typically published 3–6 months from the time of acceptance.

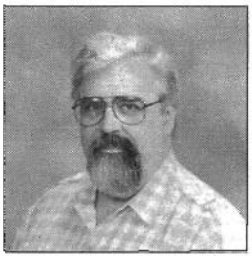
BOOK REVIEWS serve to alert the readership to books of interest and provide a valuable source for reference. Readers are encouraged to review books in their scientific fields which have implications for the Christian faith. Guidelines for book reviewers and a list of books available for review are available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

LETTERS to the Editor concerning *PSCF* content may be published unless marked not for publication. Letters submitted for publication must not be longer than 700 words and will be subject to editorial review. Letters are to be submitted as electronic copies. Letters accepted for publication will be published within 6 months.

ART EYES SCIENCE portrays original, unpublished items that integrate art, science, and faith. Submissions may be in any art form that can be depicted in a print journal and may include poetry, musical score, drawings, photography, short prose, or meditative thoughts. Submissions with text must be less then 300 words. Three paper copies and one electronic copy (Word document for text, JPG or TIFF for visual) of the item are to be sent to the editor for peer review prior to publication.

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

The View from Shepherd's Knoll ...



"What Do You Have There in Your Hand?"

At one time the biblical Moses was a shepherd, and so it was not surprising that he carried the tools of his trade including a shepherd's staff. When he was drawn to examine a miraculous non-consuming fiery bush and there heard the voice of God calling him to go on a mission to Egypt, Moses felt like someone between a rock and a hard place. Choosing whether to leave the comforts of sheep herding in Midian for the stresses of Egypt seemed like a "no-brainer," and Moses, who was not eager for such a move, voiced rational objections to the plan.

God's response to Moses' reluctance was to ask a simple question, "What do you have there in your hand?" "A shepherd's staff," Moses replied (Exod. 4:2, NLT). In the subsequent exchange, God demonstrated that a stick in the hand, which is divinely empowered, could accomplish wonders! Three lessons from this story impress me. First, God used a staff, the tool of Moses' trade, to accomplish his purpose. Second, objects that seemingly have singularity of function, when divinely empowered, can be multifunctional. Thirdly, God enables and empowers those whom he calls to perform a mission.

Miraculous burning bushes complete with audible emanating voices may not be our experience. Yet as persons transformed by our encounters with Christ and scientists who have invested years in training, research, teaching and practice, we may empathize with the Midian shepherd's experience of the collision of two seemingly disparate worlds. However, in that intersection, we can also hear God's voice, if we listen. The God of Moses is our God. The God, who used a shepherd's staff to demonstrate his power and glory millennia ago, will also use what is in our hand—scientific knowledge, skills, and technology—if we respond to his call.

In the lead article, Ken Touryan, past president of the ASA, challenges us to expand our vision and serve God by using our gifts and experiences as scientists to bring healing to the hurting needs in our world. In responding to that challenge, our mission becomes empowered by the Divine and effective in its implementation.

Next in the Articles and Communications sections, six papers creatively demonstrate connections between Christian faith and insights in philosophy, mathematics, natural science, and paleontology. Another author provides a personal perspective on Adam in the News & Views section. Twenty-six book reviews arranged in eight categories will help you find the best reading selections by contemporary authors. Seven letters by readers reflect and respond to prior published materials. Finally, two poets share their creativity in the Art Eyes Science section. The editor continues to encourage and solicit contributions especially for the Art and Early Career sections of the journal.

Perhaps you have had a "burning bush" experience, where God's call broke into your world. How did you respond? What was the outcome? In a future issue of the journal, I would like to feature a series of "burning bush" personal testimonials that describe how one's scientific tools are used for the cause of Christ. Keep your descriptions short (less than 1000 words) and submit them as email attachments (millerrj@rica.net) with "burning bush" in the subject line. Those submitted before September 1, 2004 will be considered for possible publication in the December 2004 issue.

Shalom,
Roman J. Miller, *Editor*

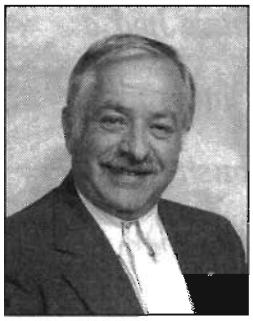
Perhaps you have had a "burning bush" experience, where God's call broke into your world. How did you respond? What was the outcome?

Plenary Presenters

ASA in the 21st Century: Expanding Our Vision for Serving God, the Church, and Society Through Science and Technology

ASA in the 21st Century: Expanding Our Vision for Serving God, the Church, and Society Through Science and Technology

Kenell J. Touryan



Kenell J. Touryan

The new knowledge gained through science has led to spectacular achievements in technology. This has led technological optimists to argue that human ingenuity will overcome all limits. Pessimists, on the other hand, insist that the world is an inexorable course to human and ecological catastrophe. A more realistic approach acknowledges negative impacts of the global scale of human activity but works to mitigate them. As an affiliation that explores any and every area relating to Christian faith and science, ASA should face these challenges head-on. ASA members should direct sustained attention to studying the global crises, counter the sweeping tide of scientific materialism, and help both the private and public sectors make wise use of all technological advances for the physical and spiritual welfare of humankind.

Are there limits to what humankind can do through science and technology?

In its sixty-two-year existence, ASA has provided a forum where scientists (physical sciences, life sciences, and social sciences), engineers, philosophers, and theologians have been able to interact with one another and help shape Christian views of science and technology. In its mission statement, ASA is committed to provide advice and direction to the church and to society at large, in how best to use the knowledge and insights gained through science (and the advances in technology) while preserving the integrity of God's creation.

Ken Touryan *received his Ph.D. from Princeton University in mechanical and aerospace sciences. He spent sixteen years at the Sandia National Laboratory, managing various projects in nuclear and fusion power. For the past fourteen years, he has been chief technology analyst at the National Renewable Energy Laboratory of the US Department of Energy (USDOE). In addition, he has been managing the USDOE program for the Initiatives for Proliferation Prevention, helping re-direct the work of former weapons scientists in Russia, Ukraine, Kazaksatan and Armenia, into non-weapons technology development. Last January, Touryan was appointed Vice President of R&D at the American University of Armenia (affiliated with UC Berkeley, CA) where he will spend four months out of a year. Touryan has over 75 publications in scientific journals, is the author of two books and has several patents. He lives in Indian Hills, CO, with his wife Cheryl. Ken may be contacted at tourken@aolcom.*

The dazzling light shed by science has led to technological achievements unequaled in human history. The successes, which bear on nearly every aspect of human endeavor, have eclipsed contributions from the humanities, including religion.

In the optimism of the Enlightenment, technology assumed a high position in Western societies, and subsequently at times has been so exalted as to become a religion.[1] In fact, science and technology have become the twin gods of the past century and no doubt will continue to entrench their lofty positions throughout the twenty-first century.

Are there limits to what humankind can do through science and technology? To answer this question, let us look at the account given in Gen. 11:1–9. Shortly after the flood, humankind designed and began to build the first skyscraper of record, "*a tower that reaches the heavens,*" as protection against natural

* *ASA President Ken Touryan presented this paper as his presidential address at the 2003 ASA Annual Meeting at Colorado Christian University, in Lakewood, CO, July 28, 2003.*

catastrophes, like the flood. In verse 6, God comes down to see the construction[2] and makes an amazing assessment: "*If as one people, speaking the same language they have begun to do this, then nothing they plan to do will be impossible for them*" (Gen. 11:6). In other words, whatever humans decide to do, as in science and technology, they will be able to accomplish.

It was not *technology* per se that God was against, but the hidden motive behind the plan: "*make a name for ourselves.*" Humans thus declare their autonomy, "Technology will solve all of our problems." Unfortunately, this autonomy, this declaration of independence, has led humankind to the threshold of global disaster, their scientific and technological achievements notwithstanding.

Technological optimists do not fret about the "two-edged sword" of technology, i.e., the environmental, social, aesthetic, and spiritual impacts of modern civilization. Most technological optimists—and apparently all economic determinists—believe that the boundless potential of human intellect will overcome problems of physical limits, thus making the earth's physical resources essentially inexhaustible. Edward Teller wrote: "Technology has opened the possibility of freedom for everyone."[3]

Most arguments about macroeconomics have, at their core, conflicting presuppositions about limits. Limited *sources* include biodiversity, cultivatable land, minerals, and energy; limited *sinks* include the ability of global ecosystems to accommodate the solid, liquid, and gaseous waste products of human activity. The exploit-and-move-on land use ethic prevalent in the United States in the nineteenth and twentieth centuries rested upon the supposition that the earth's resources are immeasurably greater than any conceivable human withdrawals, and thus could support human activity essentially without limit. Predictions that resource exhaustion would limit population growth, such as those of the nineteenth-century British economist Thomas Malthus, have not been borne out on a global scale because resource substitutions and new technology have overcome some of the physical limits. Nevertheless, archaeological evidence tells us that whole populations have disappeared due to the exhaustion of accessible resources. The long-running debate in the journals and media between economist Julian Simon of Harvard University and bioscientist Paul Ehrlich of Stanford University included wagers over evidences for their convictions.[4] Simon cited historical evidence to argue that human ingenuity will remove all limits to growth, whereas Ehrlich insisted that we are on course to resource exhaustion and ecological catastrophe. Their wager was settled in Simon's favor during his lifetime. But today the scale of human activity is so large that the impact on the earth's systems is becoming global and recovery times are measured in centuries.

Ten Pressing Issues Facing the Earth Today

Following Ehrlich, it is not hard to make a list of critical issues generated by the global scale of human activity. In order of their impact on living systems, I offer a list of ten such pressing issues cascading from one impending crisis to the next. Briefly stated they are:[5]

1. **Energy: increasing demand, dwindling supplies.** The rate at which we are exploiting our nonrenewable resources, such as fossil fuels, will inevitably lead to a global crisis in mid-century. For example, the USA alone consumes 27% of the world's energy, yet constitutes only 5.5% of the world's population.

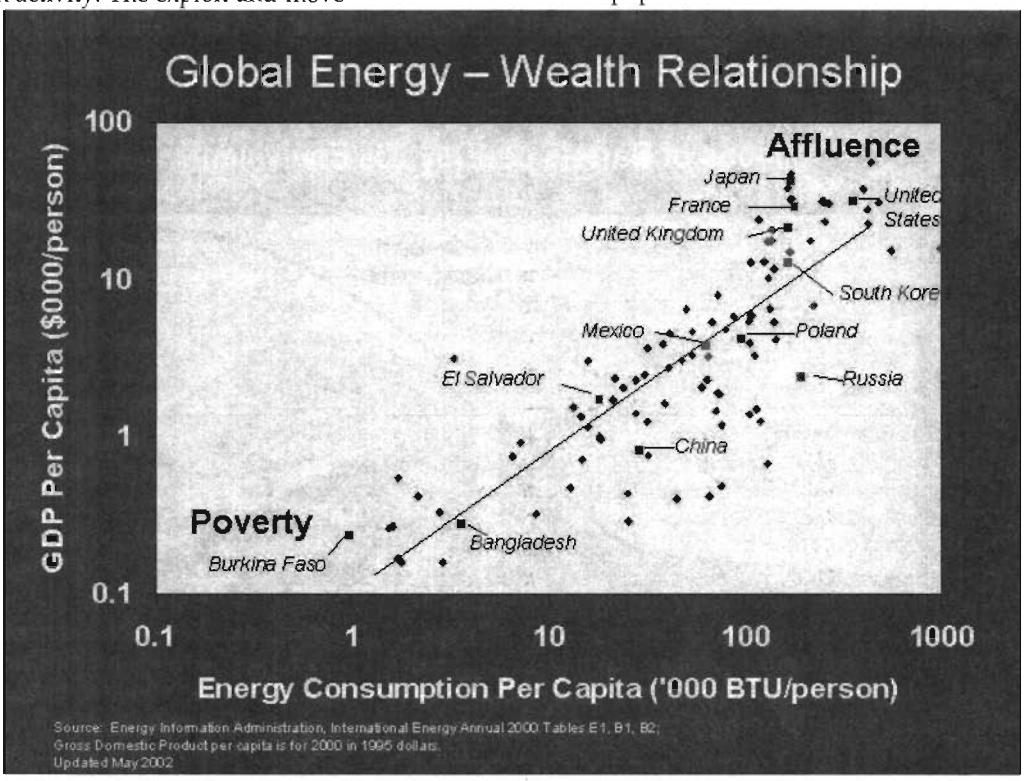


Figure 1.

Plenary Presenters

ASA in the 21st Century: Expanding Our Vision for Serving God, the Church, and Society Through Science and Technology

Today the scale of human activity is so large that the impact on the earth's systems is becoming global and recovery times are measured in centuries.

As shown in Figure 1, at this rate of use, and with the rest of the developing countries striving to achieve increased technological sophistication, global power consumption will increase from 14 TW[6] today to 30–60 TW by 2050. Where will this energy source come from? (See Figure 2.)

2. **Need for clean, fresh water.** Without adequate energy sources, the availability of renewable fresh water will be in jeopardy. Fresh water constitutes only about 2.5% of the total volume of water on Earth, and two-thirds of this fresh water is locked in glaciers and ice caps.[7] Just 0.77% of all water (~10 million km^3) is held in aquifers, soil pores, lakes, rivers, plant life, and the atmosphere. Only fresh water flowing through the solar-powered hydrological cycle is renewable. Non-replenishable groundwater can be tapped, but such extraction depletes reserves much the same way as extractions from oil wells. As of today, twenty-seven countries, such as those in the southern Sahara, are considered water-stressed countries.

3. **Food production and distribution.** With dwindling energy resources and without sufficient fresh water, severe strains will be placed on food production [on a global scale], genetically modified crops notwithstanding. As reported by Rosegrant and Cline, crop yield recently has fallen in many areas because of declining investment in research and infrastructure, as well as increasing water scarcity.[8] Additionally, climate change and the HIV/AIDS pandemic are crucial factors affecting food security in many regions.

4. **Environmental overload.** Technological advances can ameliorate the shortages mentioned above, but at what price on the environment? Atmospheric pollution, the greenhouse effect, and degradation of the biosphere and the lithosphere continue to plague the planet. Full cooperation on an international scale will be required to avoid irreversible environmental damage, such as the Kyoto Protocol of 1997. However, disagreements on how to implement regulations called for at the Kyoto Protocol cast a dark shadow on such cooperation. Again, technological innovations no doubt can develop some substitutes, assist conservation and recycling, and design benign chemicals to replace some of the toxic ones—but technological optimists believe that human ingenuity will permit us to overcome *all* limits to economic growth.

5. **Increased poverty with an increase in world population.** Although some estimates claim that the globe can sustain eleven billion people, unequal food distribution exacerbated by the crises in the availability of new energy resources and renewable fresh water could continue to leave 20% of the world's population in extreme poverty. It is sobering to realize that every year the global population increases at a rate equivalent to the population of Mexico (88 million as of 2002), mostly in less developed countries.

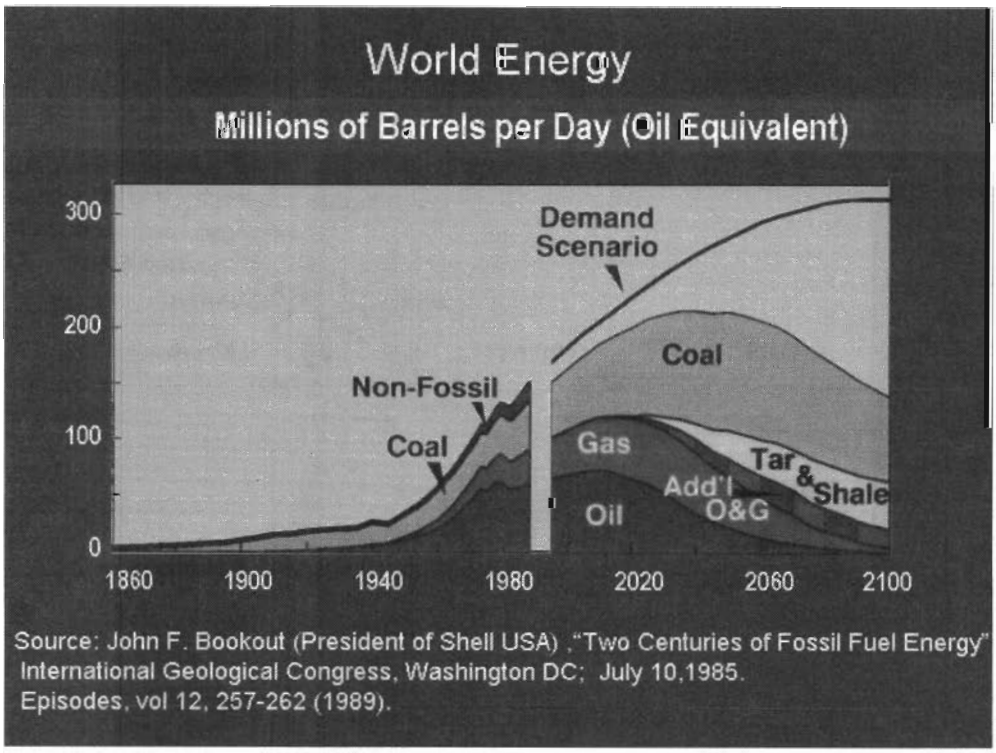


Figure 2.

6. **Pandemics and chronic diseases.** One unintended consequence of globalization is the spread of diseases that are affecting millions throughout the world. According to M. W. Mascie-Taylor and E. Karim, "the unabated pan-

demic of childhood and adulthood obesity and concomitant co-morbidities are affecting both rich and poor nations while infectious diseases remain an important public health problem, particularly in developing countries."[9] HIV/AIDS has infected forty million people worldwide, with three million deaths annually. World Vision estimates that by 2010, there will be over twenty million orphans, mostly in Africa—a potential catastrophe unequaled in human history! And all of this is occurring despite unparalleled breakthroughs in the medical sciences.

7. **Ethnic unrest and terrorism.** If technological advances in communication have increased globalization and interdependence among nations, its polar opposites, fragmentation through ethnic unrest, the rise of militant fundamentalist movements, and the availability of more sophisticated weapons (nuclear, chemical, and biological) are fueling terrorism that recognizes no boundaries.

8. **Technologically-driven ethical issues** in biotechnology, nanotechnology (manipulation of matter at the molecular and atomic levels), robotics, and cyborg technologies (interfacing the nervous system tissues with electronics) represent the next challenge. Those who glorify human ingenuity would call these breakthroughs the creation of the "transhuman species."

9. **Erosion of Judeo-Christian moral values.** The ninth crisis follows on the heels of the emerging transhumanist philosophy, more commonly described as the low but inexorable growth of secularism. With Christianity claiming that the fundamental problems of humankind arise from the corruptions of the human heart, there exists a growing confrontation between the secular and Judeo-Christian values. All of this is exacerbated by the relentless persecution of Christians, especially in third-world countries. One estimate by Paul Marshall puts martyrdom of Christians in the twentieth century alone at 26 million.[10]

10. **A nonlinear interaction exists among several of these global problems,** such as the feedback loop among demography, economics, ecology, and epidemiology. With the West's sense of responsibility to God growing dimmer, all of this could eventually lead to the loss of human dignity, human freedom, and democracy—the most tragic of all of the consequences.

How Can an Organization Such as ASA Deal with Any of These Issues?

The Chinese word for crisis consists of two characters: danger and opportunity. In his influential essay published in *Science* thirty-five years ago, Garrett Hardin suggested pessimistically that "mankind was doomed to over exploit global resources, common to humankind, unless the freedom to breed was relinquished."[11] If ASA chooses to face "the challenge of opportunity," it has to find a balance between two biblical mandates: the Creation Mandate and the Great Commission. The Creation Mandate states: *"Be fruitful and increase in numbers, rule over every living creature"* (Gen. 1:28) whereas the Great Commission states: *"Go and make disciples of all nations"* (Matt 28:18). The real challenge for the church in general, and ASA in particular, is how to maintain this balance. In what specific ways can it meet these daunting challenges? Working for new and non-polluting sources of energy? Conservation of our limited resources? Aggressive efforts at environmental protection? Insisting on proper ethical boundaries in technological advances in biotechnology, nanotechnology, and robotics? Working to limit technological growth? As the Apostle Paul states in his second letter to the Corinthians: *"Who is equal to such a task?"* (2 Cor. 2:16).

We must maintain a distinction between the creation and the Creator (Romans 1). Nature (natural resources) and technology may be used for human benefit, but usage must be measured.

Cautions from within the church against the uncritical application of technology are relatively sparse; well-known exceptions include Jacques Ellul[12] and Donald MacKay.[13] Certainly the Christian church has not hesitated to employ the latest technologies to help spread the message of the gospel. Consider missionary aviation, radio, sound systems, movies and television, computer-based concordances, and online Bibles. More recently the church has begun to wrestle with the implication of technologies that are clearly value-laden, such as weapons of mass destruction, medical sciences, GMOs, environmental damage, artificial intelligence, and the concept of sustainability.[14] God's directive on human endeavor recorded in Genesis 1 and 2 does not preclude technology as a legitimate response to the dominion mandate. The directive is supplemented, however, by significant constraints. Neither technology nor nature are to be worshiped; rather, humans must learn to operate within revealed constraints. We must maintain a distinction between the creation and the Creator (Romans 1). Nature (natural resources) and technology may be used for human benefit, but usage must be measured. Achieving sustainability requires self-assessment, the outcomes of which then must be used to

As an organization with a broad spectrum of specialties, ASA can and often does provide experts who can address every one of the problems identified above. At present, there is no easy way to identify who these members are ...

guide the collective self-limitation that will permit civilization to operate within constraints set forth in Scripture. Here are some practical suggestions for ASA members.

Identify the Special Expertise of ASA Members

As an organization with a broad spectrum of specialties, ASA can and often does provide experts who can address every one of the problems identified above. At present, there is no easy way to identify who these members are (see below).

In addition to individual contributions, ASA can provide *collective* strength to address the above challenges. ASA has three affiliations (Biology, Christian Engineers and Scientists in Technology [CEST], and Geology) and eight commissions (Bioethics, Communications, Creation, Global Resources and Environment, History and Philosophy of Science, Physical Sciences, Science Education, and Social Sciences). Some of these affiliations and commissions are active; others are not.

ASA has established a communication infrastructure that consists of a bi-monthly newsletter and a refereed quarterly journal. The ASA web site, still under development, can be modernized to provide: (1) an online directory for members to identify and contact other members on geographic location and topics of interest; (2) a moderated, low-volume, opt-out announcement e-mail list that would include alerts, critical information, and regular feature articles; and (3) a strategy of referral marketing for attracting new members, specially those with expertise in the new technical fields of biotechnology, nanotechnology, and robotics.[15]

Better Utilize ASA Resources

In the past, ASA members have placed emphasis on position papers, monographs, presentations, and special symposia conducted by various active commissions at our annual meetings. All of these are commendable efforts and should continue, but ASA has the ways and means of directing sustained attention to studying big issues. It can marshal a greater breadth of expertise than normally comes together in other venues, and it can provide helpful contributions to ethical issues. Here are some practical ideas.

- ASA commissions can develop supplementary texts or booklets for high school and college students and use the ASA web site to add the ingredients of the real world missing in secular texts regarding the kingdom of God in human affairs.[16] These supplementary materials could counter the sweeping tide of scientific materialism. One such effort is the Lay Education Committee project. The committee is preparing a book and video with the working title: "Knowing Creation: What Science and the Bible Reveal about the Heavens and the Earth."

- Greater member participation in the commissions and more proactive involvement in the above issues can be gained through the use of the new online directory. For example, expanding the mission of the Bioethics Commission to include biomedical ethics, environmental ethics, and professional/research ethics. Recent highly publicized episodes of misconduct and fraud in physics, such as the fraudulent claim of creating element 118 at Lawrence Berkeley Laboratory,[17] have prompted the American Physical Society to update and expand its professional ethics guidelines. The list of ethical issues in the biomedical and environmental fields is long: the gene pool as a resource for future economic activity; genetically engineered organs; fusion of computational electronic and genetic technologies; global reseeding of the biosphere with laboratory-conceived transgenic plants, and finally the legitimation of the framework for the biotech century.[18] All of these may be tools to enhance life and produce liberation, but if history is our guide, they also will engender unanticipated consequences and be used to further tyranny.

- The CEST Affiliation provides a forum for establishing ethical standards in engineering. The most difficult question for engineers, scientists, and businessmen is whether there should be limits set on technological growth. For example, robust growth in nanotechnology will lead to nanoelectronics to revolutionize computers and sensors, nanoelectronic based robotics with AI, and cyborg technology. Some of these advances will enable construction and maintenance in space, assist the creation of new materials that are defect-free and low cost for myriad applications, and provide access to vast information. But how will humans make wise use of these advances for the physical and spiritual welfare of all peoples?

♦ Active participation in decision-making bodies at the county, city, and state levels and on federal commissions will place the ASA members in strategic positions to influence new policies.

♦ Senior members should actively recruit and mentor graduate students, offer them guidance in their selection of majors and encourage them to seek employment in the private and/or public sector that are addressing one or more of these critical issues.

♦ Finally, ASA can have a global outreach by exporting the ASA concept beyond Canada (CSCA) and England (CiS) to other European countries; Former Soviet Union countries; and Asian, African, and Latin American countries, creating international affiliates that would adapt the ASA concept to their local cultures.

Reversing an Important Ratio

A Christian understanding of the meaning and place of technology in our lives must be neither pessimistic nor optimistic, but rather—as so often turns out to be the proper biblical exegesis—balanced between the two extremes. A Christian approach to technology must not be *pessimistic* because through the liberating, redemptive work of Jesus Christ we gain the ability to manage the creation responsibly rather than just for our personal benefit. We are (or more precisely, we can be) freed from the grip of *technique* just as we can be freed from enslavement to other sinister forces. Neither should the Christian approach be blindly *optimistic*, because taken to an extreme, technology can be exalted to the point where we become devoted to it and we expect it to save us from most of our problems. Devotion such as this is idolatry and enslavement to a master other than Jesus Christ.

As further encouragement to ASA members, we should be aware of the fact that God challenges us with an unusual ratio: Human Resources divided by Challenges (R/C) is <<1 (very much less than one). Recall for example, the resources David had against Goliath; Gideon with his 300 fighters against the challenge of the Midianites (30,000 strong); and the boy with five loaves and two fish versus a hungry crowd of over five thousand people.

The reason God permits this great imbalance to occur is that he wants to use a quantity that *he* holds, namely, the divine infinity (∞). To better picture how God reverses this inequality by using his secret quantity, let us represent the inequality by a formula R/C <1, where R represents our limited resources and C the great challenges. For example, for Gideon, this ratio was probably 0.01 (300 divided by 30,000). The same was true for David facing Goliath and the young man holding his brown bag, facing a "stadium" full of hungry people.

What God did in each of these cases, however, is *enter* the equation in the *numerator* with his resources. David knew from experience what God could do and indeed "*the battle is the Lord's*" (1 Sam. 17:37, 47). David used this knowledge, believed God, and charged the enemy. The infinity he used was the "*name of the Lord Almighty*" (v. 45). Any number—no matter how small—when multiplied by infinity, reverses the R/C ratio, and makes it much greater than 1.

We should be aware of the fact that God challenges us with an unusual ratio: Human Resources divided by Challenges is <<1 (very much less than one).

For Gideon, the infinity was "*a sword for the Lord and for Gideon*" (Judges 7:20). For the young man with the fish and loaves, it was our Lord's empowered hands, all of which reversed the ratio from very much less than one, to very much larger than one.

The following principles emerge from the above situations:

1. God does not like "nothing" or "0." After all, he created something from nothing. Multiplying "0" with "∞" is indeterminate or zero! There is no resource too insignificant for God that he cannot use it.
2. Each of us needs to yield our resources, talents, and gifts—no matter how meager—to him to multiply by his infinite power. Any number, no matter how small (but greater than "0"), when multiplied by infinity overpowers the greatest challenge in the world.
3. By taking our resources and multiplying them, God becomes our partner, albeit the *senior partner*, in having us face seemingly insurmountable odds. Only once in Scripture do we read that God took upon himself to bring salvation (Isa. 63:5). God's exclusive preference is to use his people as his hands and feet.

The outcome of all of this is victory over life's numerous, often-daunting challenges, but where all glory and honor go to the Triune God. This was clearly articulated by David who gave no credit to his skilled marksmanship in downing Goliath, but rather to the name of the Lord (1 Sam. 17:45). In fact, we can join David, when he later wrote Psalm 20, declaring "*...some trust in chariots, and some in horses, but we trust in the name of the Lord our God.*"

The Apostle Paul expresses this inner working of God's power, through his Holy Spirit by coining a new Greek

word—*oupper-ik-parisso*—translated in the NIV to *"'immeasurably more' than we ask or think"* (Eph. 3:21). The word actually means *super-extra-abundance*, an extreme state of affairs, which only the power of the indwelling Holy Spirit can bring about. Therefore, with Apostle Paul we can say with confidence *"And God is able to make all grace abound to you, so that in all things at all times, having all that you need, you will abound in every good work"* (2 Cor. 9:8, NIV). ⁂

Acknowledgment

The author acknowledges with gratitude the valuable contributions made to this article by Dr. Jack Swearengen. Jack carefully reviewed the original manuscript and provided the information and insights regarding the challenges that make technology a "two-edged sword," and how churches have begun to wrestle with the uncritical application of technology.

Notes

[1]David F. Noble, *The Religion of Technology: The Divinity of Man and the Spirit of Invention* (New York: Penguin Books, 1999).

[2]In a humorous account, the Bible states that God had to come down in order to see this "mole hill" humankind was building (Gen. 11:5).

[3]Edward Teller, *Better a Shield than a Sword* (New York: The Free Press, 1987), 151.

[4]Julian L. Simon, ed., *The State of Humanity* (Oxford, UK: Blackwell, 1995); Julian L. Simon, "'Finite' doesn't fit here," *The Oregonian* (Portland), February 11, 1997; Julian L. Simon, "Earth's Doomsayers Are Wrong," *San Francisco Chronicle*, May 12, 1995; Paul Ehrlich, *The Population Bomb* (New York: Ballantine Books, 1971); and Paul Ehrlich and Stephen Schneider, "A $15,000 Counteroffer," *San Francisco Chronicle*, May 18, 1995.

[5]For details dealing with the first six issues, the reader is referred to *Science* 302 (12 Dec. 2003): 1906–29, where nine articles discuss some aspects of these issues under the broad title "Tragedy of the Commons?"

[6]A terrawatt is 10^{12} watts; a number equivalent to a thousand, 1000 Megawatt power plants (fossil fuel or nuclear).

[7]S. L. Postef, G. C. Daily, and P. R. Ehrlich, "Human Appropriation of Renewable Fresh Water," *Science* 271 (1996): 785–8 and Peter H. Gleick, "Global Freshwater Resources: Soft Path Solution for the 21st Century," *Science* 302 (2003): 1524–8.

[8]M. W. Rosegrant and S. A. Cline, "Global Food Security: Challenges and Policies," *Science* 302 (12 Dec. 2003): 1917–9.

[9]C. G. Nicolas Mascie-Taylor and E. Karim, "The Burden of Chronic Diseases," *Science* 302 (12 Dec. 2003): 1921–2.

[10]Paul Marshall, *Their Blood Cries Out* (Dallas, TX: World Publishing, 1997), 3–14.

[11]Garrett Hardin, "'Common Pool' Resources," *Science* 162 (1968): 1243.

[12]Jacques Ellul, *The Technological Society* (New York: Vintage Books, 1964).

[13]Donald M. MacKay, *The Clockwork Image* (Downers Grove, IL: InterVarsity Press, 1974).

[14]Philip Schafran, "Is Mankind the Measure? Old Testament Perspectives on Mankind's Place in the Natural World," *Perspectives on Science and Christian Faith* 47, no. 2 (June 1995): 92–102; James Peterson, "Should We Be Concerned About People Who Do Not Yet Exist?" *Perspectives on Science and Christian Faith* 47, no. 2 (June 1995): 103–9; Bruce Beaver, "Science, Sand, and Spirit," *Perspectives on Science and Christian Faith* 52, no. 2 (June 2000): 118–22; Ian Hutchinson, "Faith in the Machine," *Perspectives on Science and Christian Faith* 52, no. 4 (December 2000): 260–2; and Glenn Morton, "Planning Ahead: Requirement for Moral Accountability," *Perspectives on Science and Christian Faith* 51, no. 3 (September 1999): 176–80.

[15]Memo submitted to the ASA Executive Council by Ernest Prabhakar, Dec. 5, 2003.

[16]Ralph Winter, "Editorial Comment," *Mission Frontiers* (Nov.–Dec. 2003): 4–5.

[17]Bertram Schwartzschild, "Lawrence Berkeley Lab Concludes that Evidence of Element 118 Was a Fabrication," *Physics Today* (Sept. 2002): 15–7.

[18]Jeremy Rifkin, *The Biotech Century* (New York: Tarcher Putnam, 1998).

Discussion on the ASA List Serv

asa@calvin.edu is a discussion group on matters of interest to ASA members.

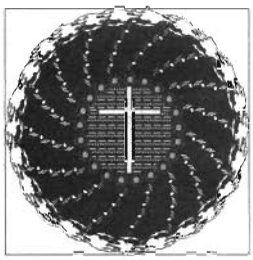
To **subscribe**, e-mail: majordomo@calvin.edu with the words "subscribe asa" (no quotes) in the body of the message. To **unsubscribe**, use the words "unsubscribe asa" (no quotes). This discussion is archived on the web. To receive a **help** document for Majordomo software, type the word "help" (no quotes) in the body of the message.

If you prefer, there is a **digest** form available. In a digest, several messages come combined in one e-mail message. Messages from the previous 24 hours are sent out at 7:30 a.m. each day.

To **subscribe**, e-mail: majordomo@calvin.edu with the words "subscribe asa-digest" (no quotes) in the body of the message. To **unsubscribe** your subscription, type the words "unsubscribe asa-digest" (no quotes) in the body of the message.

Posts to the lists should be sent to **asa@calvin.edu**

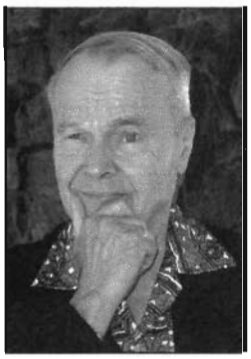
Terry Gray, ASA web master, can be reached at grayt@lamar.colostate.edu



A Conceptual Key for Deeper Insights into Continuous Causation of the Reality Flow of the Universe

George L. Bate

The concordance of certain developments in modern physics – relativity, quantum physics and string theory – invites juxtaposition with the biblical view of God's relation to the universe. Einstein's defense of the ether concept in his major paper on that subject encourages re-thinking some fundamental issues in physics. The scriptural declaration, "Upholding the universe by His word of power," is suggested as a key concept for interpreting these developments to couple that awesome word of power into the reality flow of the universe. New terminology facilitates the exploration of ideas for resolving some long-standing paradoxes in physics, as abstraction's hidden light illumines the glories of God in creation. However incredible the process envisioned for Christ's universe-upholding word of power, the higher reality flow of his life into human consciousness is far more glorious. God's highest glory only pointed to here, this creative power channeled through his living body, the Church, inexhaustibly exceeds that displayed in all the universe of galaxies.



George L. Bate

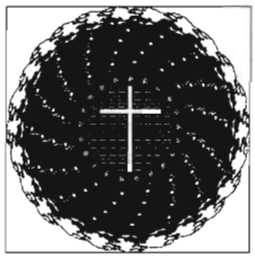
All thinking persons open to God's participation in the physical universe can appreciate rational inquiry into that participation.

In his 1974 treatise, "The Universe as Home for Man," John Wheeler raises profound questions. Noting the essence of the quantum principle that says no physics without an observer, he concludes: "In some strange sense the quantum principle tells us that we are dealing with a participatory universe."[1]

The language of "home for man" immediately suggests a designer and builder of that home, whose participation in the universe is no secret in the Judeo-Christian Scriptures. In the light of biblical reality, can "No physics without a *manager*" be excluded from the quantum principle? Following Wheeler and other physicists, Paul Davies identified quantum theory as providing "the most convincing scientific evidence yet that consciousness plays an essential role in the nature of physical reality."[2] The scientific context limits this consciousness to that of a human observer. But on what logical grounds could the physical reality described by quantum theory be declared free of the consciousness (mind) of a personal God as the key participant?

The universe as home for humans has space as the ancient accommodation for matter. Attempts to understand space and matter knowledgeably began with the classical Greeks who pondered the mystery of matter in the presence of less tangible space. Lack of space prevents an outline here of that fascinating history. Interested readers may refer to books by Nick Huggett[3] and by Henning Genz.[4] These engaging treatments – one written from the vantage-point of philosophy (Huggett) and the other from the standpoint of theoretical physics – nicely complement each other. With minimal technicalities, both are accessible to novices in philosophy and science.

Educationally equipped by Princeton (A.B., Physics), CalTech (M.S., Physics) and Columbia (Ph.D., Nuclear Geophysics), ASA Fellow **George L. Bate** *had teaching ministries for over forty years at Wheaton College (IL) and Westmont College, with current status of emeritus professor of physics at Westmont. Teaching interests included physics, astronomy, mathematics, and computer science. Over a dozen published research articles featured investigations in cosmochemistry and nuclear physics. He and his wife-of-58-years Marolyn live in Santa Barbara, Calif. Church involvement includes diaconate caring, teaching, and keeping up with young people on an advisory team for the youth ministry. Correspondence may be sent to bate@westmont.edu.*



Article

A Conceptual Key for Deeper Insights into Continuous Causation of the Reality Flow of the Universe

This inquiry [into God's participation in the physical universe] seeks the benefits of revelation in informing and illuminating science at the level of conceptual understanding.

Most of us are novices about quantum descriptions of the physical world. But all thinking persons open to God's participation in the physical universe can appreciate rational inquiry into that participation. Not an exercise in natural theology (gaining knowledge of God from nature without benefit of divine revelation), this inquiry seeks the benefits of revelation[5] in informing and illuminating science at the level of conceptual understanding. While references to matter are unavoidable, the emphasis of ancient materialism—bolstered by modern science—on matter as primary is rejected for its inversion of reality. The focus here is on Spirit (Mind) as primary and personal, assigning to matter a secondary and dependent status.[6]

Based on revelation, this emphasis opens the way (not otherwise likely) to intuitive insights in science from the realm of plausible-but-not-experimentally-demonstrable metaphysics/theology. Such intuition may seem as gross speculation to epiphenomenalists.

Nevertheless, intuition-bred conceptual insights in science are rationally communicable and putatively fit for dialog in faith and science communities. With this goal in mind, some conceptual developments linking the reality flow of the universe to continuous divine causation are sketched in this brief study of a participatory universe.

Space/Matter from Einstein to the Quantum World View

Remarkable scientific advances in the late nineteenth century prefaced Albert Einstein's work beginning in the early twentieth century. James Maxwell's 1864 work unifying electricity and magnetism notably established light as an electromagnetic oscillation. But Maxwell's equations are mute about exactly what it is that oscillates. Maxwell speculated about an ether, which concept became supported more by imagination than by understanding.[7]

Space as modern ether bears little resemblance to Aristotle's ether, a fluid medium he invented as a fifth element—the least massive of all matter—"to assure that there could be no such thing as a true vacuum."[8] Generally accepted by physicists following Maxwell's work, the new ether concept was tested by the Michelson-Morley experiment in 1887. This experiment, later repeated, showed that the speed of light is independent of the direction of motion of the earth's surface, hence arguing against ether "drag." Physicists generally interpreted this experiment as the conceptual demise of an electromagnetic ether, leaving the modern understanding of space in a conceptual vacuum.

In a little known 1924 work, Albert Einstein reviewed the ether concept.[9] Surprisingly, Einstein defends the concept, seeking to generalize Newton's absolute space[10] as an ether of mechanics synonymous with physical qualities of space. At the outset, Einstein cautions that the ether should not be discussed from the standpoint of "the material ether of mechanical wave theory, which underlies the laws of Newtonian mechanics."[11] For abstract reasons violating the four-dimensional symmetry required by special relativity,[12] this concept of the ether as a mechanical fluid was inadmissible.

Einstein does not mention the Michelson-Morley experiment. He observes that "One could in place of 'ether' also just as well speak of physical qualities of space."[13] He describes ether as "absolute (that is to say, independent of influences by any other object),"[14] with the goal of developing the concept more rigorously—"*schärfer herauszuarbeiten.*"[15] Thus, "We will denote as 'ether of mechanics' the physically real that permeates the observable ponderable bodies in Newton's theory of motion."[16] He concludes with the assertion that, apart from unlikely theoretical developments, we are not able to dispense with the concept of the ether, which he equates to a "continuum of endowed physical properties."[17]

Some forty years after Einstein's 1924 paper, P. A. M. Dirac echoed Einstein by calling for the introduction of "something corresponding to the luminiferous ether, which was so popular among physicists of the nineteenth century."[18] Dirac briefly sketched a quantum approach that would "introduce a new picture of the ether that will conform to the present ideas of the quantum theory."[19] In general, however, these views of Einstein and Dirac are not widely held among physicists today.

Max Planck introduced the quantum concept in his theoretical investigation of black-

body radiation in 1901, followed in 1905 by Einstein's generalization to light quanta (photons) for a successful interpretation of the photoelectric effect. The world of classical physics was turned upside down as quantum mechanics became well developed by the 1920s.

In the quantum world, the ether has been replaced by the quantum vacuum, with an amazing new meaning. Genz provides a definition of the quantum vacuum:

> Today, this is the way we define the [quantum] vacuum: It is the remnant left over in a volume out of which we have removed everything that can be possibly taken out. The existence of electromagnetic zero-point radiation implies that the vacuum still contains photons, the carrier particles of the electromagnetic field. The photons fluctuate into electron-positron pairs; that means that their fields also don't vanish in the vacuum. And so it goes for all the fields of all the other particles in our particle zoo—All of them swirl around in this emptiest of all spaces, in all imaginable configurations, and for the briefest of time only ... The excitations of the vacuum come and go; they oscillate, they fluctuate. It is not easy to conjure up imagery vivid enough to do justice to the fluctuating vacuum.[20]

This turbulent frenzy—referred to as *quantum foam*—in the ultimate fabric of space is not thought to be detectable above distances larger than about 10^{-35} meters, the so-called Planck distance (length).

The promising validity of string theory... contributes to a modified view of the quantum vacuum consistent with the conceptual key to a different reading of the substrate of material reality.

The most recent theoretical developments bearing on the nature of matter are the partial successes of (super) string theory. According to string theory, sub-microcosmic loops of strings have resonant frequencies that produce material particles and their forces, in analogy to the resonant vibrations of strings in a piano or violin. Brian Greene explains:

> Each elementary particle is composed of a single string—that is, each particle is a single string—and all strings are absolutely identical. Differences between the particles arise because their respective strings undergo different resonant vibrational patterns. What appear to be different elementary particles are actually different "notes" on a fundamental string. The universe—being composed of an enormous number of these vibrating strings—is akin to a cosmic symphony.[21]

This cosmic symphony plays throughout the universe! How remarkable that in string theory we can belatedly hear the overture of Jonathan Edwards' amazing declaration over two centuries ago: "God hums the tune of the universe!"

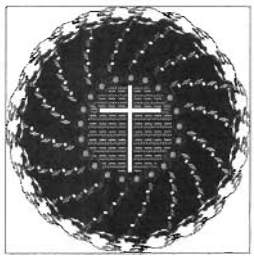
In any case, a significant advance of string theory is the replacement of point particles by vibrating string loops (and higher dimensions of vibration). In this way, the promising validity of string theory[22] also contributes to a modified view of the quantum vacuum consistent with the conceptual key to a different reading of the substrate of material reality.

Probing Century-Old Mysteries

The fundamental postulates of Einstein's special theory of relativity declare that absolute, uniform motion cannot be detected; and that the speed of light is independent of the motion of the source. By inference from the first postulate, the speed of light is also independent of the motion of the observer.

Here are great mysteries. How can the speed of light be the same for all sources and observers, regardless of their motion? Since light definitely has a wave property, how can it propagate through pure nothing where there is nothing to wave? Or if in fact a medium exists through which light and all material objects move, why is it that absolute, uniform motion of material objects relative to that medium cannot be detected? Is there an alternative explanation that will resolve these mysteries, yet remain consistent with the results of the Michelson-Morley experiment and with the fundamental postulates of the special theory of relativity? Let me suggest a possibility.

Suppose that particles or objects in motion are *instantaneously at rest* in the invisible medium through which light propagates. That is, motion is achieved not by the transport of particles or objects of fixed material content (as in Newton's space-as-container model[23]), but by the successive materializations one instant after another of the properties of the particles or objects in question at centers of activation along the path of motion (as in Descartes' relationism modified to view all space as "latent" matter, and where all matter materializes in space[24]). Since, in this view, matter at any given instant is not moving relative to the medium giving rise to its momentary materialization, it follows as an immediate consequence that absolute, uniform motion could not be detected.



Article

A Conceptual Key for Deeper Insights into Continuous Causation of the Reality Flow of the Universe

On metaphysical/ theological grounds, I do not believe chormate should be pantheistically confused in any way with the being of God who created it. Presumably chormate came into being as a created entity prior to the "big-bang" and is still expanding.

Most importantly, since all matter is posited to be instantaneously at rest in the medium through which light propagates, all observers would measure the same speed for light, regardless of their motion or that of the light sources. Thus the constancy of the speed of light becomes the abstract key for abandoning the concept of physical objects moving by transport of material substances as commonly understood. To pursue further explanation of long-standing mysteries, additional conceptual modifications are proposed with the help of new terminology.

Re-Assessing Space and Motion: Of Chormate and Strixels

The Michelson-Morley experiment laid the ether to rest, perhaps on the basis of an inadequate understanding of space and motion. The quantum vacuum was unknown at the time, not to appear until the better part of a century later. To avoid possible linguistic confusion and circumnavigate the controversies of the past, the word *chormate* (as in kor'-mate)—Greek χωρος (space) and μητηρ (mother) with a slight contraction for smoother pronunciation of a two-syllable word—is proposed. Chormate is the substrate of our universe characterized at least by the properties of the quantum vacuum. Conceivably, chormate consists of linked string loops forming an elastic network that supports the propagation of light. Each loop is available for momentary materialization into a particle.

The "mother" root of chormate has a double meaning: mother as precursor to space, and from whose womb material existence springs. Chormate more than meets Einstein's ether criterion of "the physically real that permeates bodies in Newton's theory of motion," being as invisible as the string loops (in string theory) comprising it. More than Einstein's "continuum of endowed physical properties," chormate is the matrix of instantaneous materialization that endows matter with physical properties as described in the next section.

On metaphysical/theological grounds, I do not believe chormate should be pantheistically confused in any way with the being of God who created it. Presumably chormate came into being as a created entity prior to the "big-bang" and is still expanding.

By postulate for maximum intelligibility, chormate is a three-dimensional grid of linked string loops with tensile properties appropriate for the propagation of light. Each of the strings may be "plucked" for momentary materialization. The site in chormate of a particular loop being materially activated is called a *strixel* by an analogy given in the next section. Since string loops have been estimated to be of the order of 10^{-35} meters, this distance may serve as an estimate for the size of strixels. In the absence of matter, chormate is in its passive state, without observable material properties. In the passive state, chormate may be agitated with the constant turbulence of quantum foam.

Since all matter is in motion, no sooner does a given region of strixels flash with loops "plucked" into materialization than the whole ordering collapses in that region and must be re-established in the next instant in a nearby region of strixels. In between instants of materialization, matter exists as its energy equivalent in transfer between strixels. Chormate may be associated with the zero point field, conceived in contemporary quantum physics as a boiling cauldron of quantum potential and unmanifest energy.[25] Between strixel activations, a particle exists in a state of unmanifest energy. The equivalence of matter and energy as related by $E = mc^2$ naturally follows as a qualitative concept from the unceasing activation and de-activation of strings in producing matter in motion.[26]

The propagation of light in chormate is unique in that its wavelike property involves loop displacement (in a very stiff medium) but not activation. By further postulate, only at activated strixel sites does light become grainy or particulate in the form of photons interacting with material particles instantaneously at hand. While the speed of light is absolute, all other motion of ordinary objects remains relative to observers.

Passing to the macrocosmic domain of solar-system planets, for example, their sun-centered motion is an awesomely dynamic process. The earth in particular is moved in chormate by transport of its form via materialization at enormous numbers of strixels from one instant to the next. In this model,

ether drag is effete language without meaning. The mechanism of successive materializations within chormate denies the possibility of a drag force. Thus the earth and all the planets move about the sun without any apparent drag effects, in keeping with the observed data.

A conceptual key known for nearly two thousand years suggests that the fantastic power of ordering and control—whether in the quantum sub-world or the galactic cosmos of the universe—is not resident within chormate, but originates "outside" chormate.

A Conceptual Key to the Source of Material Reality: The Actinom of God

In the New Testament, Heb. 1:3 contains an incredible revelation of the second person of the Godhead as "upholding the universe by His word of power" (RSV). This awesome word of power is designated here as the *actinom* (contraction of the root of our word "active" with νομος, Greek for "law") of God. The dictionary explains that "active" refers "to both quickness and constancy of action," which are operating characteristics of the scientifically interpreted actinom, as will be seen. The law aspect of νομος appropriately points to the actinom as the source of the laws of physics that describe material form, order, and coherence in the universe.

The Heb. 1:3 "word of power"—Christ's word, but not to be confused in this context with Christ himself—is understood here as the will of God spoken into the being and structure of all material reality, filling the universe with living potentiality for the incarnation of such spiritual beings as humans. The actinom of God indispensably undergirds material reality, and because of its roots in Heb. 1:3, Col. 1:17 and other Scripture, it is a good candidate for absolute truth. As such, the actinom of God is a proper basis for rejoicing in the glories of God as seen in creation, a seminal theme throughout the Bible.

How the actinom of God is coupled to material reality is another matter[27]—and an unfathomable mystery. Here we pass from revealed truth to metaphysics, theology, and the modern understanding of empirically based science. Rather than metaphysics in general, a particular subset applies in this context—here designated as *theophysics*. Just as metaphysics is pre-physics not subject to experimental proof, theophysics is pre-physics incapable of empirical demonstration but is consistent with biblical truth, which therefore admits a higher order of epistemological reliability. Theophysics, then, is that theologically informed metaphysics which can assist conceptually in linking the actinom of God, which we cannot see, to the tangible material reality it produces.

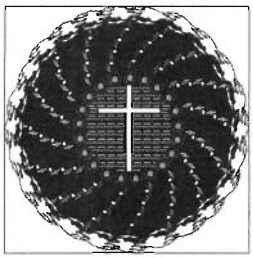
If modern science is understood from the standpoint of critical realism,[28] a theophysical implication follows: Considering the actinom along side scientific understanding of physical reality intuitively sheds light (however speculative) on the connection of the actinom to that reality. This juxtaposition is denoted here as the *paractinom* (par-act'-i-nom from *para*, Greek for "along side")—the actinom understood (however dimly) in the light of modern science. While the paractinom is no more empirically verifiable than any metaphysical postulate, the concept may permit a more coherent and intellectually satisfying understanding of God's great cosmos that is so expressive of his glory.

Moreover, no claim is made here for a paractinomic theory since no mathematical formalism is offered, and empirical verification is denied. A scientific theory is understood in the physics community to be essentially characterized as mathematical (however abstract) and empirically verifiable.[29] The present theophysical development cannot be confused with physics by claiming empirical verifiability. A caution arises from theophysics itself: If the paractinom were to be empirically verified, such verification might compel cognitive assent to the divine origin of material reality. Such intellectual coercion is incompatible with the role of faith in scriptural teaching.

The actinom of God is the will of God spoken into the being and structure of all material reality, filling the universe with living potentiality for the incarnation of such spiritual beings as humans.

As the continuing intelligent cause of all material reality, the paractinom is posited to activate string loops instant by instant, and consequently to provide the basis for all of the laws of physics. Material existence is impossible without the sustaining power of the paractinom of God. Such a view of the source of material reality is diametrically opposed to the deism that effectively dismissed God as a retired engineer after his creation of the universe.

In the paractinomic view of physical reality, motion is at the heart of instantaneous materialization. This view makes conceptually explicable the profound interlinking of space, mass-energy, and time displayed in Einstein's relativity equations.



Article

A Conceptual Key for Deeper Insights into Continuous Causation of the Reality Flow of the Universe

As free moral agents (biblically perceived), humans have remarkable powers of creative thought which, while at home in the material context of the brain – sustained in form from one instant to the next by the paractinom – cannot be reduced to a purely material phenomenon.

A crude analogy can help visualize how the paractinom sustains matter in its endless motion. Consider television pictures formed on a monitor. As scenes of action unfold in successive pictures, nothing in the screen of the monitor actually moves. Apparent movement derives from the sweep of the electron beam as it activates, from one instant to the next, different pixels of phosphor in the screen, so that the patterns of pixel activation give the appearance of motion from one "instantaneous" picture to the next. In radical contrast to the virtual motion seen on a television monitor, the motion realized by activation of strings at strixels is real—however much the emphasis shifts to the transport of form (shades of Plato!) and pattern of coherence, as opposed to the conventional idea of material transport.

The larger the unmanifest energy of a particle, the shorter its time duration—estimated to be exceedingly small—between materializations. Suppose, for illustration, that for an electron moving at 10^6 meters/second, the time between successive materializations is 10^{-21} second. Thus the two strixels excited are separated by a distance of 10^{-15} meter, on the order of a nuclear diameter. This distance straddles about 10^{20} strixel sites. Thus successive materializations are separated by 10^{20} strixel sites. The coincidental nuclear span of 10^{-15} meter also indicates an abundance of strixel sites within nuclear dimensions for the more closely spaced materializations of nucleons and their constituent quarks.

In a single atom of moderate complexity like iron-56, for example, the degree of inner order and coherence required for the atom's contribution to the sustained properties of a substance like hemoglobin is incredible. Inside the iron nucleus 56 protons and neutrons harmoniously buzz, accompanied by the choreographed dance of 26 electrons outside the nucleus. Since all matter is in motion, no sooner is a given set of strixels activated into materialization of an iron atom than the whole ordering must vanish and be re-established in the next instant in another set of strixels for the "transport" of the iron atom. The amount of information processing required in such short time frames for a 1-centimeter displacement of a single iron atom alone may well exceed the combined power of all the computers in the world, granted sufficient speed and time resolution. Compound this situation with the enormous complexity of a living red-blood cell containing many iron atoms, and the genius of paractinomic management of reality flow staggers human imagination.

An immediate consequence of the paractinomic process—the momentary materialization of particles at strixels in chormate[30]—is the inherent fuzziness of matter predicted by quantum mechanics at sufficiently small distances. If a moving particle materializes from strixel to remote strixel, what more natural consequence (in principle, not merely due to instrumental interference) than attempts to exactly locate the particle, while simultaneously attempting to determine its precise momentum, should be lost in a shroud of fuzziness? Pulsations in and out of the material state at very high frequencies during the flow of time must be inherently fuzzy.

Pure energy is structureless as far as we know. Yet when radiant energy is manifest in bundles called photons, these packets not only carry a discrete amount of energy, they also possess momentum and therefore have prescribed direction. This suggests that in the paractinomic view, since the momentary material form of a particle is at rest in chormate, the momentum of particles is actually carried by bundles of unmanifest energy carrying their kinetic energy as well as mass-equivalents.

Living beings have a range of autonomy in controlling the motion of objects in chormate, as well as their own. As free moral agents (biblically perceived), humans have remarkable powers of creative thought which, while at home in the material context of the brain—sustained in form from one instant to the next by the paractinom—cannot be reduced to a purely material phenomenon.

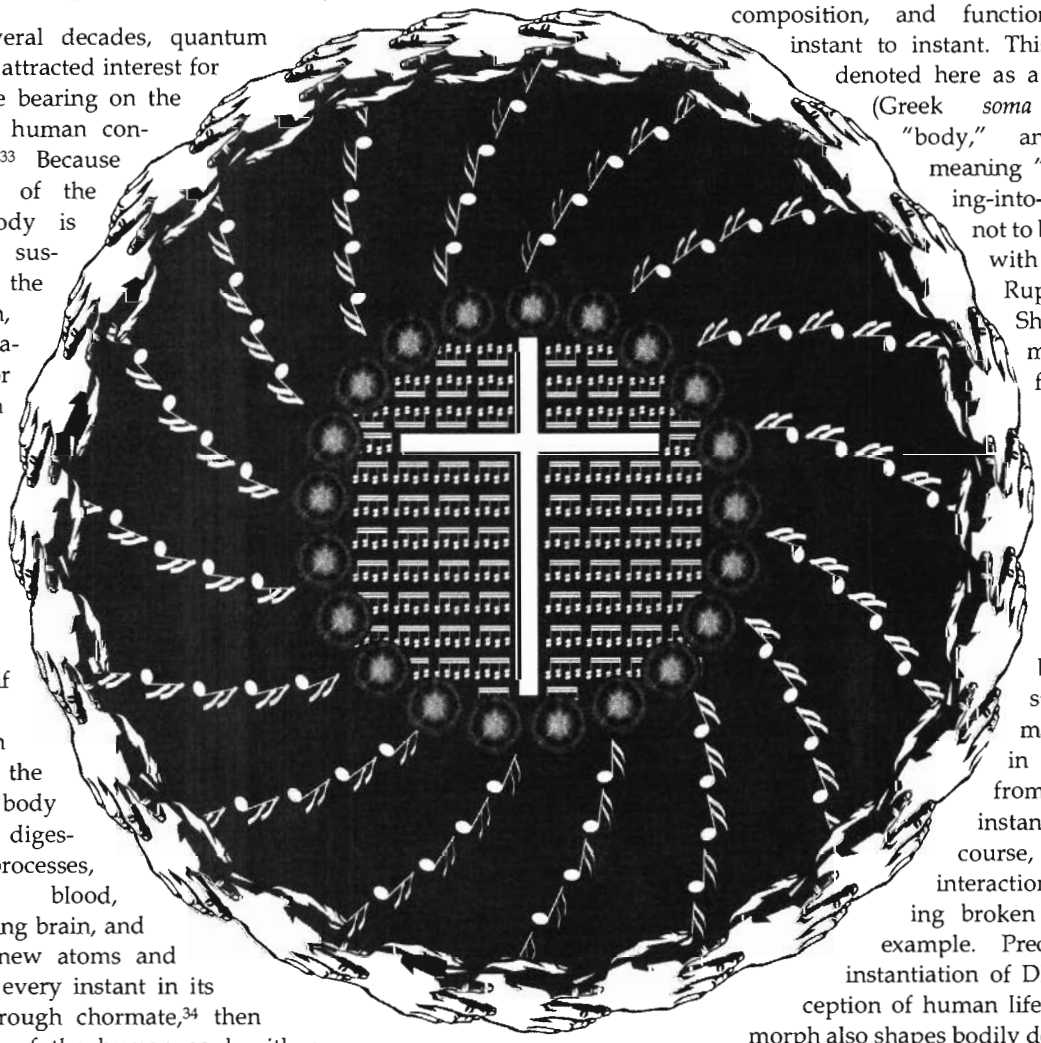
The Body-Mind Problem in a Paractinomic World

In the hierarchy of creaturely privileges, speculation on the essence of the human spirit cannot rank very high compared to the enjoyment of the proper objects of mental thought. The apotheosis of that enjoyment lies in communion with the Lord of life who fashioned our being and sustains our moment-by-moment existence. Nevertheless, if

taken with ontological seriousness, paractonomic possibilities have significant implications for the traditional mind-body problem. The few observations shared here may at least provide alternatives to conclusions of world views closed to the actinom-of-God concept.

Thinking about our inner world can be redeemed by rising above the dispassionate abstractions of materialist thought to share the Psalmist's adoring wonder about human beings. Not only did he marvel about his physical origin in his mother's womb,[31] he also could not exhaust the fathomless depths of his inmost being.[32]

For several decades, quantum theory has attracted interest for its possible bearing on the mind and human consciousness.[33] Because the being of the human body is physically sustained by the paractinom, the implications for the human spirit are much more direct than those of quantum theory. Namely, if the paractinom recreates the human body (dynamic digestive processes, circulating blood, neuron-firing brain, and all) with new atoms and molecules every instant in its motion through chormate,[34] then association of the human soul with a body of static matter is an impossibility. Traditional mind-body monism is wrenched in two.



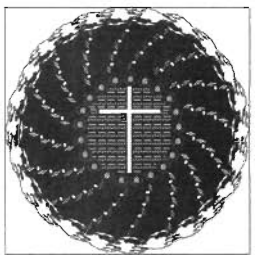
Computer graphics art work by Janice Bate.

Theophysically, the paractinom concept has nothing to say about the origin, nature, and location of the human soul within the body because the soul is not known to be material in any way. Empirical science cannot define the human soul, let alone measure it. Since we perceive the paractinom through the juxtaposition of the actinom with modern science, paractinomic understanding must remain agnostic about the soul in all its mystery, because science is silent. Revelation is a more likely source of understanding the human soul; but that revelation is not given to definitions satisfying intellectual curiosity.

In any case, the biblical emphasis is on human beings as spiritual beings—the human spirit temporarily dwells in a tent.[35] Since there is no static material composition of the human body in the paractinomic view, the soul of each person may be associated with an immaterial template that carries information about the body's form, composition, and functioning from instant to instant. This template, denoted here as a *somamorph* (Greek *soma* meaning "body," and *morphe* meaning "form coming-into-being"), is not to be confused with biologist Rupert Sheldrake's morphogenic field.[36]

The somamorph originates the continuing pattern that gives form to the body's substance as it materializes in chormate from instant to instant, subject, of course, to physical interactions producing broken bones, for example. Preceding the instantiation of DNA at conception of human life, the somamorph also shapes bodily development into adulthood and accounts for the body's aging. Not the soul, the somamorph is an immaterial template—transcending the discontinuities of instantaneous materializations in chormate—provided by the actinom for the association of soul and body while mortal life lasts.

Edgar Mitchell summarizes recent work about "Nature's Mind: The Quantum Hologram,"[37] which strikingly parallels the somamorph in its association of a quantum hologram with every physical object. The somamorph



Bohm's implicate order behind material reality corresponds to the will of God through the actinom for the structure and functioning of the universe. The paractinom, corresponding to the holomovement, carries the autonomously active will of God for the flow of material reality out of chormate into the explicate order of the universe.

may be conceived as a dynamically changing quantum hologram, however enshrouded in the paractinomic mystery of immaterial encoding. As used here, "somamorph" relates only to the human body, not to inanimate physical objects treated in Mitchell's work.

The power entailed in the paractinom's ordered control at the chormate level defies human comprehension. But a larger theophysical perspective reveals more comprehensible wonders behind material reality. In part, that larger view has been framed in a different perspective by physicist David Bohm.

The Paractinom and the Implicate Order

David Bohm, staunch anti-reductionist and defender of causality, has offered a new metaphysical system featuring the *implicate order*. He finds the source of material reality enfolded in the implicate order, which is "primary, independently existent, and universal."[38] This is in contrast to the traditional mechanistic order,[39] an explicate order "present to the senses."[40] Bohm explains:

> It is the implicate order that is autonomously active while the explicate order flows out of a law of the implicate order, so that it is secondary, derivative, and appropriate only in certain limited contexts.[41]

Russell summarizes Bohm's view as follows:

> We are to regard empirical phenomena as "explicate," the fragmentary traces of an ever-present yet hidden implicate order endowed with entirely new ontological structures.[42]

Wholeness, movement, and flow are key concepts for Bohm. He proceeds in analogy:

> order and measure [are] "enfolded" and "carried" not only in electromagnetic waves but also in other ways (by electron beams, sound, and in other countless forms of movement). To generalize so as to emphasize undivided wholeness, we shall say that what "carries" an implicate order is the *holomovement*, which is an unbroken and undivided totality.[43]

Bohm and Peat further describe the holomovement as "the fundamental ground of all matter ... each object or entity appears as a relatively stable and constant form out of the holomovement and into the explicate order."[44]

Movement for Bohm "is in general *discontinuous* in the sense that action is constituted of *individual quanta*."[45] He devotes considerable attention to the movement of a single electron. He explains:

> [It] can go from one state to another without passing through states in between. This is possible, of course, because the "particle" is only an abstraction of a much greater totality of structure. This abstraction is what is manifest to our senses (or instruments) but evidently there is no reason why it has to have continuous movement (or indeed continuous existence).[46]

Frescura and Hiley, associates of Bohm's London Birkbeck School, support motion discontinuity by replacing continuity of substance with "continuity of form."[47]

Similarities to theophysical concepts outlined in this paper can be drawn. Bohm's implicate order behind material reality corresponds to the will of God through the actinom for the structure and functioning of the universe. The paractinom, corresponding to the holomovement, carries the autonomously active will of God for the flow of material reality out of chormate into the explicate order of the universe. Like Bohm's holomovement, the paractinom is undefinable and immeasurable. The replacement of continuity of substance in the motion of all objects by continuity of form is a core concept in both approaches. However, while Bohm sees that "in the implicate order the totality of existence is enfolded within each region of space (and time),"[48] this abstraction drawn from analogy to the hologram has little meaning except through the actinom, to be noted shortly.

Other differences arise. The language of qualities (primary, independently existent, universal[39]) Bohm attributes to the implicate order has religious overtones. Bohm's conception of God, which tends to be peripheral to his metaphysical understanding, has been the subject of careful study. Sharpe finds that Bohm's belief in a personal God can be deduced circuitously,[49] but Russell is more direct in his disagreement. He states:

> Of course Bohm's view of nature does not necessarily imply the further premise that God is personal ... Bohm is probably closest to a panentheistic and impersonal conception of God.[50]

The Bible pictures God consistently as intensely personal, whose magnificent being is love.[51] Therefore the paractinom is the intelligible creativity of a personal God in the universe, in contrast to Bohm's impersonal God of the holomovement.

Russell and Sharpe pursue the ancillary question of purpose in Bohm's universe. Russell answers with a conditional affirmation[52] while Sharpe concludes "no strong picture of a purpose for the universe shines out of Bohm's writings."[53]

In contrast, the biblical view—the premise of the actinom—shines with purpose. It is seen both in the cosmic order[54] and implicit to the foreordination of the saints[55] as the focus of God's love (the universe as the required physical setting for the incarnation of human life).

Bohm's emphasis on human consciousness as part of his metaphysical system invites further comparison with actinom-based reality of a higher order.

Consciousness as Channel for God's Highest Creative Activity

Rare among physicists, Bohm develops insights into the supreme gift of consciousness. John Polkinghorne notes the "evolution" of consciousness as "the most significant thing that has happened in cosmic history."[56] Too complex to outline here, brief highlights of Bohm's insights serve as springboards to the biblical revelation of amazing new life flowing—through free choice of recipients' consciousness—into the universe for time and eternity.

For Bohm, "consciousness—thought, feeling, desire, will, etc.—is to be comprehended in terms of the implicate order, along with reality as a whole."[57] He develops this to mean, "consciousness is no longer to be fundamentally separated from matter,"[58] specifically that "consciousness and matter in general are basically of the same [implicate] order."[59] Thus consciousness, although a subtler aspect of matter, is a material process for Bohm.

Further, Sharpe notes: "He believes the consciousness folded into the implicate order is indivisible and that the consciousness of humanity is one. Each person displays an unfolding of this consciousness."[60] Russell[61] and Sharpe trace Bohm's further developments to an infinity of levels of nature and consciousness, to a beyond, "the domain of the sacred, the spirit, the holy, God."[62]

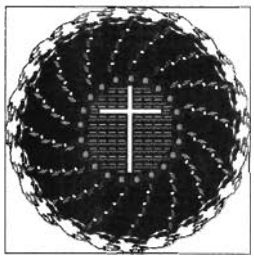
While Bohm's insights have validity in another context (to be addressed shortly), I believe that at face value they conflict with a biblical understanding. Theophysically, the Bible does not support consciousness as a material process, however little we are given to understand what it is.[63] Such understanding is not required for realizing the purpose of consciousness.

The wonders of the paractinomic flow of material reality—if indeed ontologically true—pale into shadows compared to the glorious experience of the ongoing creation of new life in human consciousness. Pale because paractinomic activity, beyond humbling thoughts of its totally awesome power, is not intended for conscious awareness any more than meditation on our bodily movement through chormate at more than 67,000 miles/hour adds to the quality of life. Conscious fellowship with Christ in our inner being excels all other reality, effected through a much higher power.[64]

Anchored in the somamorph, consciousness can be conceived as truly continuous, therefore "free floating" in paractinomic activity and rigorously associated with each person's body.

Some systematization may assist a clearer perception of the distinction earlier suggested about the soul: namely, *contra* Bohm, matter and consciousness are of a different order. While the paractinom upholds the material order that gives consciousness bodily support, consciousness itself is sustained by a means other than the paractinom. Granted that intimate union of consciousness (mind, soul) and body is indisputable. But it might be fairly conjectured that consciousness is more at home in the somamorph, if not least because death cannot touch the somamorph. If tied solely to the body, consciousness in the paractinomic view ultimately would consist of a stream of discrete bits of awareness. But, anchored in the somamorph, consciousness can be conceived as truly continuous, therefore "free floating" in paractinomic activity and rigorously associated with each person's body.

This distinction derives from George MacDonald's insight into John 1:3, 4: *All things were made through Him [Christ] ... That which has been made was life in Him* (RSV). According to MacDonald's fine trinitarian interpretation, all things (the physical universe) were made *through* Christ (via the paractinom in this context) in accomplishing his Father's will, but life was made *in* him, "something



Immanelife welling up in consciousness opens practicable biblical truths, far surpassing any knowledge of physical reality, that move us from intuitive speculation to faith in assured reality of the highest order.

brought into being by Himself."[65] This life, given at natural birth but made everlasting only through free choice by repentant sinners, needs a biblical name for the freely chosen life: *Immanuel life*, or *Immanelife* for short. God-with-us life begins with new birth from above[66] and, through the endless creativity of his Spirit, percolates into consciousness as Christ is formed throughout life in those choosing new life.[67]

Immanelife welling up in consciousness opens practicable biblical truths, far surpassing any knowledge of physical reality, that move us from intuitive speculation to faith in assured reality of the highest order. The apotheosis of biblical truth for living began through the unspeakable agony of the God-man on a Roman cross. Incredibly, this event redeems all desiring humankind—*One died for all*[68]—opening up the mainstream of human consciousness passing from the dominion of darkness[69] into a kingdom of glorious light[70] (if only dimly perceived in this life).

The incredible power in Immanelife for this darkness-to-light transition is dimly sensed by the transformation from autonomous self-will to the joyful "Thy will be done" of servanthood, described as wondrous creativity by MacDonald.[71]

Immanelife necessarily is first experienced in individual consciousness. This miraculous outpouring of new consciousness is depicted by MacDonald, who rejoiced in

> the splendor of a consciousness rushing from the wide open doors of the fountain of existence, the ecstasy of the spiritual senses into which the surge of life essential, immortal, increate, flows in silent fullness from the heart of hearts—what may it, what must it not be, in the great day of God and the individual soul.[72]

Amazingly, the uniqueness of each personality flourishes in the same implantation of Christ's consciousness in all Immanelifers. Personality, limitless in its development through consciousness in Immanelife, moves us beyond individuality in the miracle of love-merging to our true identity in fellowship with God and his children in the Church.

Glossary of Terms Introduced for Economy of Words and Efficiency of Explanation

Actinom. Name for the universe-upholding word of Christ's power by which the will of God is spoken into the being and structure of the universe moment by moment. Hebrews 1:3, Colossians 1:17. Also see paractinom below.

Chormate. Space mother (from the Greek). The invisible substrate of the universe consisting of a three-dimensional grid of linked string loops (as in string theory) that supports the propagation of light. Proposed with properties of the quantum vacuum as the precursor to space, chormate sustains the instantaneous materialization of matter.

Immanelife. Contraction of Immanuel life (God-with-us life). That freely chosen new life in Christ imparting shared consciousness, with God first and then with others, through Spirit-nurtured growth to a true identity in fellowship with God and His children in the Church.

Paractinom. Contraction of *para* (Greek, alongside) and actinom. Proposed as a scientific interpretation of the coupling of the actinom to material reality by bringing science alongside the actinom in critical realism. The paractinom "speaks" matter into being by "plucking" string loops at strixels. Not a scientific theory subject to empirical verification, the paractinom is pre-physics in the presuppositional sense of establishing the laws of physics for the structure and order of the universe.

Somamorph. An immaterial body template used by the paractinom in directing the human body through chormate. Preceding the DNA that it forms, the somamorph guides the development of the body from birth to maturation and the aging process. Proposed as the home for the continuous flow of consciousness in the soul of each individual.

Strixel. Sites (beyond numbering) of instantaneous materialization of particles moving in chormate throughout the universe, by activation of string loops (as in string theory). In analogy to pixels in the coating of television screens, a strixel is to a string loop as a pixel is to a grain of phosphor.

Theophysics. A subset of metaphysics informed by, and consistent with, biblical truth. An axiomatic pre-physics not subject to empirical proof.

While Bohm sees individual consciousness deriving from societal consciousness, Immanelife leads to a higher order of shared consciousness in the living organism of Christ's body, the Church. Because this shared consciousness is effected through the Holy Spirit, Bohm's implication that the totality of consciousness is enfolded in individual consciousness is lovingly mirrored in each believer's relationships in the church: *That they may all be one even as We are one.*[73]

This oneness entails the unspeakable privilege of shared consciousness: *in Christ we who are many form one body, and each member belongs to all the others.*[74] The Apostle's call, *I plead with you to be of one mind, united in thought and purpose,*[75] reveals the rigorous demands of shared consciousness in the tough climb from the actual toward the real ideal. Far from being lofty truth attainable by only select saints, the breath-taking implications for transformation of the simplest relationships open to all have been beautifully articulated by George MacDonald.[76]

Immanelife produces neither perfect individuals nor perfect churches,[77] although those outcomes are its constant motivation. The fragmentation that Bohm laments is no stranger to the very world where unity of shared consciousness has its greatest power of enablement. Immanelife thrives in self-denial and obedience to him who calls us into the valleys of life, where it is "neither beautiful, poetic, nor thrilling," for the (humanly) impossible task of lifting up valleys and bringing mountains low.

If the limitless joy of God begins in Immanelife, it is boundless in scope as God enables Immanelifers in shared consciousness to grasp the multidimensional love of Christ. Remarkably, their calling to *know this love that surpasses knowledge*[78] in shared consciousness is effectuated through union with Christ, and has the incredible purpose that they *may be filled to the measure of all the fullness of God.*[79]

Such fullness immeasurably transcends the fading glories of a physical universe and releases Immanelifers from mere enjoyment to the highest exaltation in conscious togetherness: *to Him be glory in the church and in Christ Jesus throughout all generations, for ever and ever!* [80] ⁂

Notes

Abbreviations for Bible translations: Msg, *The Message*; NIV, *New International Version*; NLT, *New Living Translation*.

[1]J. A. Wheeler, "The Universe as Home for Man," *American Scientist* 62 (1974): 683–91.

[2]P. Davies, *God and the New Physics* (New York: Simon and Schuster, 1983), 100

[3]N. Huggett, *Space from Zeno to Einstein* (Cambridge: MIT Press, 1999).

[4]H. Genz, *Nothingness: The Science of Empty Space* (Reading, MA: Helix/Perseus Books, 1999).

[5]Among many who repudiate natural theology, George MacDonald in *Creation in Christ* (Wheaton, IL: Harold Shaw Publishers, 1976) cautions that "human science cannot discover God; for human science is but the backward undoing of the tapestry-web of God's science, works with its back to Him ..." (p. 145). Moreover, he finds that even the highest truth can be emasculated of real meaning:

> The highest truth to the intellect, the abstract truth, is the relation in which man stands to the Source of his being—his will to the Will whence it became a will, his love to the Love that kindled his power to love, his intellect to the Intellect that lighted his. If a man deal with these things only as things to be dealt with, as objects of thought, as ideas to be analyzed and arranged in their due order and right relation, he treats them as facts and not as truths, and is no better, probably much the worse, for his converse with them ... (p. 145).

Personal experience testifies that hearty endorsement of these truths by no means exempts one from the struggles required to enjoy truth in its highest meaning, hard won by working into the tapestry-work of God's science with our faces toward him.

[6]Ultimately anchored in the Judeo-Christian Scriptures, the primacy of the spiritual over the material is not a new tenet. Over a half-century ago, C. S. Lewis in *Miracles* (New York: The MacMillan Company, 1948) offered key considerations in familiar terminology: "The Supernaturalist believes that the one original or self-existent thing [God] is on a different level from, and more important than all other things" (p. 18). Again, "The Supernaturalist believes that one Thing exists on its own and has produced the framework of space and time and the procession of systematically connected events which fill them" (p. 20).

[7]Genz, *Nothingness*, 217. According to Genz, "[Maxwell's] theory tells us the properties of the fields described and also those of their presumed carrier substance, the ether. Seen in this way, the ether in its ground state is nothing but empty space under another name."

[8]Huggett, *Space from Zeno to Einstein*, 56.

[9]A. Einstein, *"Über den Äther," Verhandlungen Schweizerischen Naturforschenden Gesellschaft* 105, Part 2 (1924): 85–93. I could not find an English translation of Einstein's Ether paper. My heartfelt thanks to Dr. H. Michael Sommermann, professor of physics at Westmont College, for valued assistance in translating Einstein's paper. All quotations referring to Einstein's paper are from my translation.

[10]For a summary of Newton's concept of absolute space, see Genz, *Nothingness*, 145–9.

[11]Einstein, *"Uber den Ather,"* 85.

[12]P. A. M. Dirac, "The Evolution of the Physicist's Picture of Nature," *Scientific American* 208, no. 5 (May 1963): 51.

[13]Einstein, *"Uber den Ather,"* 85.

[14]Ibid., 85.

[15]Ibid., 86.

[16]Ibid., 86.

[17]Ibid., 93.

[18]Dirac, "The Evolution of the Physicist's Picture of Nature," 50.

[19]Ibid., 51.

[20]Genz, *Nothingness*, 220.

[21]B. Greene, *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory* (New York: W. W. Norton, 1999), 146.

[22]Noting an inspiring set of breakthroughs in the latter half of the 1990s, Greene sounds a note of realistic and cautionary hope:

> Whether string theory is an incidental rest stop along this path [of attempting to fathom the cosmos], a landmark turning point, or in fact the final destination we do not know. But the last two decades of research by hundreds of dedicated physicists and mathematicians from numerous countries has given us well-founded hope that we are on the right and possibly final track (Ibid., 20).

[23]Huggett, *Space from Zeno to Einstein*, 128. Huggett provides a brief description of Newton's "space-as-container" model.

[24]Ibid., 101. Huggett interprets Descartes' approach with a critical question: "When a rock moves, does it remain composed of the same matter, or does the matter stay behind so that the properties move and become attached to successive pieces of matter?" This is breathtakingly close to the proposal here, which answers the

question thus: The properties of a rock move from one site of materialization to the next, not leaving matter behind or becoming attached to successive pieces of matter, but framing the rock at any given position by instantaneous materialization.

[25]Genz, *Nothingness*, 283. The field most pertinent to the quantum vacuum is the Higgs field, a concept of abstract symmetry-breaking. According to Genz, the vacuum state is the ground state of the universe, for which the total energy is zero. Also see p. 289.

[26]In the Einstein formula for mass-energy equivalence, E is energy, m is mass, and c is the speed of light, all in consistent units.

[27]This phrase illustrates the advantage of using *actinom* in preference to the biblical *logos*. In John 1:1, *logos* refers to Christ. *Actinom* has a narrower meaning, having to do with the activity of the *logos* in relation to the reality flow of the universe. It might be mentioned here that the basic concepts presented in this paper were developed, in my ignorance, independently of much of the relevant literature. Parallel consequences described in the literature, none of which is explicitly stated as derivative from the actinom, were discovered after the fact—with grateful astonishment, I might add. Following initial reviews and circulation of the first draft of this paper, many helpful resources were suggested—particularly the writings of David Bohm, which I gratefully acknowledge. A special note of appreciation to Stacy Ake of the Metanexus Institute for alerting us, at the 2002 annual ASA meeting, to the treasures of George MacDonald's unspoken sermons—herein referenced as *Creation in Christ* (see note 5) but now out of print. After years of back-burner wrestling with mysteries in physics, the key concepts had been formulated by the time I read Genz, Greene, and Huggett (in their works earlier referenced above).

[28]John Polkinghorne in *Beyond Science: the Wider Human Context* (Cambridge: Cambridge University Press, 1996) states:

> "Realism" because it claims that science actually does tell us about the [objective] physical world, even if it does not do so finally and exhaustively. "Critical" because it recognizes the subtlety and ultimate unspecifiability of the scientific method (p. 18).

[29]For a general discussion of theory and theory testing, see J. Polkinghorne, *Reason and Reality* (Valley Forge, PA: Trinity Press International, 1991): 23–5; and R. J. Russell, "The Physics of David Bohm and Its Relevance to Philosophy and Theology," *Zygon* 20, no. 2 (June 1985): 141–5.

[30]Other implications of the paractinomic process are too numerous to list here. In passing, intelligent design becomes a foregone conclusion, however stimulating the discovery of evidences for design in life and the universe. Miracles remain miracles; but the control of matter to manifest the glory of God—whether it be through a floating ax-head or through the torching of Elijah's sacrifice in the contest with Baal worshipers—is certainly manageable through the paractinom.

[31]Psalm 139:13, 14: *You made all the delicate, inner parts of my body and knit me together in my mother's womb. Thank you for making me so wonderfully complex! Your workmanship is marvelous* (NLT).

[32]Psalm 139:1-10 has been amplified to better appreciate the sense of wonder at the awesome mystery of the human heart: "There is something infinitely more mysterious to the Psalmist than the great universe outside, and that is the mystery of his own heart. There are mountain peaks in my soul, he implies, that I cannot climb; there are ocean depths I cannot fathom; there are possibilities in my heart that terrify me; therefore, O God, search me out" Oswald Chambers.

[33]Twenty years ago Paul Davies in *God and the New Physics* wrote:

> There is, however, a growing awareness that the [quantum] theory contains some astonishing insights into the nature of the mind and the reality of the external world, and that full account must be taken of the quantum revolution in the search for an understanding of God and existence (p. 100).

[34]All matter on earth is in motion, not just on the micro scale. The earth's speed around the sun is only a fraction of that in which the solar system participates (intra- and inter-galactic) but is not trivial by human measure. Since Copernicus, most people not in the Flat Earth Society have believed that the earth revolves about the sun. The average speed of that revolution is easily calculated if for convenience the earth's orbit is approximated by a circle (actually slightly elliptical) of average radius R = 93,000,000 miles. The earth travels the circumference, $2\pi R$, of this circle in one year. Taking the year as 365 24-hour days gives the earth's speed = distance divided by time = 2x3.14x93,000,000/(365x24) = 67,000 miles/hour. Thus each person on earth moves through chormate with a speed of 67,000 miles/hour, plus or minus a small surface speed (latitude dependent) due to the earth's 24-hour rotation on its axis.

[35]For example, 2 Cor. 5:1: *when this tent we live in, our body here on earth, is torn down* ... (TEV); and 2 Peter 1:13: ... *as long as I live in the tent of this body* (NIV).

[36]K. J. Sharpe, *David Bohm's World: New Physics and New Religion* (Lewisburg, Bucknell University Press, 1993): 66. Sharpe describes Sheldrake's morphogenic field as produced by recurring behavior that "instantaneously spreads out through time and space and directs other members of the species in question toward the same form or behavior."

[37]E. Mitchell, "Nature's Mind: The Quantum Hologram," *International Journal of Computing Anticipatory Science*, ed. D. M. Dubois, 7 (2000): 295–312. Mitchell concludes in part, "recognition that the quantum hologram is a macroscale, non-local, information structure described by the standard formalism of quantum mechanics extends quantum mechanics to all physical objects including DNA molecules, organic cells, organs, brains and bodies."

[38]D. Bohm, *Wholeness and the Implicate Order* (Boston: Routledge & Kegan Paul, 1980), 185. "Our proposal to start with the implicate order as basic, then, means that what is primary, independently existent, and universal has to be expressed in terms of the implicate order."

[39]Ibid., 185. In the traditional mechanistic order, "All that is primary, independently existent, and universal is thought to be expressible in an explicate order, in terms of elements that are externally related (and these are usually thought to be particles or fields, or some combination of the two."

[40]Ibid., 186."We can, for convenience, always picture the explicate order or imagine it, or represent it to ourselves, as the order present to the senses."

[41]Ibid., 185.

[42]R. J. Russell, "The Physics of David Bohm and Its Relevance to Philosophy and Theology," 172.

[43]Bohm, *Wholeness and the Implicate Order*, 151.

[44]David Bohm and F. David Peat, *Science, Order, and Creativity*, 2d ed. (New York: Routledge, 2000),180

[45]Bohm, *Wholeness and the Implicate Order*, 175

[46]Ibid., 184.

[47]F. A. M. Frescura and B. J. Hiley, "The Implicate Order, Algebras, and the Spinor," *Foundations of Physics* 10, no. 1/2 (1980): 10.

> ... the relative ease with which particles can be created and annihilated by being transformed from "substance" into electromagnetic energy and vice versa has long implied a denial of the basic relevance of the identity of the substance. What is suggested instead is its replacement by what we shall call continuity of form.

[48]Bohm, *Wholeness and the Implicate Order*, 172.

[49]Sharpe, *David Bohm's World*, 97. After declaring the holomovement God to be personal, Sharpe concludes: "The holomovement God is the source of all our objective and subjective experiences. Thus God could relate to us personally." The implications "are subjects for theology to ponder."

[50]Russell, "The Physics of David Bohm and Its Relevance to Philosophy and Theology," 153.

[51]1 John 4:16b, *God is love. Whoever lives in love lives in God, and God in him* (NIV).

[52]Russell, "The Physics of David Bohm and Its Relevance to Philosophy and Theology," 154.

> Bohm is tentative about [traditional] theological implications of his cosmology. Yet as his cosmology is explored further, its theme of cosmic order could provide renewed grounds for the

intelligibility of faith in the creative presence of God in nature and a new mode of divine purpose in the world.

[53]Sharpe, *David Bohm's World*, 91.

[54]See Ps. 19:1–6, Rom. 1:20, Col. 1:16b, and Rev. 4:11a among others. In particular, Rev. 4:11a reads: *You are worthy, O Lord our God, to receive glory and honor and power. For you created everything* (NLT).

[55]See, for example, Ps. 139:16: *All the days ordained for me were written in your book before one of them came to be* (NIV); also Eph. 1:4a: *Long before He laid down earth's foundation, He had us in mind, had settled on us as the focus of His love* (Msg).

[56]Polkinghorne, *Beyond Science*, 88. Polkinghorne's conclusion is fair enough, but I find his suggested path of evolution inadequate because theophysically, the Bible cannot easily be pressed into conformity with the idea of consciousness as a product of evolutionary development.

[57]Bohm, *Wholeness and the Implicate Order*, 196.

[58]Ibid., 197.

[59]Ibid., 208.

[60]Sharpe, *David Bohm's World*, 61.

[61]Russell, "The Physics of David Bohm and Its Relevance to Philosophy and Theology," 153–4.

[62]Sharpe, *David Bohm's World*, 61. See also pp. 92–4.

[63]A principal focus of Mitchell's paper, note 37 above, is on understanding consciousness largely through information processing and the quantum hologram.

[64]Ephesians 3:16, 17: *I pray that out of His glorious riches He may strengthen you with power through His Spirit in your inner being, so that Christ may dwell in your hearts through faith* (NIV).

[65]MacDonald describes that life as "the thing made *in* the Son—made by Him inside Himself, not outside Him—made not *through* [as was the material universe by the paractinom] Him but *in* Him—the life that was His own, as God's is His own" MacDonald, *Creation in Christ*, 16.

[66]John 3:7b: *You must be born again* (NIV).

[67]Galatians 4:19: *until Christ is formed in you* (NIV); and 2 Peter 1:4.

[68]2 Corinthians 5:14: *we are convinced that One died for all* (NIV).

[69]Colossians 1:13a: *For He has rescued us from the dominion of darkness and brought us into the kingdom of the Son He loves* (NIV).

[70]Colossians 1:12b: *to share in the inheritance of the saints in the kingdom of light* (NIV).

[71]G. MacDonald, *Far Above Rubies*, a short story now out of print and, no other sources being known, available on the Internet: www.johannesen.com/FarAboveRubiesComplete.htm: 8. "For what good is there in creation but the possibility of being yet further created? And what else is growth but more of the will of God?"

[72]MacDonald, *Creation in Christ*, 198.

[73]John 17:22b (NIV).

[74]Romans 12:5 (NIV).

[75]1 Corinthians 1:10 (NLT).

[76]MacDonald, *Creation in Christ*, 185.

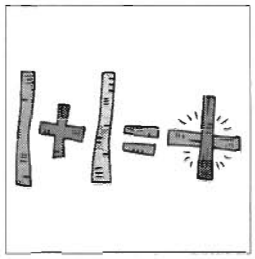
> The man with God's righteousness does not love a thing merely because it is right, but loves the very rightness in it. He not only loves a thought, but he loves the man in his thinking that thought; he loves the thought alive in the man. He does not take his joy from himself. He feels joy in himself, but it comes to him from others, not from himself—from God first, and from somebody, anybody, everybody next.

[77]The first three chapters of the book of Revelation document the sad state of affairs in some churches still under the rich guidance of the apostolic era, not to mention the problems noted in the Galatian and Corinthian epistles.

[78]Ephesians 3:19a (NIV).

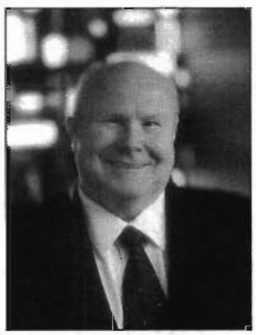
[79]Ephesians 3:19b (NIV).

[80]Ephesians 3: 21 (NIV).



A Mathematical Analogue for a Model of the Trinity

Bill R. Williams and Mark S. Dickerson



Bill R. Williams

We believe in one God, Father, all-sovereign, maker of all things seen and unseen; and in one Lord Jesus Christ, the Son of God, begotten from the Father as only-begotten, that is, from the substance of the Father, God from God, light from light, true God from true God, begotten, not made, homoousios *with the Father, through whom all things came into existence, the things in heaven and the things on the earth, who because of us men and our salvation came down and was incarnated, made man, suffered, and arose on the third day, ascended into heaven, comes to judge the living and the dead; and in one Holy Spirit. And those who say "there was once when he was not" or "he was not before he was begotten" or "he came into existence from nothing" or who affirm that the Son of God is of another* hypostasis *or substance, or a creature, or mutable or subject to change, such ones the catholic and apostolic church pronounces accursed and separated from the church.*

– The Creed of the Synod of Nicaea (June 19, 325).[1]

Of what use is it to discourse learnedly on the Trinity, if you lack humility and therefore displease the Trinity. ... I would far rather feel contrition than be able to define it. If you knew the whole Bible by heart, and all of the teachings of the philosophers, how would this help you without the grace and love of God? – Thomas á Kempis.[2]

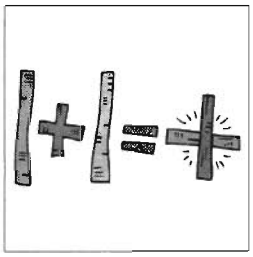
While we should continue to be concerned with logical consistency in expressing the doctrine of the Trinity, we cannot fully comprehend its mystery.

Since the time of the early church fathers, theologians have struggled to understand the relationship between the three Persons of the Trinity. What came to be accepted as orthodox doctrine, the Nicene Creed, presents a logical and philosophical conundrum: How can we hold that there is only one God and at the same time hold that there are three distinct divine Persons, each of whom is God? In wrestling with this puzzle, writers have analyzed Scripture, imported terms such as *hypostasis* and *homoousios* from Greek philosophy, employed the methods of logic and philosophy, and considered models and analogues from human experience. In recent decades, a number of scholars have studied the formal logic of the doctrine of the Trinity, including Rahner,[3] Geach,[4] Power,[5] Cartwright,[6] and Macnamara et al.[7] However, as Poythress has pointed out, formal logic must take into account instantiation and association:

> Within a Christian framework, the analogical character of categories makes it necessary to check on the content or meaning of each statement, and to evaluate it within a larger network of contexts, including the context of persons who are reasoning, the situation being reasoned about, and ultimately the context of God himself.[8]

While we should continue to be concerned with logical consistency in expressing the doctrine of the Trinity, we cannot fully comprehend its mystery. We can best approach this transcendent reality through the use of metaphor and analogy. The importance of

Bill R. Williams *began teaching mathematics in 1965 at Grand Canyon University in Phoenix, AZ, was named president of the university (1978–2000), and currently is chancellor. He is professor of mathematics and founder/director of Canyon Institute for Advanced Studies. He received a B.S. in mathematics, Grand Canyon University; M.A. in mathematics and four National Science Foundation grants for graduate study in mathematics at the University of Illinois; M.S. and Ed.D. in mathematics education, Arizona State University; and a post-doctoral NSF grant at Utah State University. Bill teaches "Christ in Contemporary Society" at his church. He is the author of* Man's Mathematical Models *(Nelson-Hall) and various mathematics and religion articles. Bill enjoys weightlifting and martial arts and is an ASA member. He and his wife Shirley have two children and reside in Phoenix, Arizona.*



an ongoing effort to gain insight into the Trinitarian mystery is underscored by the observation made by Timothy George[9] in the February 2002 issue of *Christianity Today*:

> Sadly, the doctrine of the Trinity may be the most neglected doctrine we hold. We are baptized in the name of the Father and the Son and the Holy Spirit. We often hear that wonderful Pauline benediction at the end of 2 Corinthians, "May the grace of the Lord Jesus Christ, and the love of God, and the fellowship of the Holy Spirit be with you all." The Trinity is essential to our statements of faith, our creeds, and our confessions. Yet we neglect it.[10]

Brief Overview of Trinity Models

In the first formal Trinitarian treatise that we have, *Against Praxeas*, Tertullian (ca. 160–220) employed a number of metaphors to describe the Father as the source of life, the Son as the agent of life and the Spirit as the giver of life. He coined the word "Trinity" and used the words "substance" and "person" in describing the relation of Father, Son, and Holy Spirit. He said that they relate to each other as a fountain, a stream, and a river or "the Father is the sun, the Son is its sunbeam whose point (apex) is the Holy Spirit, bearer of warmth and life."[11] Yet Tertullian held that there was a time before creation in which the Father existed without the Son.

In the fourth and fifth centuries, authors used both psychological and social analogies. Augustine focused on the concept of relationship: "The names, Father and Son, do not refer to the substance, but to the relation ..."[12] The relationships that distinguish one divine being from another are eternal: the Father is always begetting, the Son is always being born, and the Spirit is always proceeding from the Father and Son.[13] Similarly, Augustine used the analogy of lover, beloved, and love itself to describe the Trinity.[14] He also spoke of a trinity in sight (the object that is seen, vision itself, and the attention of the mind),[15] a trinity in the human spirit (mind or self-knowledge, self-love or self-esteem, and will)[16] as well as a trinity in love. The idea expressed is that there are three faculties in humans that are not ultimately totally separate entities. The problem with Augustine's analogies is that they fail to preserve the permanence of the distinction between the three elements.[17] Also in the analogy of mind, self-esteem, and will, we have only one entity, the mind, and two of its states or activities.

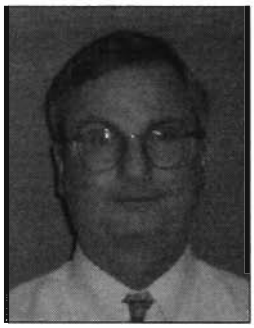
Based on Augustine's analysis, Richard of St. Victor considered the implications of love as the basis of a proof for the doctrine of the Trinity.[18] Richard distinguished the three Persons by their relations of love, with the Father as giver, the Son as receiver, and the Holy Spirit as gift.

> To give is the personal property of the unbegotten Father, to receive is the property that distinguishes the person of the Son, who also gives to the Holy Spirit, who is totally receptive from the Father and the Son from both of whom he simultaneously proceeds.[19]

Gregory of Nyssa noted that Peter, James, and John, being one in manhood, were called three men and argued that the three divine Persons have a similar relationship to the Godhead.[20] "[Indeed], there are many hypostases of the one man and [precisely] three of the one God."[21]

Gregory of Nyssa also used a scientific analogy, comparing the Trinity to colors of the rainbow:

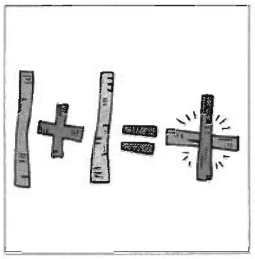
> Now this brilliance is both continuous and divided. It is of many colours; it is of many forms; it is insensibly steeped in the variegated bright tints of its dye; imperceptibly abstracting from our vision the combination of many coloured things, with the result that no space, mixing or parting within itself the difference of colour, can be discerned either between blue and flame-coloured, or between flame-coloured and red, or between red and amber ...



Mark S. Dickerson

In the fourth and fifth centuries, authors used both psychological and social analogies [to explain the Trinity].

Mark S. Dickerson *has been practicing law since 1976 and has served in private practice, as general counsel for a multi-national corporation listed on the New York Stock Exchange, and as a member of a crisis management team addressing the legal and financial issues facing a large charitable organization involved in one of the largest charitable bankruptcy proceedings in U.S. history. Dickerson currently serves as general counsel of Azusa Pacific University. He received a B.S. in mathematics from Grand Canyon University and a J.D. from Harvard Law School. He is currently a candidate for an M.A. in theology at Fuller Theological Seminary. Mark teaches both Law of Higher Education and Ministry and the Law classes for graduate schools at his university and serves as a fellow of the Institute of Leadership Studies at Vanguard University. He enjoys hiking and reading and is active in his community. He and his wife Barbara have two children and reside in Azusa, California.*



Article

A Mathematical Analogue for a Model of the Trinity

Newton's scientific approach to Christianity led him to serious reassessment of his beliefs regarding the miraculous and mysterious, even where that put him in conflict with accepted Church teaching.

> As then in the token we clearly distinguish the difference of the interval between them; so in like manner conclude, I pray you, that you may reason concerning the divine dogmas; that the peculiar properties of the hypostases, like colours seen in the Iris, flash their brightness on each of the Persons ... but that of the proper nature no difference can be conceived of as existing between one and the other, the peculiar characteristics shining, in community of essence on each.[22]

A contemporary of Thomas Aquinas, Bonaventure (1217–1274) wrote a book entitled *The Threefold Way* in which he based his threefold path to God on the numerous "trinities" found in nature:

> So this is the three-day journey into the wilderness, or the three degrees of light within a single day: dusk, dawn, and noon. It represents the triple existence of things, that is existence in physical reality, in the mind, and in the Eternal Art ... It also represents the presence in Christ, our Ladder, of a triple substance, bodily, rational and divine."[23]

In the seventeenth century, Isaac Newton deduced the characteristics of God from his analysis of the natural, physical order:

> This most beautiful system of the sun, planets and comets could only proceed from the counsel and dominion of an intelligent and powerful Being ... He is eternal and infinite, omnipotent and omniscient; that is, his duration reaches from eternity to eternity; his presence from infinity to infinity; he governs all things, and knows all things that are or can be done ... We know him only by his most wise and excellent contrivances of things, and final causes; we admire him for his perfection; but we reverence and adore him on account of his dominion; for we adore him as his servants; and a god without dominion, providence and final causes is nothing else but Fate and Nature.[24]

Newton's scientific approach to Christianity led him to serious reassessment of his beliefs regarding the miraculous and mysterious, even where that put him in conflict with accepted Church teaching. He held the doctrine of the Trinity to be a fraud,[25] and compared the Trinity to three bodies, **a**, **b**, and **c**, only one of which contained gravity (**a**, the one representing the Father). He noted that if body **a** pressed down on the other two they would each apply a downward force, not because they contained gravity on their own, but that the force was communicated by body **a**.[26] Newton concluded from this that "by saying there is but one god, the father of all things, I deprive not ye son & holy ghost of the divinity wch they derive from ye father &c."[27]

Newton's contemporary, John Wallis, was also a mathematician and part-time theologian. Wallis, a firm believer in the Nicene Creed, illustrated relationships within the Trinity using the analogy of the three dimensions of a euclidian geometrical cube. "This longum, latum, profundum (Long, Broad, and Tall) is but One Cube; of Three Dimensions, and yet but One Body: And this Father, Son and Holy Ghost; Three Persons, and yet but One God."[28]

Moving to the twentieth century, Charles MacKenzie applied the concepts of Karl Heim in developing a model of the Trinity. Heim viewed reality as being comprised of various "spaces," the non-objective space of personal relationships, the physical space of three dimensions, a suprapolar space which is the point of contact between the Infinite God and creation and the ultimate space being the omnipresence of God.[29] MacKenzie applies Heim's view of spaces and speculates:

> Could it be that within God are three equal suprapersonal "dimensions" which interpenetrate each other (perichoresis) and yet which are eternally distinct and different? Just as the impersonal dimensions we experience, length and breadth and height, permeate each other yet are distinct from each other, so infinite suprapersons and the suprapersonal "dimensions" they create may permeate each other, being mutually dependent and mutually exclusive, without losing identity. Just as suprapolar space may encompass and permeate all lower spaces without absorbing or being absorbed by them, similarly the transcendent Trinity enfolds all reality in its suprapersonal love and power without absorbing or being absorbed by it.[30]

While the approaches of Wallis and MacKenzie have much to commend them, neither model takes into account the relationship between the infinite nature of God the Father and the finite nature of his Son while Jesus lived on earth. We need to be able to reconcile the statements of Jesus that "I and the Father are one"[31] and "He who has seen me has seen the Father"[32] and the declaration of Paul that the fullness of the Godhead was in Jesus[33] with texts that indicate or imply that Jesus is a separate being from the Father. The passages that support the finiteness and distinctiveness of Jesus are numerous and include numerous references by Jesus to God in the third person or the first person plural,[34] Jesus' prayers to the Father,[35] texts that imply limitations to his powers,[36] Jesus' statements that he had been sent by the Father,[37] and Scripture passages concerning Jesus' humanity including the narratives of his birth, life, crucifixion, and death.[38]

A Proposed Mathematical Analogue

With a sober nod to the advice of Thomas á Kempis and a firm declaration that no model conceived by human beings can capture the mystery of the Trinity, we suggest a mathematical analogue based on the concept of isomorphisms (systems or structures of like form) that may present a modest alternative to the analogues and metaphors that have been proposed as well as offer tentative suggestions for further exploration. While no model can provide us with a literal description of reality, this mathematical analogue offers three advantages in considering the Trinity: (1) the ability to work with finite and infinite concepts in an explicit manner using the notion of sets; (2) systems that have formal internal consistency; and (3) descriptors that may help provide clarity of meaning.

In order to accommodate the relationship between God the Father and God the Son described above, a model is needed in which two systems are structurally equivalent without being identical, one of the systems having infinite representations while the other is finite and the systems' relationships to each other are time-independent. The mathematical concept of an isomorphism allows us to develop systems in which these properties are present. For the sake of simplicity we will confine our isomorphism discussion to two systems representing the Father and the Son. However, natural extensions of the concepts presented could add a third system representing the Holy Spirit, only making the analysis a bit more complex and requiring more depth of mathematical description.[39] In order to strike a balance between readability and formal mathematical development of ideas and terms used, while retaining acceptable descriptive clarity, we will use mathematical terms informally in the text and occasionally include more technical information in the endnotes.

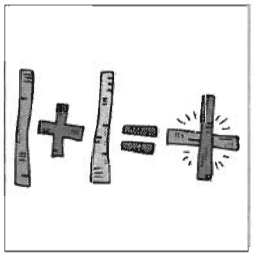
In basic terms, an isomorphism exists where two groups (or collections of elements with particular mathematical properties) are structurally identical. Relationships between the elements in the two groups are expressed in terms of a mapping function or rule in which every element in group A can be mapped to one and only one (or associated with exactly one) element in group A'.[40] We consider two different systems: System I deals with an abstract set of elements consisting of the whole numbers W = {0, 1, 2, 3, ...} and System II's mathematical description is motivated by the motion of a physical object.

A model is needed in which two systems are structurally equivalent without being identical, one of the systems having infinite representations while the other is finite and the systems' relationships to each other are time-independent.

System I has as its elements five subsets: (i) all whole numbers that have a remainder of 0 when divided by 5; (ii) all whole numbers that have a remainder of 1 when divided by 5; (iii) all whole numbers that have a remainder of 2 when divided by 5; (iv) all whole numbers that have a remainder of 3 when divided by 5; and (v) all whole numbers that have a remainder of 4 when divided by 5. Notice that System I has as its elements five infinite sets: [0], [1], [2], [3], [4]. Each one is an infinite subset of the whole numbers and can be expressed as follows:

[0] = {0,5,10,15,20,25 ...}
[1] = {1,6,11,16,21,26 ...}
[2] = {2,7,12,17,22,27 ...}
[3] = {3,8,13,18,23,28 ...}
[4] = {4,9,14,19,24,29 ...}

We introduce a type of addition for the 5 elements of System I and call it "addition modulo 5 ($+_5$)," meaning that one can take any pair of the elements in System I and add them using addition modulo 5. For example, consider subset [1] = {1, 6, 11, 16, 21, 26, ...}and subset [3] = {3, 8, 13, 18, 23, 28, ...}. In order to add these two subsets using modulo 5 addition, we take any number out of [1] and any number out of [3], add them together using ordinary addition, and then find the remainder when that result is divided by 5. For instance, 11 from [1] and 23 from [3] will add under ordinary arith-



Article

A Mathematical Analogue for a Model of the Trinity

We consider two different systems: System I deals with an abstract set of elements consisting of the whole numbers W = {0, 1, 2, 3, ...} and System II's mathematical description is motivated by the motion of a physical object.

metic to 34, and upon dividing by 5 yields a remainder of 4. Note that adding any number from [1] to any number from [3], using ordinary addition and then dividing by 5 will always yield 4, a number in [4]. Usual notation for the preceding description is to write [1] $+_5$ [3] = [4], but keep in mind an infinite array of additions and divisions is represented in the symbolism [1] $+_5$ [3] = [4].

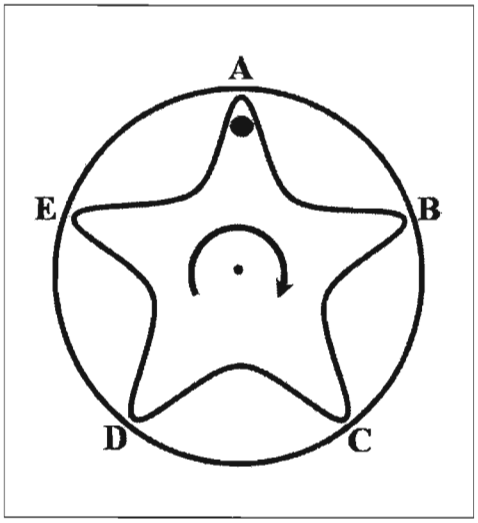
In a similar manner addition modulo 5 can be used with any two subsets in System I. Table 1 summarizes all the possible results that can occur with the $+_5$ addition on pairs of [0], [1], [2], [3], [4]. In the table the first term to be added is found in the first column, and the second term is found along the top row. The unique result for the modulo 5 addition of each pair is shown at the row/column intersection.

Table 1

$+_5$	[0]	[1]	[2]	[3]	[4]
[0]	[0]	[1]	[2]	[3]	[4]
[1]	[1]	[2]	[3]	[4]	[0]
[2]	[2]	[3]	[4]	[0]	[1]
[3]	[3]	[4]	[0]	[1]	[2]
[4]	[4]	[0]	[1]	[2]	[3]

System II is a physical system with a circular dial that has five elements (one with a dot for reference) and five setting positions: A, B, C, D and E. Setting A is the topmost position and each of the other positions are equally spaced around the circle from position A. Thus B is 72° from position A in a clockwise direction, position C is 144° from position A, and D and E are at 216° and 288° respectively from position A. At 360° we are back at position A (which is equivalent to a 0° clockwise direction from position A). Figure 1 depicts the dial and the dotted point A, the initial or 0° rotation position.

Figure 1



The physical motions of the dial turned in a clockwise direction can be expressed in mathematical notation in the following manner: Let T be a 0° rotation of the dial and let T' be a 72° rotation of the dial. Continuing in like manner, we can write:

T : 0° clockwise rotation
T' : 72° clockwise rotation
T'' : 144° clockwise rotation
T''' : 216° clockwise rotation
T'''' : 288° clockwise rotation

For pairs of rotations selected from the list of rotations presented, an operation of "and then" (*) is defined as follows: do the first rotation (first element of the pair) and then do the second rotation (second element of the pair.) For example, starting with the configuration of Figure 1, the pair of rotations (T', T''') with the operation * results in the dotted point moving from position A to position B, "and then" to position E. The other points similarly move one position "and then" three positions. We observe that (T', T''') with the operation *, or (T' * T'''), is associated uniquely with (equivalent to) the rotation T''''. Again for specificity (similar to the construction of Table 1), let the first term in the pair of rotations be taken from the first column in Table 2 and the second rotation be taken from the top row, entering the unique result at the row/column intersection.

Table 2

*	T	T'	T''	T'''	T''''
T	T	T'	T''	T'''	T''''
T'	T'	T''	T'''	T''''	T
T''	T''	T'''	T''''	T	T'
T'''	T'''	T''''	T	T'	T''
T''''	T''''	T	T'	T''	T'''

Establishing Structural Identity Between Systems I and II

If we now let * be replaced by $+_5$ in Table 2, and T, T', T'', T''' and T'''' be replaced by [0], [1], [2], [3] and [4], respectively, then the two tables are shown to be identical. Here is what we have accomplished. We have shown structural identity between two seemingly quite different systems. System I was taken from the abstract set of whole numbers W = {0, 1, 2, 3, ...}, divided into five infinite subsets on which we have shown an operation $+_5$ for all the possible combinations of pairs [0], [1], [2], [3], [4]. System II was illustrated by a physical entity (a circular dial) that had five elements upon which an operation "and then" was defined for all possible pairs of elements (rotations).

In short, System I and System II have exactly the same structure (attributes), even though System I has an infinite number of different representations to express exactly the same structure as System II which has only a finite number of different expressions.

We have the two systems (representing Father and Son) that are distinctly different, one with infinite representations [System I] while the other has only finite expression [System II].

Now to establish the analogue, we associate the Father expression of the Trinity with System I with its infinite representation of attributes (structure). We similarly associate the Son with the finite attributes (structure) of System II. Hence, we have the two systems (representing Father and Son) that are distinctly different, one with infinite representations while the other has only finite expression. Furthermore, the relationship between the two systems is independent of time. Yet, they are identical in a very fundamental (structural) way. While these systems are simple, they do, in some rudimentary way, embody an analogue of the concept of the Trinity that we have set out to illustrate.

This analogue is consistent with Scripture's teaching regarding the Trinity. A number of texts, such as John 1:1 and Phil. 2:6, state that the "fullness of the Godhead" was in Christ before the Incarnation,[41] and in John 1:14 and 1 John 1:1-3 we see that the "fullness of the Godhead" was in Christ during the Incarnation while Jesus was on earth. Thus, from a scriptural point of view, the infinite nature of the Father was fully expressed through his Son.

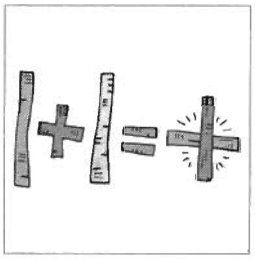
Further, if God's expression of the finite/infinite polarity of his Being through the Father/Son relationship is a constant, time-independent quality, we may consider the present "fullness of the Godhead" (after the Incarnation) as consistent with the constancy of the immanence of God in time and space. The Son is associated with the finite pole of the Godhead expression, reflecting the immanent nature of God, and the Father is associated with the infinite pole, reflecting the transcendent nature of God, not confined to time/space temporality. Under this view, Christ's statement that he was leaving and sending the Holy Spirit to do his work[42] takes on the possible interpretation that the empowerment of the immanent nature of God in time and space (to accomplish God's purposes with his creation and humanity) is the Holy Spirit.[43] The Spirit is also in communication (harmony) with the Father (transcendent/infinite pole), bringing the dynamic quality of Christianity through the "fullness of the Godhead" inherent in Christ to every "present" time.[44] This provides us with a partial response to the concern expressed by Ted Peters when he asserts:

> The fundamental issue regarding the Trinity is not the so-called threeness of God. It is rather the dynamism of the divine life that can redefine itself by self-separating and reuniting, by dying and rising.[45]

Further Considerations

Some further ideas are now considered based on element notions regarding finite sets and infinite sets but without specifying structural properties between the sets such as those expressed in the previous development. In particular, we consider a significant enigma that is apparent regarding the Father and Son concepts of the Trinity and the death of Christ at Calvary. By associating the finite set generated from the points on the dial with Christ and the infinite set of whole numbers with the Father, we note a simple but perhaps conceptually helpful idea for considering the question: "How can God Incarnate (Christ) die and yet the Father abide?" With an infinite number of elements in the set associated with the Father, the nature of the transcendent God remains the same even if a finite number of his elements associated with (supervened upon) the human (finite) attributes of the Son cease forever. One can subtract a finite number of entities from an infinite set (like the finite and infinite sets we have just described) and still have an infinite set of the same type (attributes), although the resulting infinite set is not made up of exactly the same elements.

The notion that the death of Christ implies the death of God the Father is inconsistent with what Scripture teaches



With an infinite number of elements in the set associated with the Father, the nature of the transcendent God remains the same even if a finite number of his elements associated with (supervened upon) the human (finite) attributes of the Son cease forever.

us about the suffering that Christ experienced in his separation from the Father, and the consequent suffering that the Father must have known with the death of his Son. How could the suffering and death in the immanent domain be known in the transcendent domain (in any meaningful or sustained way) if the transcendent domain could perish? If God were amort in both the immanent and transcendent domain, there would be no meaningful description of suffering in the Godhead. The symbolism of the atonement in the Old Testament sacrifices pointing to the One who would be the ultimate, perfect sacrifice as a propitiation for sin would have no meaning if the transcendent God could not sense or know of the suffering being expressed in Christ's death and especially the pain and suffering of separation from the Father that Christ knew on the cross. Moreover, Christ's claims that he would ascend to be with the Father after his death would be meaningless.[46] From a Christian perspective, if God ceased in totality, would this not imply the cessation of all things?

Perhaps one of the greatest reasons for the starkness of the finality of death is our awareness of death breaking all of our relationships in the temporal domain with no hope of restoration in that domain, as we know it. As Christians, we believe that the cessation of physical life only affects what we see and experience in the space/time continuum or immanent domain of God. But our faith would hold that in the transcendent domain there is still some quality of our existence that continues in some fashion or form (e.g., Christ's statement to the man on the cross, "Today you shall be with me in Paradise."). Hence, a possible partial interpretation of Christ's prayer regarding the coming crucifixion and his requesting, "Father, let this cup pass from me," is that from the moment of his physical death the expression of his earthly relationships changed.

However, this break in the space/time dimension would allow an additional quality in the relationship, a quality of completeness of the time/space relationship that could only occur from the Son's fulfillment of the provision for redemption through his obedience, death, and resurrection. Not only does this completeness affect time and space, but it also affects the new heaven and the new earth, along with all qualities of the immanent and transcendent domains. Even in his appearance to Mary Magdalene at the tomb he indicated that he had a different body.[47] The humanity of Christ cried out with the same agony about physical death, as all humanity cries out regarding the crossing of this chasm, but in his spirit Christ knew a greater agony in death awaited him than just the physical aspect of dying. This is indicated by his statement on the cross about the Father forsaking him.[48] The forsaking was obviously not of a total or eternal nature, except for the Father forsaking the Son in the form of the separation brought about by the undeserved sin borne by the Son, which Christ in his humanity agonized over on the cross. At the moment of death the human time/space relationship with the Father was broken forever, as it is in any human death. But the quality of life that transcends the time/space continuum takes on a completeness and eternal quality that is the great hope and joy of Christians and, no doubt, Christ's faith from the human perspective allowed him to cross that chasm of physical death and spiritual agony with the assurance of the wholeness of the eternal relationship of the Father and Son that melded together the physical time/space life into the transcendent life with the Father.

While the continuing life of the Father was never interrupted, it surely bore the sorrow and the pain of the breaking of the time/space relationship with the Son. Thus, the atoning redemptive power of the crucifixion was brought to its fullness in the unimaginable agony of the dying of the Son with the inherent separation of the Son from the Father giving rise to the infinite suffering that could only be experienced by the living Father. The relationship of Christ the Son with the Father was transformed by death. In the Resurrection, a fulfilled relationship of the Son and the Father brings forth for humanity an expectation of an expression of completeness and unspeakable joy which can be shared by those who receive salvation and fellowship with God both in the immanent domain and in the transcendent domain. Thus, Christ was able to pay the price for sin making possible redemption and becoming the cornerstone for believers' faith and salvation. ⁂

With Appreciation

The authors greatly appreciate the helpful comments and counsel in the preparation of this paper. Special gratitude for Dr. Clark Youngblood, professor of Christian studies at Grand Canyon University, for his review and comments. Mr. Jim Armstrong, programs director at Canyon Institute for Advanced Studies (CIAS), provided both input and editing guidance. The valuable insights and comments of the referees were very helpful. Any errors in any domain of this paper are solely the fault of the authors.

Notes

[1]W. G. Rusch, ed., *The Trinitarian Controversy*, trans. W. G. Rusch (Philadelphia: Fortress Press, 1980) 49.

[2]Thomas á Kempis, *The Imitation of Christ*, trans. Leo Sherley Poole (Harmondsworth, 1953) 27.

[3]K. Rahner, *The Trinity*, trans. J. Donceel (New York: Sanbury, 1974).

[4]P. T. Geach, *Logic Matters* (Berkeley: University of California Press, 1972).

[5]W. L. Power, "Symbolic Logic and the Doctrine of the Trinity," *The Illif Review* 32 (1975).

[6]R. Cartwright, "On the Logical Problem of the Trinity," in R. Cartwright, *Philosophical Essays* (Cambridge: Bradford/MIT Press, 1987) 187–200.

[7]J. Macnamara, M. L. P. Reyes, and G. E. Reyes, "Logic and the Trinity," *Faith and Philosophy* 11, no. 1 (January 1994): 3–18.

[8]V. S. Poythress, "Reforming Ontology and Logic in the Light of the Trinity: An Application of Van Til's Idea of Analogy," *Westminster Theological Journal* 57, no. 1 (Spring 1995): 210.

[9]Timothy George is a *Christianity Today* executive editor and dean of Beeson Divinity School at Samford University.

[10]Timothy George, "Is the God of Muhammad the Father of Jesus?" *Christianity Today* 40, no. 2 (February 4, 2002): 35. This article is adapted from his book *Is the Father of Jesus the God of Muhammad?* (Grand Rapids, MI: Zondervan, forthcoming).

[11]Mary T. Clark, "The Trinity in Latin Christianity," in *Christian Spirituality: Origins to the Twelfth Century*, B. McGinn, J. Meyendorff, and J. Leclercq, eds. (New York: Crossroads, 1985), 276–90.

[12]Saint Augustine, *The Trinity* in vol. 45 of *The Fathers of the Church*, trans. Stephen McKenna (Washington, DC: Catholic University of America Press, 1963), 180.

[13]Ibid., 180, 516–8.

[14]Ibid., 271–3.

[15]Ibid., 316–22.

[16]Ibid., 425–8.

[17]An economic view of the Trinity conceives of the Son and the Holy Spirit as functions or expressions of God rather than distinct persons.

[18]Clark, "The Trinity in Latin Christianity," 286–9.

[19]Ibid., 287.

[20]Gregory of Nyssa, "Concerning We Should Not Think of Saying That There Are Three Gods to Ablasius," in W. G. Rusch, ed. and trans., *The Trinitarian Controversy* (Philadelphia: Fortress Press, 1980), 149–61.

[21]Quoted by C. Plantinga, Jr., "Trinity," *International Standard Bible Encyclopedia* 4 (Grand Rapids: Eerdmans Publishing Company, 1988), 919.

[22]Quoted by David Brown, *The Divine Trinity* (London: Gerald Duckworth & Co., 1985), 285.

[23]St. Bonaventure, "Mystical Opuscula," in *The Works of Bonaventure*, trans. Jose de Vinck (Paterson, NJ: St. Anthony Guild Press, 1960), 10.

[24]A. R. Hall and L. Tilling, eds., "December 10, 1692," *The Correspondence of Isaac Newton*, 3 vols. (Cambridge: 1959–1977), III: 234–5.

[25]Richard S. Westfall, *Never at Rest: A Biography of Isaac Newton* (New York: Cambridge University Press, 1980), 313ff.

[26]Yahuda MS 14, ff., 173–3, cited in Westfall, *Never at Rest*, 317.

[27]Ibid.

[28]Wallis, "The Doctrine of the Blessed Trinity Briefly Explained in a Letter to a Friend," in Charles R. Roberts, "The Limits of Reason: John Wallis & His Theology; Orthodoxy, Religious Controversy & Natural Philosophy in Seventeenth-Century England" (master's thesis, Claremont Graduate School, 1995), 9. Another mathematician who sought evidence of the Trinity in mathematics was William Hamilton, a nineteenth-century scholar who invented the algebra of "quaternions" while seeking an algebra based on triples of numbers. See Gene B. Chase, "How Has Christian Theology Furthered Mathematics," in *The Role of Beliefs in Mathematics and the Natural Sciences: An Augustinian Perspective*, vol. 2 of *Facets of Faith and Science*, ed. Jitse M. van der Meer (Lanham, MD: University Press of America, 1996), 202–4.

Fifteenth century theologian Nicholas of Cusa also considered an analogy from geometry. In *De venatione sapientiae*, Cusanus suggests a geometrical model of the Trinity in which the Trinity is a "perfect triangle with three perfect sides." The "two equal sides of a right triangle are constructed and the arc of the circle whose radii are formed by the two sides is to be drawn so that the third side of the triangle is the chord corresponding to the arc." The sides of this triangle are extended to infinity. Cusanas claims that at some point in the expansion, the two sides, the chord, and the arc of the circle all become the same infinite straight line. Quotations translated by Clyde Lee Miller in *Reading Cusanus: Metaphor and Dialectic in a Conjectural Universe* (Washington, DC: The Catholic University of America Press), 224–5.

[29]Karl Heim, *Christian Faith and Natural Science* (New York: Harper and Bros., 1953).

[30]Charles S. MacKenzie, *The Trinity and Culture* (New York: Peter Lang Publishing, Inc., 1987), 111–2.

[31]John 10:30.

[32]John 14:9.

[33]Col. 2:9. In commenting on this passage, Greek scholar A. T. Robinson notes that Paul is saying that "'all the *pleroma* of the Godhead,' not just certain aspects, dwells in Christ and in bodily form ... dwells now in Christ in his glorified humanity ... " A. T. Robinson, *Word Pictures in the New Testament* IV (Nashville: Broadman Press, 1931), 491.

[34]For example, see Luke 22:28 where Jesus states: "My Father has granted me a kingdom" and John 14:23 in which Jesus says: "If anyone loves me, he will keep my word; and my Father will love him, and we will come to him, and make our abode with him." See also, Matt. 6:30, 33; 7:21; 10:33; 11:25–27; 16:15–17; 18:19; 26:39, 42, 64; Mark 15:34; Luke 2:49, 11:2; 22:28; 23:34, 46; John 14:15–18. The authors would like to thank Jim Armstrong, CIAS Programs Director, for pointing out these passages.

[35]See, e.g., Matt. 26:42 and many of the texts cited in endnote 26.

[36]For example, note Mark 6:4–6, in which Jesus tells his disciples: "A prophet is not without honor except in his hometown and among his own relatives and his own household. And he could do no miracles there except that he laid his hands upon a few sick people and healed them."

[37]See, e.g., Matt. 15:24, John 3:16–17, and Luke 10:16.

[38]At the outset we have the question of whether God can experience physical death. In addition, Jesus refers to being forsaken by God (Mark 15:34), and committing his spirit to God (Luke 23:46).

[39]Taken from Col. 2:9, New American Standard translation.

[40]Rather than suggesting a third system to represent the Holy Spirit such that all three systems are isomorphic, we will propose later in the paper that perhaps the Holy Spirit can be envisioned in relation to the particular systems developed and the rule of association between them. Many homomorphisms (isomorphisms) could be constructed other than the one presented in this paper that could allow for more meaningful interpretations, but considering the increased complexity of the mathematical concepts needed to construct more interpretive models, the authors decided on the ones presented in order to minimize the mathematical conceptualizations needed.

[41]From a mathematical point of view, groups are said to be isomorphic (or structurally identical) if they differ only in the names of their elements. An isomorphism of group A onto group A' is a homomorphism that is one to one and onto A'. A map of group A into a group A' is a homomorphism if and only if $\varphi(ab) = \varphi(a)\varphi(b)$ for all $a,b \in A$. See John B. Fraleigh, *A First Course in Abstract Algebra*, fifth ed. (Reading, MA: Addison-Wesley Publishing Company, 1993), 161–226; Richard Laatsch, *Basic Algebraic Systems: An Introduction to Abstract Algebra* (New York: McGraw-Hill Book Company, 1968), 76–96.

[42]John 14:26; Acts 1:4–5.

[43]Ted Peters, *God as Trinity: Relationality and Temporality in Divine Life* (Louisville: Westminster/John Knox Press, 1993), 14.

[44]E.g., John 20:17; John 14:1–3.

[45]John 20:17.

[46]Another way to view the Holy Spirit in the Godhead expression in the model presented would be to associate the notion of the Holy Spirit with the relationship between System I and System II that is expressed by the mapping or rule that prescribes the correspondence of elements between the two systems. Then the finite is constantly associated with the transcendent (Father) and empowered through the Holy Spirit's presence.The time independent quality of the mapping or rule between the two systems provides for an "always" component for the two systems we have used and the relationship between them. This economic Trinity concept of the Holy Spirit as a mapping relationship is not unlike that of Nicholas of Cusa who considered the Holy Spirit to be the nexus between the Father and the Son. See Cusanas' *De visione Dei*, chap. 17 and *De pace fidei*, chap. 8, 24.

[47]The proposed analogue using isomorphisms allows us to consider the role of Holy Spirit in either an economic or immanent Trinity. From an economic Trinity perspective, the Holy Spirit may function as a mapping relationship or nexus between the two systems. Within an immanent Trinity, the Holy Spirit may be seen as a distinct infinite system which remains in eternal communication with the Father and the Son.

[48]Mark 15:34.

Books Received and Available for Review

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

Philip Clayton, *In Whom We Live and Move and Have Our Being: Panentheistic Reflections on God's Presence in a Scientific World*, Eerdmans, 320 pages, 2004

M. A. Cremo, *Human Devolution: A Vedic Alternative to Darwin's Theory*, Torchlight Publishing, 554 pages, 2003

Paul Davies, *The Cosmic Blueprint*, Templeton Foundation Press, 222 pages, 2004

George A. Erickson, *Time Traveling With Science and the Saints*, Prometheus Books, 177 pages, 2003

Kitty Ferguson, *The Fire in the Equation: Science, Religion, and the Search for God*, Templeton Foundation Press, 300 pages, 2004

Owen Gingerich, *The Book Nobody Read: Chasing the Revolutions of Nicholaus Copernicus*, Walker and Co., 306 pages, 2004

W. R. Godfrey, *God's Pattern for Creation: A Covenantal Reading of Genesis 1*, P & R Press, 142 pages, 2003

Susan Haack, *Defending Science Within Reason*, Prometheus Books, 410 pages, 2003

M. Heller, *Creative Tension: Essays on Science and Religion*, Templeton, 182 pages, 2003

Heather Hendershot, *Shaking the World for Jesus: Media and Conservative Evangelical Culture*, Chicago University Press, 255 pages, 2004

John Horgan, *Rational Mysticism: Dispatches from the Border Between Science and Spirituality*, Houghton Mifflin, 292 pages, 2003

Harold Koenig & Douglas Lawson, *Faith in the Future: Healthcare, Aging, and the Role of Religion*, Templeton Foundation Press, 220 pages, 2004

James Martin-Schramm & R. L. Stivers, *Christian Environmental Ethics: A Case Method Approach*, Orbis Books, 320 pages, 2003

Dorothy McDougall, *The Cosmos as the Primary Sacrament: The Horizon for an Ecological Sacramental Theology*, Peter Lang, 190 pages, 2003

T. L. Nichols, *The Sacred Cosmos: Christian Faith and the Challenge of Naturalism*, Baker Book House, 240 pages, 2003

Ted Peters, *Science, Theology, and Ethics*, Ashgate, 350 pages, 2003

Ted Peters & Martinez Hewlett, *Evolution from Creation to New Creation: Conflict, Conversation and Convergence*, Abingdon Press, 215 pages, 2003

S. G. Post, *Human Nature and the Freedom of Public Religious Expression*, Notre Dame Press, 2003

Samuel Powell, *Participating in God: Creation and Trinity*, Fortress Press, 238 pages, 2003

Anne Primavesi, *Gaia's Gift: Earth, Ourselves and God After Copernicus*, Routledge, 150 pages, 2003

Jeffrey Pugh, *Entertaining the Triune Mystery: God, Science, and the Space Between*, Trinity Press International, 194 pages, 2003

R. J. Rolwing, *Digging Up Darwin in Ohio Without Holding Your Nose*, Xlibris, 220 pages, 2003

Fazale Rana and Hugh Ross, *Origins of Life: Biblical and Evolutionary Models Face Off*, NavPress, 300 pages, 2003

Thomas Shannon, ed., *Reproductive Technologies: A Reader*, Sheed and Ward Book, 145 pages, 2004

Geoffrey Simmons, *What Darwin Didn't Know: A Doctor Dissects the Theory of Evolution*, Harvest House, 315 pages, 2004

M. G. Towne, *Honest to Genesis: A Biblical and Scientific Challenge to Creationism*, Publish America, 380 pages, 2003

Allen Verhey, *Reading the Bible in the Strange World of Medicine*, Eerdmans, 400 pages, 2003

Joseph Vining, *The Song Sparrow and the Child: Claims of Science and Humanity*, Notre Dame University Press, 216 pages, 2004

Cletus Wessels, *Jesus In The New Universe Story*, Orbis Books, 240 pages, 2003

The Invisible Link Between Mathematics and Theology

Ladislav Kvasz

If we compare the mathematics of antiquity with that of the seventeenth century, we find differences in a whole range of aspects. For the ancients, notions like infinity, chance, space, or motion fell outside mathematics, while in the seventeenth century new mathematical theories about these notions appeared. I believe that this fundamental change can be ascribed to the influence of theology. For the ancients, ontology and epistemology were in unity. They considered the world to be as it appeared to them; the phenomena as infinity or chance, which appeared to them as ambiguous, they held to be really so. For modern humanity, ontology and epistemology differ in a fundamental way. The being of the world is determined by the omniscient God, therefore it is perfect, while our knowledge of the world is determined by our finite capacities, and therefore it is ambiguous. It is this gap between ontology and epistemology, which makes the mathematicization of notions such as infinity or chance, despite their apparent ambiguity, possible.

Ladislav Kvasz

In the history of mathematics, we can find several topics that reveal a direct connection between mathematics and theology. Perhaps the most famous of them is set theory, connected with the transition from the concept of the potential infinity to that of the actual infinity. In the works of Bernard Bolzano and Georg Cantor, the founders of set theory, we find theological influences, the analysis of which plays an important role in the understanding of the history of that theory.[1]

Another topic revealing the encounter of mathematics and theology is mathematical logic. Gottlob Frege and Bertrand Russell mark the end of a long tradition focused on critical examination of the various proofs of God's existence, in the course of which many of the principles of modern logic were discovered.[2] To illustrate this, it is sufficient to mention Kant's thesis, according to which existence is not a real predicate. Kant formulated this thesis in his criticism of Anselm's ontological proof of God's existence (as existence is not a real predicate, from the premise that all positive predicates apply to God, his existence does not follow). In mathematical logic, Kant's thesis is one of the principles of the syntax of predicate calculus. In accordance with this principle, existence is formalized by using quantifiers and not predicates. Nevertheless, besides such direct connections between mathematics and theology we also can find a hidden but, in my view, an even more important influence of theology on mathematics. This hidden influence concerns the boundary, discriminating the phenomena open to mathematical description from those which defy mathematical description.

An ... important influence of theology on mathematics ... concerns the boundary ...

In the first part of this article, I present five examples from the history of mathematics that illustrate the deep changes which occurred in this discipline between the late antiquity and the early modern era. Each of these examples, taken separately, is well known in the history of mathematics, but by putting them together a *common pattern of change* seems to appear. In each of the five cases, a phenomenon considered by the ancients to defy mathematical description

Ladislav Kvasz *was born in Bratislava in 1962. He graduated in 1986 in mathematics at the Comenius University in Bratislava. In 1995, he defended the thesis "Classification of Scientific Revolutions" and received a Ph.D. in philosophy. Since 1986, he has been a lecturer at the Faculty of Mathematics and Physics of Comenius University. He became a reader of courses in history of mathematics in 1999. Currently, Ladislav's main field of interest is history and philosophy of exact sciences, which he attempts to connect to a broader cultural background. His address is: Department of Humanities, FMFI-UK, Mlynská dolina, 84248 Bratislava*

The mathematics of the sixteenth and seventeenth centuries was not simply a revival of the ancient tradition. It differed from the mathematics of the sixteenth and seventeenth centuries in a whole range of aspects, which, in my view, can be ascribed to the influence of monotheistic theology on mathematics.

was mathematicized. The thesis of this article is that monotheistic theology with its idea of the omniscient and omnipotent God, who created the world, indirectly influenced the process of this mathematicization. In *separating ontology from epistemology*, monotheistic theology opened the possibility to explain all of the ambiguity connected to these phenomena as a result of human finitude and so to understand the phenomena themselves as unambiguous, and thus accessible to mathematical description.

Shifts of the Boundaries of Mathematicization in Early Modern Era

If we want to analyze the implicit, indirect way in which monotheistic theology influenced the development of western mathematics, it seems appropriate to compare the mathematics of late antiquity with that of the sixteenth and seventeenth centuries. In this later period, western mathematics, after long centuries of decline and stagnation, finally reached an intellectual level comparable with the late Hellenistic era, characterized by the work of Archimedes and Apollonius. Comparing the mathematics of these two epochs, we find a surprising fact. The mathematics of the sixteenth and seventeenth centuries was not simply a revival of the ancient tradition. It differed from the mathematics of the sixteenth and seventeenth centuries in a whole range of aspects, which, in my view, can be ascribed to the influence of monotheistic theology on mathematics. In order to get a better understanding of these aspects, I will concentrate on five notions that underwent radical changes. These are the notions of infinity, chance, the unknown, space, and motion.

1. *Apeiron*—infinity. What we refer to today as infinite was in antiquity subsumed under the notion of *apeiron* (απειρον). Nevertheless, compared with our modern notion of infinity, the notion of *apeiron* had a much broader meaning. It applied not only to that which was infinite, but also to everything that had no boundary (i.e. no *peras*), that was indefinite, vague, or blurred. According to ancient scholars, *apeiron* was something lacking boundaries, lacking determination, and therefore uncertain. Mathematical study of *apeiron* was impossible, mathematics being the science of the determined, definite, and certain knowledge. That which had no *peras* could not be studied using the clear and sharp notions of mathematics.

Modern mathematics, in contrast to antiquity, makes a distinction between infinite and indefinite. We consider the infinite, despite the fact that it has no end (*finis*), to be determined and unequivocal, and thus accessible to mathematical investigation. Be it an infinitely extended geometrical figure,[3] an infinitely small quantity[4] or an infinite set,[5] we consider them as belonging to mathematics. The ancient notion of *apeiron* was thus divided into two notions: the notion of the *infinite* in a narrow sense, which became a part of mathematics, and the notion of the *indefinite*, which, as previously, has no place in mathematics.

2. *Tyché*—randomness. Another difference between the ancient and modern mathematics appears in the understanding of randomness (*tyché*–τυχη). The notion of *tyché*, similarly to that of *apeiron*, had a much broader meaning than our modern notion of randomness; besides random events, it also designated chance, luck, and fate in general. Therefore, it was not accessible to mathematical investigation. *Tyché* belonged in the competence of an oracle than that of mathematics. For ordinary people, their personal fate remained hidden. From the sixteenth century onward, books on gambling started to appear in mathematical literature, and during the seventeenth century, the modern probability theory developed from this tradition.[6] From the viewpoint of ancient scholars, a mathematical theory of *tyché* is just as absurd as a mathematical theory of *apeiron*. And in the case of *tyché*, the breakthrough toward modern mathematics happened along the same lines, as it did in the case of *apeiron*: the ancient notion was divided into two concepts. The first of them, the concept of randomness, became the subject of the theory of probability, while the second one, the notion of fate, remained beyond the boundaries of exact sciences.

3. *Arithmos*—unknown. The third change has to do with the birth of algebra, and especially with the notion of the unknown, which since Descartes is most often expressed by the letter x. Algebra was created in the Arabic civilization, as the name of this math-

ematical discipline indicates. The Arabic civilization is monotheistic, similar to western civilization. Thus, following my thesis about the implicit connection between monotheistic theology and modern mathematics, the birth of algebra can be placed beside the birth of the theory of probability and the mathematical theory of the infinite.

First of all, I would like to stress that the ancient mathematicians did not know the notion of the unknown in its modern, algebraic form. Of course, in antiquity, mathematicians dealt with a rich variety of practical problems, requiring them to find a certain number. The Greek mathematicians usually called this the unknown number (*arithmos*—αριθμος). However, in solving such problems they proceeded in a synthetic way, using only the values of the known quantities given in the formulation of the problem. The unknown quantity, precisely because it was unknown, could not be used in arithmetical operations.

The basic idea of algebra is to represent the unknown by a letter and subject it to the same arithmetical operations as ordinary numbers.[7] The purpose of the algebraic symbolism is to overcome the epistemological barrier separating those quantities we know from those we do not know. Thus in algebra, we work with both the known as well as the unknown quantities, as if they were equivalent. From the point of view of ancient mathematics, this is something absurd, because if we do not know the value of a quantity, we cannot determine the outcomes of the arithmetical operations applied to it. According to the ancient understanding, what is undetermined cannot become the subject of mathematical operations.

The birth of algebra consisted of the creation of a notion of the unknown, which, despite its undetermined value, can be used as if it was fully determined. I believe that this notion can be put alongside the notions of infinity and randomness to represent the third important breakthrough of the boundaries of the sharply given, by which the world of mathematics was characterized in the ancient understanding.

4. *Kenón*—space. A change analogous to that of the notions of infinity, probability, and the unknown occurred in the transition from the ancient to modern mathematics in the understanding of space. Closest to our modern notion of space was the ancient notion of emptiness (kenón—κενον). For the ancient philosophers, with the exception of the atomists and the Epicureans, the notion of emptiness was problematic. Emptiness is where there is nothing, and so it has no specific attributes that can be studied. Not even the atomists, who accepted the existence of emptiness, were able to say much about it. Thus emptiness is surely not suitable to become a subject for mathematics. Mathematical knowledge is characterized by clear and precise notions, which is definitely not the case with the notion of emptiness.

Nevertheless, early modern science is founded on the mathematical notion of space. Newton, for instance, took the absolute space to be one of the fundamental categories of his system, and he explicitly referred to it as "mathematical" space.[8] Thus, in complete analogy to the previous three cases, a further region is mathematicized—a region that from the ancients' point of view defied any mathematicization. The new mathematical notion of space is a narrowing of the original notion of *kenón*, just as infinity was a narrowing of *apeiron* and probability was a narrowing of *tyché*. We can assert that space is three dimensional, orientable and continuous; we can hardly ascribe any of these attributes to emptiness.

From the ancient notions, which were broad and ambiguous [apeiron, tyché, kenón, and kinesis], narrow and specific parts [infinity, randomness, space, and motion] were separated, and it was only these narrower notions that were mathematicized.

---

5. *Kinesis*—motion. For the last example illustrating the differences between ancient and modern mathematics, let us turn to the notion of motion. The Greek notion of *kinesis* (κινησις), which designates motion, has a much broader meaning than our modern notion of motion. Besides the change of position in space, it encompasses growth, aging, and change of color. According to the ancient understanding of mathematics, *kinesis*, like *apeiron* and *tyché*, defied mathematicization. Aristotle explained why it is impossible to describe *kinesis* in mathematical terms. For an ancient scholar, a mathematical theory of *kinesis* would be the same absurdity as a mathematical theory of *apeiron* or a mathematical theory of *tyché*. The mathematicization of motion introduced by Galileo has many aspects analogous to the previous cases of mathematicization described above: the broad and general ancient notion of *kinesis* was divided into two notions. One of them was narrower, including only changes of position (i.e., local motion) and the other, a broader one, included the rest. Galileo developed a mathematical science only for the narrower notion of local motion.[9]

A Common Pattern of the Shifts of the Boundaries of Mathematicization

In the previous section, I brought together some examples documenting that, in the early modern era, some new mathematical disciplines were founded (*algebra, probability theory,* and *kinematics*) and a radical change occurred in our understanding of *infinity* and *space*. If we compare these five new areas of mathematical scholarship with ancient mathematics, we can see that in ancient times all of these areas were considered to defy mathematical description. The mathematicization of these areas in the sixteenth and seventeenth centuries have many common features. The first of them is that the ancient notions of *apeiron, tyché, kenón,* and *kinesis* were much broader than our modern notions of infinity, randomness, space, and motion, which became the bases of the new mathematical disciplines. Today we strictly discriminate between the infinite and the indeterminate, between randomness and fate, between emptiness and space, between motion and change. Thus from the ancient notions, which were broad and ambiguous, narrow and specific parts were separated, and it was only these narrower notions that were mathematicized.

The success of modern mathematics consisted precisely in that it has found a way to overcome the residual ambiguity of the narrow notions of infinity, probability, space, and motion.

The second common feature of the changes discussed above is that the new, narrow notions of infinity, probability, space, and motion still preserved some degree of ambiguity. However, this residual ambiguity was much weaker than the original ambiguity of the ancient notions. This weakening of ambiguity was very important, because it was precisely the ambiguity of the notions of *apeiron, tyché, kenón* and *kinesis* that led the Greek mathematicians to consider these notions as defying mathematical investigation. The success of modern mathematics consisted precisely in that it has found a way to overcome the residual ambiguity of the narrow notions of infinity, probability, space, and motion.

Now we come to the third common feature of the above-mentioned changes. Let us first take the notion of infinity. While for the ancients *apeiron* was a negative notion associated with going astray and losing the way, for the medieval scholar, the road to infinity became the road to God. God is an infinite being, but despite his infiniteness, he is absolutely perfect. As soon as the notion of infinity was applied to God, it lost its obscurity and ambiguity.[10] Theology made the notion of infinity positive, luminous, and unequivocal.[11] All ambiguity and obscurity encountered in the notion of infinity was interpreted as the consequence of human finitude and imperfection alone. Infinity itself was interpreted as an absolutely clear and sharp notion, and therefore an ideal subject of mathematical investigation.

Similarly, in the case of the notion of randomness, the consequence of God's omniscience was that the ambiguity of this notion has lost its ontological dimension and was reduced to a simple epistemological negativity. God knows the outcome of every toss of a dice in advance, and it is only due to the finiteness of the human mind that this knowledge remains hidden for us. Thus a random event, at least from God's point of view, is precisely determined and therefore suitable for mathematical description. Now it becomes comprehensible how the idea of a totally deterministic universe and the classical interpretation of probability could originate in the same mind, namely in the mind of Pierre Simon de Laplace. Determinism and randomness are two aspects of the same reality. Determinism is the ontological side and probability the epistemological side of the same world. According to Laplace, the world is absolutely deterministic, but to the human mind, it is opened only in a probabilistic way.

A similar tension between the ontological definiteness (necessary for the application of arithmetical operations) and epistemological indefiniteness is characteristic in the notion of the unknown in algebra. The unknown is unknown for us, finite beings. For God there are no unknowns at all. As soon as he looks at the formulation of an algebraic problem, he immediately sees the value of the unknown. He has no need to solve the equations, because due to his omniscience, he immediately knows the solutions. Thus, in a way similar to the case of the theory of probability, in algebra too, the *ontological ambiguity,* which prevented the Greeks from mathematicizing this area, was transformed into an *epistemological ambiguity,* having its

roots in human finiteness and therefore being irrelevant with respect to mathematicization.

The case of kinematics is similar. On the ontological level, motion is perfect and absolutely determined. The fact that it appears to us as something ambiguous (for instance, we are not able to decide whether the free fall is accelerated or not) is a consequence of our imperfection alone. The notion of space is even clearer. In his *Scholium generale,* Newton characterized the absolute space as *Sensorium Dei.* Therefore the possibility of its mathematicization originates in God's perfection. To humans, only the relative, empirical space is accessible.

Monotheistic Theology as a Source of the Shifts of the Boundaries of Mathematicization

In summary, ontology and epistemology were in unity for the ancients. They considered the world to be as it appeared to them; the phenomena, which appeared to them as ambiguous and dim, they held to be really so. For modern humanity, ontology and epistemology differ in a fundamental way. The being of the world is determined by God, therefore it is unequivocal and perfect. On the other hand, our knowledge of the world is determined by the finite capacities of the human mind, and therefore it is ambiguous and dim. It is precisely this gap between epistemology and ontology, which makes possible the mathematicization of regions that are opened to us only in an ambiguous way. If all of the perceived ambiguity is attributed only to human finitude—i.e., if it is interpreted as epistemological—the mathematicization on the ontological level becomes possible.

This shows that monotheistic theology probably played a more important role in the creation of modern mathematical sciences than usually admitted. Monotheistic theology brought about a fundamental change of the general epistemological background, in that it separated ontology from epistemology. This separation led finally to the birth of modern mathematics with its notions of infinity, probability, the unknown, space, and motion. The fundamental differences between early modern mathematics and the mathematics of the Hellenistic period can be perhaps characterized as breaking of the boundaries of the unequivocally given and opening of the world of mathematics to the ambiguously given phenomena such as infinity, randomness, or motion. This is a fundamental change, perhaps the most important one since the discovery of proof and of the idea of an axiomatic system. And this fundamental change, this radical break towards modernity, is most likely linked with monotheistic theology.

Monotheistic theology brought about a fundamental change of the general epistemological background, in that it separated ontology from epistemology. This separation led finally to the birth of modern mathematics with its notions of infinity, probability, the unknown, space, and motion.

Of course, the evidence given by five episodes from the history of mathematics is far from being conclusive. My aim is not to settle the question of the role of theology in the development of science and mathematics, but to propose an indirect method of its study. As Max Weber analyzed the role of Protestant ethics in the development of modern capitalism, in a similar way, it is possible to analyze the role of monotheistic theology in the development of modern science. Monotheistic theology, like Protestant ethics, did not directly influence its development. Rather, it helped to create conditions in which the development of modern science became possible. ⁂

Acknowledgments

I would like to thank to Botond Gaal, Donald Gillies, Eberhard Knobloch, and Pavol Zlatos for their criticism of the previous versions of this paper. I would like to express my gratitude to the *Alexander von Humboldt Foundation* for a scholarship at the Technical University in Berlin, which made it possible for me to write this paper. I am grateful to the editor, Roman J. Miller, and to the two anonymous referees for their helpful comments and their assistance in the preparation of the final text.

Notes

[1]For the discussion of the role of theological ideas in the work of Georg Cantor (1845–1918) see chapter 6 in J. W. Dauben, *Georg Cantor: His Mathematics and Philosophy of the Infinite* (Princeton: Princeton University Press, 1979); M. Hallet, *Cantorian Set Theory and Limitation of Size* (Oxford: Clarendon Press, 1984), and chapter VIII in J. Ferreirós, *Labyrinth of Thought. A History of Set Theory and Its Role in Modern Mathematics* (Basel: Birkhauser, 1999). The theological background of the works of Bernard Bolzano (1781–1848) on set theory is discussed in P. Zlatos, *Ani matematika si nemôze byt*

istá sama sebou, Úvahy o mnozinách, nekonecne, paradoxoch a Gödelovych vetách (Even mathematics cannot be certain about itself, Essays on sets, infinity, paradoxes, and Gödel's theorems, in Slovak) (Bratislava: IRIS, 1995).

[2]See Zlatos, *Ani matematika si nemôze byt istá sama sebou*; P. Hajek, "*Goedeluv dukaz existence Boha*" (Gödel's proof of God's existence, in Czech) in J. Malina and J. Novotný, eds., *Kurt Goedel* (Brno: Universitas Masarykiana, 1996), and P. Zlatos, *Gödelov ontologicky dôkaz existencie Boha* (Gödel's onthological proof of God's existence, in Slovak) in J. Rybár, ed., *Filozofia a kognitívne vedy* (Bratislava: IRIS, 2002).

[3]One of the first infinitely extended geometrical figures was studied by Evangelista Torricelli (1608–1647) in 1646. See D. J. Struik, *A Source Book in Mathematics, 1200–1800* (Cambridge, MA: Harvard University Press, 1969), 227–32.

[4]Infinitely small quantities were used by Johannes Kepler (1571–1630) in his *Nova stereometria doliorum vinariorum*, published in Linz in 1615 and by Galileo Galilei (1564–1642) in his *Discorsi e dimonstrazioni matematiche, intorno a due nuove scienze; attenenti alla mecanica i movimenti locali*, published in Leiden 1638. See Struik, *A Source Book in Mathematics, 1200–1800*, 192–209.

[5]The notion of an infinite set was introduced by Bolzano in his *Paradoxien des Unendlichen* in 1851. See B. Bolzano, *Paradoxien des Unendlichen* (Hamburg: Felix Meiner, 1975).

[6]One of the first books on gambling was *Liber de Ludo Aleae* (Book on Games of Chance) written by Gerolamo Cardano (1501–1576) before 1565. See O. Ore, *Cardano the Gambling Scholar* (Princeton: Princeton University Press, 1953). The theory of probability arose from the works of mathematicians such as Pierre de Fermat (1601–1665), Blaise Pascal (1623–1662), Christian Huygens (1629–1695), Johann Bernoulli (1667–1748), Abraham de Moivre (1667–1754), and many others. See F. N. David, *Games, Gods and Gambling: A History of Probability and Statistical Ideas* (London: Charles Griffin, 1962).

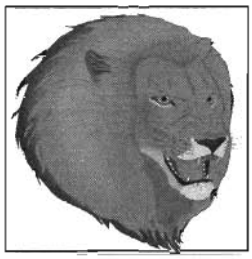
[7]Al Khwarizmi introduced around 820 three operations with the unknown: *al gabr*, *al muquabala* and *al radd*. From the first of them, algebra got its name. See B. L. van der Waerden, *A History of Algebra: From al-Khwarizmi to Emmy Noether* (Berlin: Springer, 1985).

[8]The notion of absolute space was introduced by Isaac Newton (1643–1727) in the Sholium at the beginning of the first book of the *Philosophiae Naturalis Principia Mathematica* published in 1687.

[9]Galileo laid the foundations of kinematics in *Discorsi e dimonstrazioni matematiche, intorno a due nuove scienze; attenenti alla mecanica i movimenti locali* published in 1638.

[10]The change of the attitude toward the notion of infinity can be seen by Nicolaus von Kues (1401–1464), see E. Knobloch, *Unendlichkeit und Mathematik bei Nicolaus von Kues* in A. Schürmann and B. Weiss, eds., *Chemie–Kultur–Geschichte, Festschrift für Hans-Werner Schütt* (Berlin: Verlag für Geschichte der Naturwissenschaften und der Technik, 2002), 223–4.

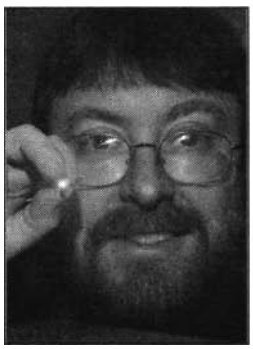
[11]A discussion of the theological background of modern science can be found in A. Funkenstein, *Theology and the Scientific Imagination* (Princeton: Princeton University Press, 1986) or in B. Gaal, *The Truth of Reason and the Reality of the World* (Debrecen: Debrecen Reformed College, 2002).



Why Were Dangerous Animals Created?

David Snoke

Nature is filled with many examples of violent and ferocious creatures. Many Christians cannot imagine that God would create such things in an unspoiled, "very good" world. To explain their existence, some Christians hold to a view that demons created such things, while other Christians hold to a view that all such things were created as a response to human sin. The latter view typically entails belief in a recent creation. I argue that violent and dangerous creatures are affirmed as good creations of God in the Bible, and discuss the biblical rationale for their creation.



David Snoke

My grandfather loved the outdoors, and often taught me camping tips and facts of nature. One of his favorite sayings was "NITRIC"—"Nature In The Rough Is Cruel." By this acronym, he warned every woodsman to remember that nature, real nature, can treat you in the same harsh way it treats its own. We may like to see pictures of fuzzy animals, but if we ever forget NITRIC when we are alone in nature, we may come to a quick end.

Why is nature so cruel? We recoil when we see some activities in nature: insects eating their mates, mothers eating their young, sharks ripping their prey to shreds, and parasites sucking the lifeblood from their hosts. In Darwin's famous example, one type of larvae eats a spider from the inside out, allowing the vital organs to live until it has eaten all of the rest of the spider. Why does nature have such creatures?

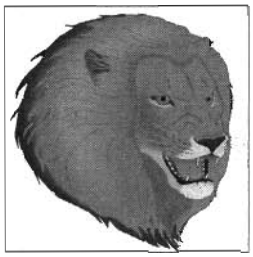
As amply documented by C. G. Hunter,[1] Darwin and most Victorians could not imagine that God would create creatures that did such things. Those who pointed to evidence of God's design in nature looked exclusively for attributes of cooperation, sharing, and harmony in nature. These aspects of life certainly exist in nature, but other aspects also exist: inefficiency, competition, and violence. As scientists studied nature in greater detail, they found many things that did not fit into the preconceptions Victorian Christians had for how God would have made things. This created a serious theological problem—if our view of the character of God says he would not allow something, and then we see it does exist, how can we believe in God?

Darwin, and many after him, solved this problem by separating God from nature. Either God did not exist at all, or God is fundamentally divorced from the world of nature. In this view, the cruelty of nature arises with no rhyme or reason—nothing but blind forces drive nature. God perhaps set up these forces, and we can honor him for the outcome of their actions in the overall balance of nature, but we cannot attribute the specific design of all creatures to the handiwork of God.

Many Christians rejected Darwin's theory, and many in the creationist movement continue to reject it to this day. However, a great number have affirmed Darwin's starting point, that certain types of animals are not good, and therefore God would not create such animals in a good world. This is one of the fundamental arguments made against interpreting the fossil record in terms of animals fighting and dying over millions of

If our view of the character of God says he would not allow something, and then we see it does exist, how can we believe in God?

David Snoke *is associate professor of physics and astronomy at the University of Pittsburgh. He has published extensively on his research on the optics of semiconductors and other materials. He received his bachelor's degree in physics from Cornell University in 1983 and his Ph.D. from the University of Illinois at Urbana-Champaign in 1990. He is an ASA member and licensed to preach in the Presbyterian Church in America. He and his wife have homeschooled their four children, and he has recently published an integrated curriculum on physics, theology, and philosophy aimed at homeschoolers and Christian schools, available at www.arn.org. David may be contacted by email: snoke@pitt.edu.*



Article

Why Were Dangerous Animals Created?

The main force of argument for an utter divorce of God from his creation, at one extreme, and for young-earth creationism, at the other extreme, stems from the view that some types of life could not be part of a "very good" creation.

years before people existed. Genesis 1 says that the world created by God was "very good," while these things seem obviously "bad."

Recently, the creationist movement has been stimulated by the scientific analysis of the Intelligent Design movement, represented by authors such as Michael Behe,[2] William Dembski,[3] and Phillip Johnson.[4] The Intelligent Design movement is faced with a dilemma, however. Do we point to all life as examples of good design, or do we exclude some types of life as bad? If we say that all life is well designed, then we must include sharks and parasites and other things that do not fit the preconceptions that many people have of good things God would make. If we say that God did not design such things, then we undermine the Intelligent Design argument, saying that such complicated things could arise without the intervention of God.

This dilemma is well appreciated by opponents of the Intelligent Design movement. Often, when speakers like Phil Johnson or Michael Behe present their cases for the design of life or the universe, the response of those who oppose them is not to debate the facts that they present, but to ask a question such as, "Yes, but how do you explain the existence of parasites? Did God create parasites?"[5]

Some creationists affirm that God created these things, but only as a judgment on humankind after Adam and Eve had sinned. This creates another dilemma. The Intelligent Design movement says that we should accept the appearances of things—if something appears designed, then it is designed. But to most scientists, the earth appears to have had millions of years of fighting and dying animals before people existed. If we deny these appearances, holding out for recent creation of all things which involve animal death, can we fault the Darwinist who denies the appearance of design, holding out for a naturalistic mechanism for the design of life?

These dilemmas arise only if we agree that God would not make dangerous animals in a good world. Although there are other arguments, the main force of argument for an utter divorce of God from his creation, at one extreme, and for young-earth creationism, at the other extreme, stems from the view that some types of life could not be part of a "very good" creation. Therefore, we must revisit our assumptions and ask what the Bible says about them.

The Gap Theory and Demonic Creation

If we assume that God would not make dangerous animals, then perhaps someone else made them. One argument made by some Christians is that demons created all of the cruelty in nature. The Bible teaches that demons exist. But the view that demons created all natural cruelty has two severe problems from a biblical perspective. First, the Bible never teaches this. There is no story of demons twisting God's creation, no story of anyone but God creating things. Second, saying that demons created all of these cruel things gives demons more than their due. Demons are never credited with creative power in the Bible, only destructive power. Only God bears the title of Creator. God constantly vaunts his works of creation; for example, Rom. 1:20 says that we see *God* in nature, not the handiwork of evil demons.

In response to the first objection, Christians who believe in demonic responsibility for natural cruelty often promote the Gap theory,[6] which says that between Gen.1:1 and 1:2 a lengthy story of demonic activity took place—a war in heaven, followed by the casting of demons to earth, and then followed by a massive twisting of animal nature to demonic ends. To support this theory, they point to Jer. 4:23, which says that after a battle in Israel, the land was "formless and void," the same words used in Gen. 1:2. From this they conclude that this phrase implies the destructive aftermath of a battle.

This argument is, to say the least, tenuous. Is it not more likely that Jer. 4:23, written long after Genesis, was using the imagery of Genesis 1 to describe an empty wasteland? In effect, it was saying: "There was so much destruction that the land was sent back to the barrenness of the world as it was before God created life." One single verse in Jeremiah associated with war does not prove that this phrase must always mean "there had been a war." Instead of taking the plain meaning of the words, those who hold to the Gap theory read an entire war into

one-half of a verse. Genesis 1 at face value is a seamless narrative about God's sovereign acts of creation, not a disjointed story of creation, warfare, destruction, and reconstruction.

The second objection to demonic creation has even more weight. In ascribing to the demons the power to create new species, they set them up as almost equal with God. Some would argue that the demons did not create new species, they just "twisted" them to evil behaviors. This explanation indicates a lack of knowledge of the types of things found in creation. Some species, such as sharks and viruses, are perfectly designed killing machines. They could not have had other behavior without being entirely re-designed from scratch. Like turning an Oldsmobile into a heat-seeking missile, "twisting" a shark from a friendly creature to its present form would amount to a new creation. The Bible in no place credits demons with the power to do any such thing. According to Scripture, demons could not even light a fire when asked (1 Kings 18). To give them such credit nearly amounts to demon worship.

God Takes Credit

If not demons, then we have only two other choices – either (1) God created these dangerous species, or (2) God is not in control of the world. The second choice amounts to either atheism or dualism. The Bible, on the other hand, is full of statements which give God the credit for creating all things, including all kinds of cruel things. In the latter chapters of the book of Job, for example, God takes credit for creating several things which may surprise us.

- God takes credit for the "birth pangs" of wild goats (39:3), far from the influence of any humans. This is a representative example of animal suffering without any human influence.
- God takes credit for creating the "ostrich" which he "did not endow with wisdom," so that she is "cruel to her young" (39:16–17). This is a representative example of another type of "natural evil" – creatures which neglect their young or even eat them. God claims this behavior as his own creation. One also can include in this category all types of behaviors which imply overproduction and inefficiency in propagation, such as animals in rut which attempt to copulate with the wrong thing (such as a dog on a person's leg), animal homosexuality, and all types of creatures which disperse seed in places where it will never grow up.
- God takes credit for creating creatures like the eagle, whose babies "drink blood" (39:30). This is a representative example of carnivorous animals. The carnivorousness is not an "aberrant" behavior of the creatures, but part of their behavior from birth. Besides the eagle, God mentions the lion, which hunts its prey (38:39), and the raven (38:41), which eats only dead creatures, as creatures of which he is proud.
- God takes credit for the warhorse, which "strikes terror" into the hearts of those around it (39:20). The horse loves warfare (39:25). This is a representative of animals which not only practice violence, but seem to love it. Cats which seem to enjoy torturing mice also fall into this category.
- God takes credit for creating the "leviathan," which has "rows of sharp teeth" (41:14). This is a representative example of animals that are designed for killing.

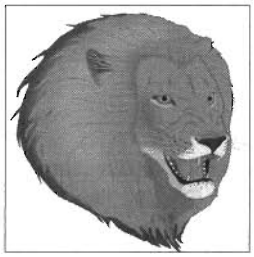
The main force of argument for an utter divorce of God from his creation, at one extreme, and for young-earth creationism, at the other extreme, stems from the view that some types of life could not be part of a "very good" creation.

God does claim direct responsibility for the creation of natural evil, that is, things in nature which terrorize us. ... God neither apologizes for making these things, nor weeps over them – he glories in them.

In Isa. 45:6–7, God also talks of his creative acts:

> I am the Lord, and there is no other. I form the light and create darkness, I bring prosperity and create evil. I, the Lord, do all these things ... Woe to him who quarrels with his Maker, to him who is but a potsherd among the potsherds on the ground. Does the clay say to the potter, "What are you making?" ... It is I Who made the earth and created mankind upon it. My own hands stretched out the heavens; I marshaled their starry hosts.

Note that God says that he creates "evil." This word is translated "disaster" in the New International Version (NIV), but is the exact same Hebrew word as "evil" elsewhere in the Old Testament, and therefore I have used that word in the above passage. The translators of the NIV chose "disaster" because many theologians have argued that the "evil" which God claims to create here is "natural evil," not human sin. I agree that human sin is not in view here as the "evil" which God has created. But God does claim direct responsibility for the creation of natural evil, that is, things in nature which terrorize us.



Article

Why Were Dangerous Animals Created?

The natural world is filled with numerous harsh and cruel things, but those who hold to the Fall-recreation view would say that the Bible has a remarkable silence about the creation of such things.

This type of passage is common in Scripture. The Psalmist, for example, praises God for his acts of creation:

> He appointed the moon for seasons, the sun knows its going down. You make darkness, and it is night, in which all the beasts and creatures of the forest creep about. The young lions roar after their prey, and seek their food from God (Ps. 104:19–21).

Again, carnivorous animals are included in the things which God appointed along with the sun and moon. God neither apologizes for making these things, nor weeps over them—he glories in them.

The Fall-Recreation Theory

Although Scripture has many passages in which God takes credit for these things, we react against this claim. How can a good God make such creatures? In the beginning, God made all things "very good." How can such creatures be good?

Many Christians answer this question by saying that God did create them, but they are not "very good." In this argument, God did not make these creatures in the beginning; the world of Genesis 1 knew nothing of them. Instead, God created them only after the Fall of humankind into sin.[7] All of these creatures came into being as part of the curse on the ground that God gives in Gen. 3:17. Because of this, God is not ultimately responsible for these terrible things; humans are. All of these things are part of God's response to human sin.

Romans 5:12 which says "death came through sin" is sometimes used to support this view. Carnivorous animals, it is argued, could not have existed before death. Romans 8:20–22 also is used to support this view, which says that "the creation was subjected to frustration, not by its own choice, but by the will of the one who subjected it, in hope that the creation itself will be liberated from its bondage to decay and brought into the glorious freedom of the children of God." The argument is made that the "subjugation" of the creation to futility could only have come about because of human sin.

While this is a common view among Bible-believing Christians, it has several major problems. First, like the Gap theory, which says that natural evil was created by demons in a major war that Scripture just happens to brush past in going from Gen. 1:1 to 1:2, this view also inserts a major event into a passage in Scripture that, on the face of it, says no such thing. The sum total of the effect on the natural world mentioned in the curse of Genesis 3 is that the ground will produce thorns and thistles. There is no mention of the creation of entirely new species like sharks and lions which are designed to kill, no mention of new species like larvae and parasites which cause suffering, no mention of any major change in the natural world at all. Adam and Eve depart from the garden into a world that—for all we can tell—is pretty much the same as it always was. The picture of the curse is an exile into a pre-existing "outer darkness." This theme of the curse as an outward motion runs throughout Scripture (e.g., Exod. 29:14, Lev. 10:4, 16:10, Num. 15:35, Matt. 25:30, Heb. 13:12–13, Rev. 22:15).

Second, in the most straightforward reading, Genesis 1 describes the creation of all of the animals and plants we know. There are not two creation stories in the Bible, one for the good things and one for the bad things—there is only one creation story. The natural world is filled with numerous harsh and cruel things, but those who hold to the Fall-recreation view would say that the Bible has a remarkable silence about the creation of such things. There are millions of carnivorous species in the world today. If all of these carnivorous species came into being only at the Fall, then we must imagine a creation event nearly as dramatic as the original creation. Yet all the Bible mentions when Adam and Eve are cursed is that thistles will grow in the fields.

Some would say that the things created in Genesis 1 are the same species we know today as carnivorous and cruel or stupid creatures, but at the Fall they were "twisted" only a small bit to obtain their present forms. As discussed above, this view shows only ignorance about the degree of specialization of the design of carnivorous and parasitical creatures. To change a tapeworm from a friendly, nonparasitical creature into its present form is akin to changing an Oldsmobile into a heat-seeking missile. Can we even imagine a nonparasitical tapeworm?

Third, Genesis 1 specifically includes "great sea monsters" among the things created before the Fall (Gen. 1:21, KJV). Some translations mute this name to be "great sea creatures," but the Hebrew really is better translated "sea monsters," or "great reptile monsters." This Hebrew word is equated with another Hebrew word, the "leviathan," in at least two places in Scripture, Isa. 27:1 and Ps. 74:13–14. Hebrew poetry often acts as a dictionary, by saying the same thing twice in different words, a stylistic device known as parallelism. In these two passages, the "great sea monster" is parallel with the "leviathan." This is important, because as we have seen in Job 41, the leviathan is clearly described as a ferocious carnivore with rows of sharp teeth. While some may want to say that chapters 38–41 of the book of Job are speaking of God's creation of animals after the Fall, at least one of these creatures is specifically mentioned in Genesis 1 as existing before the Fall. We are twisting Scripture if we try to make the "monsters" of Genesis 1 anything less than monstrous. Some Christians will fight all day for the literal meaning of the word "day" in this chapter, but they nevertheless try to avoid the most natural meaning of the word for "sea monster."

The presence of the sea monsters is less surprising if we understand the significance of the presence of the sea in Genesis 1. To many of us, the sea is a wonderful place to spend a vacation, but to the ancient Hebrews, the sea was a place of dread, not only because of the power of the waves and storms, but also because of the lurking sea monsters (which may have included sharks and whales as well as reptilian creatures). The sea is never presented in a positive light; it is always the instrument of destruction, from Noah's flood to the destruction of Pharaoh's army to the storms which nearly killed Jonah and Paul. In the book of Revelation, when the wonderful New Jerusalem is unveiled, the striking statement is made "there will no longer be any sea" (21:1). This may disappoint ocean lovers, but the symbolism comes from the Hebrew view of the sea: the sea represents terror, and in Heaven there will be no terror.

The message of the creation story, which is told not only in Genesis 1 but throughout the rest of Scripture, is that God created that terrifying sea, but he is sovereign over it and holds it back. All of the following passages have this theme, God created the sea as a terrifying force but told it "thus far you may come and no further": Job 38:8, Ps. 33:7, Ps. 93:4, Prov. 8:29, and Jer. 5:22. The sea monsters are part of this terror, constantly mentioned in connection with the sea. See Job 7:12, Ps. 74:13, Ps. 104:25, Isa. 27:1, Hab. 1:14, and Amos 9:3.

In other words, we may read Genesis 1 with modern eyes and see it as an idyllic, peaceful world, but for the ancient Hebrew, the presence of the sea in Genesis 1 gave a very different picture. It said that the dangerous things of the world were under God's control. The sea and the sea monsters were created by God and ruled by him.

Fourth, if the argument for this view is that animal death and suffering could not deserve the pronouncement of "very good" in Genesis 1, then how can they be good now? Yet Scripture teaches that all things are good.

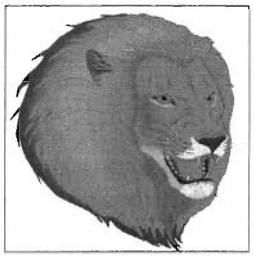
For the ancient Hebrew, the presence of the sea in Genesis 1 ... said that the dangerous things of the world were under God's control. The sea and the sea monsters were created by God and ruled by him.

Martin Luther said:

> For all that God made "was very good" (Genesis 1:31) and is good to this day, as the apostle says in 1 Timothy 4:4, "Every creature of God is good," and in Titus 1:15, "To the pure all things are pure." It therefore becomes vain, evil and noxious, etc., without its fault and from the outside, namely, in this way: because man does not judge and evaluate it rightly and because he enjoys it in a wrong way.[8]

As Luther says, Scripture never teaches that God says "now things are not good." Rather, in the most direct reading, Genesis 1 deals with the creation of the things we know now, and these things are very good. Scripture supports this view with statements that the things which are created testify to us about God. Romans 1:20 says: "For since the creation of the world God's invisible qualities—his eternal power and divine nature—have been clearly seen, being understood from what has been made." If the things in nature today are "bad," does that then mean that God's nature is bad? If some are bad and some are good, how do we know the difference, and glorify God for some and not for others? It would seem from this passage that *all* things testify about God's nature. In the speech made by God at the end of Job discussed above, it is also hard to miss how God vaunts the *goodness* of the creatures he mentions, such as the blood-sucking eagle babies and the terrible-toothed leviathan. God does not say such things are bad. Rather, he humbles Job by pointing out the greatness of these things, in aspects such as their power, diversity, and unique abilities.

What about the passages from Romans used to support the Fall-recreation view? As stated above, Rom. 8:20–23



Article

Why Were Dangerous Animals Created?

Animals do not have eternity in their hearts. Is it therefore a great evil if they die? The Bible does not say it is evil if animals die; it says it is a great evil if people die like the animals.

says that the whole creation has been subjected to "futility." Nothing in this passage connects this futility to the sin of Adam and Eve, however. In fact, the exact language of Rom. 8:22 favors the view that it has been subjected to futility since the beginning. This verse says: "We know that the whole creation has been groaning as in the pains of childbirth right up to the present time." The phrase "right up to the present time" is best translated as "all the way up to the present time"; in other words, "from the beginning up to now," *not* "from some intermediate time up till now."

Reading the passage this way implies that futility has been part of the creation since the beginning. Is there any other scriptural support for this? Yes, in the famous book of futility, Ecclesiastes. The first chapter begins with a litany of statements about the futility of the world. "Futility," also translated "vanity," refers to the fact that things which are done get undone—things strive for life but die, people work for money but lose it, etc. Ecclesiastes 1 gives a list of various types of futility, which include "the sun rises and then it sets" and "the streams flow to the sea, but the sea is never full. To the place the streams come from, there they return again." What is significant here is that these things—the alternation of day and night, and the balance of the land and the seas—are present in Genesis 1 *before* the Fall. It is only at the end of Revelation, in the New Heaven and Earth, that there is no darkness and no sea. In the world of Genesis 1, these futility elements exist from the beginning. Futility, or vanity, does not imply badness. Instead, the word for futility ("*habel*" in Hebrew) refers to something which has no concrete weight in itself, something which is temporary and fleeting, not evil. Vain things become evil only if we grasp them too hard, instead of grasping onto the Creator.

Another futility symbol in Genesis 1 is the grass of the field. The grass, specifically mentioned in Gen. 1:11–12, is also used in numerous passages (e.g., 2 Kings 19:26; Pss. 37:2, 103:15; Isa. 40:6, 51:12; Matt. 6:30, and 1 Pet. 1:24) to symbolize futility, as something which shoots up and dies quickly. (Although several different Hebrew words are used for grass, these are all equated in Isa. 37:27 as plants which dry up quickly.)

If we add in the evidence of carnivorous creatures like the "great sea monsters," Genesis 1 presents a picture of futility from the very beginning. This does not make the world bad, however. Ecclesiastes bemoans the fact that humankind is trapped in the cycles of futility in this world. As discussed in the next section, if humans are exempted from these cycles by having eternal life, then the futility of the world should not bother us.

As mentioned above, Rom. 5:12 and a similar passage, 1 Cor. 15:21, are also used to argue for a re-creation at the Fall. But these verses, which say "death came from sin" and "death came through a man," do not have animal death in view at all. This is clear in the last phrase of Rom. 5:12: "death came through sin, and in this way death spread to all men, because all sinned." The same is true of the 1 Corinthians 15 passage, which goes on to say: "For as in Adam all die, so in Christ all will be made alive. But each in his own turn: Christ, the firstfruits; then, when he comes, those who belong to him." The contrast is between people who die and people who belong to Christ and therefore live forever.

Animal Death and Human Death

Many Christians believe that no animals died before the Fall, although the Bible does not teach this doctrine explicitly anywhere. If no animals died, then there clearly would be a problem with overpopulation on an earth millions of years old if the creatures multiplied as they presently do. This is one reason why many Christians insist on a young earth, with only a few days before the Fall of Adam and Eve. This explanation does not completely solve the problem, however, because some species of insects are so prolific that if they multiplied at present rates, they would have covered the earth six feet deep by the end of one week, if none of them died. Nevertheless, if one rejects the possibility of animal death before the Fall, the young-earth view looks much more attractive than the old-earth view.

The basic argument against animal death before the Fall is that death is bad, and therefore could not have existed in a "very good" world. This brings us to the core of the problem. On what basis do we say that animal

death, suffering, and stupidity are "bad" and therefore a good God could not have made them?

The primary argument seems to consist of anthropomorphization. We imagine ourselves in the place of the animal or insect, and shudder to think of such things happening to *us*. But we are not animals. Is it valid to say that what is bad for people is bad for animals?

Many in the modern world would certainly say so. But this is because the modern world has lost the sense of the distinctiveness of humans as made in the image of God. Scholars now argue that whatever animals do is natural for humans, too—if animals fornicate in public or kill their young, then so may we. By extension, one may argue that it should be normal to defecate in public, eat one's mate (after all, some spiders do it), fight over food, etc.

The Bible stands against this behavior. Starting with Genesis 1, the Bible creates a clear distinction between people and animals. People have the image of God (1:27) and have dominion over all the plants and animals (1:28). This separateness includes the hope of eternal physical life. In Genesis 2, Adam and Eve are given the Tree of Life which they may eat of and live forever; in the New Testament, those who are in Christ are promised a new eternal body (1 Cor. 15:35–44).

Notice that eternal physical life was not automatic and natural for Adam and Eve. They had to eat of a special tree. By implication, if they did not eat of it, they would die by natural causes. This principle is stated explicitly by God in Gen. 3:22, when he says: "And the LORD God said, 'The man has now become like one of us, knowing good and evil. He must not be allowed to reach out his hand and take also from the tree of life and eat, and live forever.'" At the end of the Bible, when people are given eternal physical life again in Heaven, they once again eat of the Tree of Life (Rev. 22:2).

No animals ate of the Tree of Life. Why should we assume, then, that they had eternal life? If death was natural for Adam and Eve, if they did not eat of the Tree, then why should it not be natural for animals? This is then the curse on humankind—to be denied the Tree and treated just like the animals. Psalm 49 makes this explicit: "Man, despite his riches, does not endure; he is like the beasts that perish" (49:12) and "A man who has riches without understanding is like the beasts that perish" (49:20).

People were not meant to die, because God ordained a special role for people. People have eternal spirits; animals do not. Our reaction against animal death, then, comes from imagining ourselves in their place and feeling that for *us*, death and suffering like that would be a great evil. We know in our hearts that we were meant for something more. Death and suffering are "futility," and while futility is natural for animals, *we* revolt against it. As 1 Corinthians 15 teaches, death is an "enemy" (15:26) to be vanquished when we gain new, glorified bodies. This is the message of Ecclesiastes. We see that we are subject to death and suffering, but we cannot live with the idea of being just like the animals in this way. Ecclesiastes 3:10–11 says:

> I have seen the burden God has laid on men. He has made everything beautiful in its time. He has also set eternity in the hearts of men; yet they cannot fathom what God has done from beginning to end.

We are trapped in time, but we know that we belong to eternity, and wish for eternal life. Eccles. 5:16 says: "This too is a grievous evil: As a man comes, so he departs, and what does he gain, since he toils for the wind?"

But animals do not have eternity in their hearts. Is it therefore a great evil if they die? The Bible does not say it is evil if animals die; it says it is a great evil if people die like the animals.

We may not like animal death and suffering, but the fact is that the Bible does not say anywhere that such things are bad, in and of themselves. If animals do not have eternal life, then their deaths are no more significant than the breaking apart of a rock or the evaporation of a pool of water. A rock can give praise to God in its existence, and so can an animal, as a beautiful thing, but neither was meant to last forever.

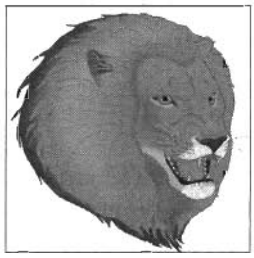
Why?

The biblical case seems sound enough, but we still react against the idea. Why, why? Why did God do it that way? How can God be good and make animals suffer and die?

If God's character is eternal and unchanging, as the Bible says, then if we see wrath in nature now, we should expect he would reveal this aspect of his character from the very start.

At one level, God reserves the right to be inscrutable. No one can fathom the reasons for all he does (Job 11:7; Ps. 145:3; Eccles. 3:11, 11:5; Isa. 40:28). We must simply trust him when he tells us it is all "very good," as Martin Luther said in the quote above.

At another level, however, there is at least one very obvious lesson in all of it: God is dangerous and powerful. Paul says this explicitly: "For since the creation of the



Article

Why Were Dangerous Animals Created?

God, as ... revealed in Scripture and in nature [is] powerful, uncontrollable, and able to pour out extreme violence, yet also [is] just, merciful, and able to bless beyond all our expectations.

world God's invisible qualities—his eternal power and divine nature—have been clearly seen." (Rom. 1:20). God's power is clearly seen—he is capable of creating severe pain and great destruction.

This is an unpopular doctrine, but it is throughout the Bible. Many times people read the Bible and are turned off by the amount of wrath in it. Not only the Old Testament, but the New Testament is filled with wrath. Some people think Jesus preached only love, but we hear about Hell more from the lips of Jesus than from any other speaker in the Bible. The entire Gospel revolves around the idea of avoiding God's wrath; in fact, God pours out his wrath on his Son so that we may avoid it. The book of Revelation has page after page of wrath. Both the Old Testament and the New Testament describe God as a warrior (Exod. 15:3, Rev. 19:11).

Many people say they do not believe that God is wrathful, but on what basis do they say that? Is it because nature is so gentle and kind that the God who created nature could not have done and said all of those wrathful things in the Bible? On the other hand, some people who believe in the Bible say that they do not believe God would create cruel things. On what basis do they say that? Is it because of the complete lack of cruelty and wrath in the Bible? We have two things which agree completely—the Bible and nature—in giving us a stark picture of God's wrathful nature, but instead of accepting them, we reject both. On what basis, then, do we reject them? Merely our own wishes? If religion is about believing what is true, not just what we wish was true, then surely we must swallow the hard pill that God, the real God who exists and created the world, is not just the way we would like him to be. This is why many people hate him. But they cannot say it is illogical to say that God has wrath. What is illogical is to believe in a God who would never harm a flea, when we see lots of harmed fleas around us.

This fact may drive some people to prefer atheism, but even nature's terrors testify that God exists. We must marvel at the shark, even while fearing it. It is well designed, frighteningly so. So also are many parasites. It is hard to believe that such well-designed weapons could arise by chance—they are "good" designs. Darwinism, of course, tries to give us an explanation for this apparent design without referring to God, but the real force of the argument against intelligent design of these things is theological. As documented by C. G. Hunter,[9] Darwinists typically do not rely on demonstrating ways in which design can easily arise by random forces. Instead, they frequently bring up notions of God; in particular, they argue that God would not create "bad" things such as violence, redundancy, and inefficiency.

Those who believe that all natural evils arose after the Fall of humankind cannot avoid this point. If it would have been bad for God to have made wasp-eating larvae before the Fall, how is it now justified? If we say that the only merit in making natural evil is to punish humans, then how are we punished by the death of a wasp? If we say, on the other hand, that the death of the wasp serves as a reminder to us of the wrath of God, why could that not have been the case *before* the Fall? God's wrath did not suddenly spring into existence when Adam and Eve sinned, and God had no desire to hide this side of his nature. Romans 1:20 says that the character of God has been seen in what has been made since the very beginning of creation. If God's character is eternal and unchanging, as the Bible says, then if we see wrath in nature now, we should expect that God would reveal this aspect of his character from the very start.

The story of Genesis 2 clearly shows that God wanted to remind people of his wrath even before the Fall. He makes a very real threat to Adam and Eve: "In the day you eat of it, you shall die" (2:17). Has anyone ever wondered how Adam and Eve knew what he was talking about? If there was no death in their world, God's words would have been meaningless. Just as God's threat of wrath existed before the Fall, so also the agents of wrath existed before the Fall.

This brings us to an important theological point. Many Christians have the view that Adam and Eve were in Paradise, then lost it, but in Heaven we will get that same Paradise back. This is not correct. The world of Genesis 1–2 is completely different from the world of Revelation 21–22. As discussed above, in the description of Heaven in Revelation 21–22, we find no darkness, no sea, no death, no threats or tests, and no evil spirits. In the world of Genesis 1–2, we find darkness, the sea with sea monsters, the

threat of death from the lips of God himself, and an evil spirit lurking about. The Garden of Eden was not Heaven! Humankind did not have glory and honor; humankind was on probation. The world of Genesis 1–2, our world, was not meant to last forever. Humankind was tested for obedience to a positive command (Be fruitful and fill the earth) and a negative one (Do not eat from the Tree of Knowledge of Good and Evil). The Garden of Eden was typological of Heaven, as a special place of God's miraculous protection, but it was not the same as Heaven. Just like the tabernacle of Moses, which Heb. 8:5 takes as symbolic of Heaven, the Garden had an inner place near to the presence of God and an outer place of separation from God.

If Adam and Eve had obeyed and passed the test, they would not have stayed in the same world forever. How could they, if they were fruitful and multiplied and never died? At some point, the world with its finite surface would be overpopulated unless God took them to Heaven. We do not know what God would have done in that case, but we can say that this world was not meant to last forever. We see this in the fact that the world which *will* last forever, described in Revelation 21–22, is utterly different from the one we live in now. Jesus also made this point when he said: "When the dead rise, they will neither marry nor be given in marriage" (Matt. 22:30, Mark 12:25, Luke 20:35). In the Garden of Eden, marriage was a central theme of the whole story!

We therefore cannot use pictures of Heaven to argue what creation looked like before the Fall. Humankind did not lose Heaven at the Fall; they were never in it. Yet God is loving, because the door is not slammed shut. We still can reach Heaven through the work of Jesus, who solved our main problem—the wrath of God.

Conclusions

The view pressed on us by both Scripture and nature is that God created all kinds of scary things to demonstrate his wrath and power from the very beginning. If humankind had never fallen, we could have looked at these things from a distance and not have been subject to them like the animals. Having fallen, we are cast into that world along with the animals.

The clear message of Genesis 1 is that all creatures of God are very good even if they frighten us with their ability to terrorize. There is no other creation story in Scripture, whether in a gap between Gen. 1:1 and 1:2, or in a gap between Gen. 3:24 and 4:1. The creation story of Genesis 1 is the creation story of *our* world; the passage goes to great lengths to say that God created all of the plants and animals at this time, including scary ones like great sea monsters.

Does this change our view of God? Only for the better. Proverbs 1:7 defines the beginning of wisdom as the fear of God. Jeremiah 5:22 defines what the fear of God is:

> "Should you not fear me?" declares the LORD. "Should you not tremble in my presence? I made the sand a boundary for the sea, an everlasting barrier it cannot cross. The waves may roll, but they cannot prevail; they may roar, but they cannot cross it."

That sea which appears in Genesis 1, along with all the other things created, should cause us to "tremble."

Does this mean that we should not strive against disease and death, then, because they were created by God? Absolutely not. People were meant to live forever as physical beings, and every effort to diminish human suffering and death is a recognition of the holiness and specialness of human life. We have no equivalent mandate to preserve the life of every animal, however. If all death is evil, it would seem to follow unavoidably that we must fight against all animal death, becoming vegetarians and teaching sharks not to kill. The Bible gives a very different view, however. According to the Scriptures, we have dominion over the animals and plants, using them wisely and not wasting their lives, but we may kill them and let them exhibit their killer nature. The great evil is not the suffering and death in nature, but our own sin which causes us to act like animals and suffer the judgment of dying like them.

The young-earth creationist and the atheist Darwinist have in common their belief that God would never create killer things. The atheist removes God from the picture to account for the natural evils of this world, while the young-earth creationist removes the record of killer animals from the picture to preserve the goodness of God. Both of these views need to interact with a fully biblical picture of God, as he is revealed in Scripture and in nature—powerful, uncontrollable, and able to pour out extreme violence, yet also just, merciful, and able to bless beyond all our expectations. ⁂

Notes

[1]C. G. Hunter, *Darwin's God: Evolution and the Problem of Evil* (Grand Rapids, MI: Brazos Press, 2001). This book reviews at length the issue of natural evil as treated by Christians in the past two centuries, including Christian evolutionists.

[2]M. J. Behe, *Darwin's Black Box: The Biochemical Challenge to Evolution* (New York: Free Press, 1996).

[3]W. A. Dembski and M. Behe, *Intelligent Design: The Bridge Between Science and Theology* (Downers Grove, IL: InterVarsity Press, 1999).

[4]P. Johnson, *Darwin on Trial* (Downers Grove, IN: InterVarsity Press, 1993).

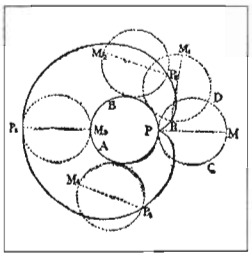
[5]For example, this was precisely the line of attack taken by Gerald Massey in response to a talk by Owen Gingrich on March 14, 1997 at the Philosophy Department of the University of Pittsburgh, which I attended, in which Gingrich described the fine tuning in the structure of stars. Johnson and Behe were presented with the same line of argument recently on *Firing Line* on national television.

[6]For example, see G. H. Pember, *Earth's Earliest Ages* (Revell, 1900), reprinted in several subsequent editions.

[7]For example, H. M. Morris, *The Twilight of Evolution* (Grand Rapids, MI: Baker Book House, 1963).

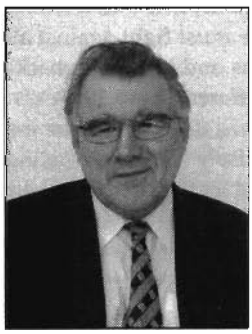
[8]Martin Luther, *Lectures on Romans*, W. Pauck, trans. (Philadelphia: Westminster Press, 1961).

[9]Hunter, *Darwin's God.*



Venn's Diagram in Mathematics and Its Application to Theological Ethics

Igor Kišš



Igor Kišš

Various analogia entis *can provide great help as we try to understand theological truth better.*

In order to understand theological theories, it is sometimes necessary to simplify them through analogies. This was Jesus' own purpose in his parables. Again and again, Jesus drew new analogies from everyday life. To express it in theological language, we would say that the parables use a certain kind of *analogia entis*, designed to help us understand theological theories. For example, Jesus used the analogy of a father's love for his lost son to help us deepen our understanding of God the Father's love for us (Luke 15:11–32). In another parable, using the analogy of wheat and weeds, Jesus made a point about how wrong it would be for anyone to try to exterminate all the bad people in this world, explaining that injustice might be caused by such radical actions (Matt. 13:24–30, 34–43).

Various *analogia entis* can provide great help as we try to understand theological truth better. According to Paul Tillich, it is possible to model such analogies because of the analogy between the human *logos* and the divine *Logos*.[1] Of course, we cannot construct theological conclusions and new theological axioms on the basis of analogies, especially when the biblical revelation does not give us answers to our questions. That would mean developing a certain *theologia naturalis*. Karl Barth is right when he looks critically upon the *analogia entis* in theology as the source of new articles of faith. However, Barth goes too far in his critique of *analogia entis* in his discussion with Erich Przywara, when he categorically refuses every *analogia entis*.[2]

If we use *analogia entis* only as parables and analogies to clarify what we already have received in the revelation, then every *analogia entis* (in this sense) is useful. That is to say, analogies and parables were used by Jesus to give us a better understanding of God's Word. In other words, we can say that there is an admissible form of *analogia entis* and an inadmissible form of *analogia entis*. Inadmissible use of analogy aspires to draw theological conclusions from the natural world about the nature of God that either exceed or contradict biblical revelation. Admissible use of analogy accepts the truth of biblical revelation and seeks to communicate that truth by using analogies drawn from the natural world.

However, creating parables drawn from everyday life, as Christ often did in the gospels, is not the only way of using analogies. In this paper,[3] I would like to show how mathematics is also a proper form of *analogia entis* for communication and illustration. I do not wish to develop a new kind of *theologia naturalis*. I only use it for pedagogical clarity as do the parables of Jesus.

We must consciously step back from highly philosophical and speculative scholastic concepts about *analogia attributionis* and *analogia proportionalis*, which we encounter in the teachings of Thomas Aquinas, Duns Scotus, Cardinal Cajetan, Suarez, and, more recently, Erich Przywara. Elementary overviews of these concepts can be found in any theological lexicon under the relevant head-

Igor Kišš *teaches dogmatics and ethics at the Evangelical Theological Faculty of the Comenius University in Bratislava, Slovakia. From 1997 to 2003, he was the dean of the faculty. His special field of interest is the theology of Luther, and he wrote his dissertation on Luther's ethics of the Church. Another of his works is "Christian Responsibility for the World according to Luther." Kišš's work is also published in German and American theological journals (in the USA particularly the* Luther Digest*). He is the member of the European ethical society* Societas Ethica *and a participant in the dialogue between science and Christian faith. Correspondence can be sent to: kiss@fevth.uniba.sk*

ings.[4] Instead of philosophical speculation, we will deal with the practical application of the analogies of mathematics and theology. We can make use of them in elementary education in theological ethics and catecheses.

One Case of Usage of Mathematics in Ethics

In this paper, I would like to deal with one mathematical case, which might well clarify complicated relationships in theological ethics. This is the so-called "Venn's diagram," (see Figure 1 below) which belongs to the mathematical theory of sections. Using these circles, Venn interestingly shows how there can be different relationships among mathematical sets. They can be of triple character, such as in the relation of integration, conjunct, and adjunct. But that is exactly the same for the relationships among various kinds of laws in ethics. Students of theology, as well as high school students in their religion classes, often have a hard time understanding what the mutual relations might be between *lex Christi* (Christ's Sermon on the Mount) and *lex naturalis* (natural law).

Lex naturalis is the highest human principal of the natural moral code. But how is it different from Christ's Sermon on the Mount, and how are these two relatively identical? What is the relation between these two forms of law and the civic moral code, which used to be defined as *lex gentium*, or conventional morality? And what is the relation among all of these three and immorality? Because of the difficulty of these relations, a high school student is often confused. The difficulty comes at those points of intersection of the four sets of laws (*lex Christi, lex naturalix, lex gentium, lex amoralis*), where other ethical subsets arise. Very quickly we can find ourselves in an ethical labyrinth, where it is not always easy to orient ourselves in order to determine proper ethical behavior. Here again the mathematical analogy of the Venn circles can help us understand various kinds of ethical behavior. The application of the Venn circles, which students know from their high school math classes, can illuminate a lot and also can lead to interesting discussions on the questions of theological ethics. (Theoretically sixteen aggregates should emerge. In our diagram, we use only nine because the others are empty aggregates. It would not do to have an overlapping of the *lex Christi* and *lex amoralis*.)

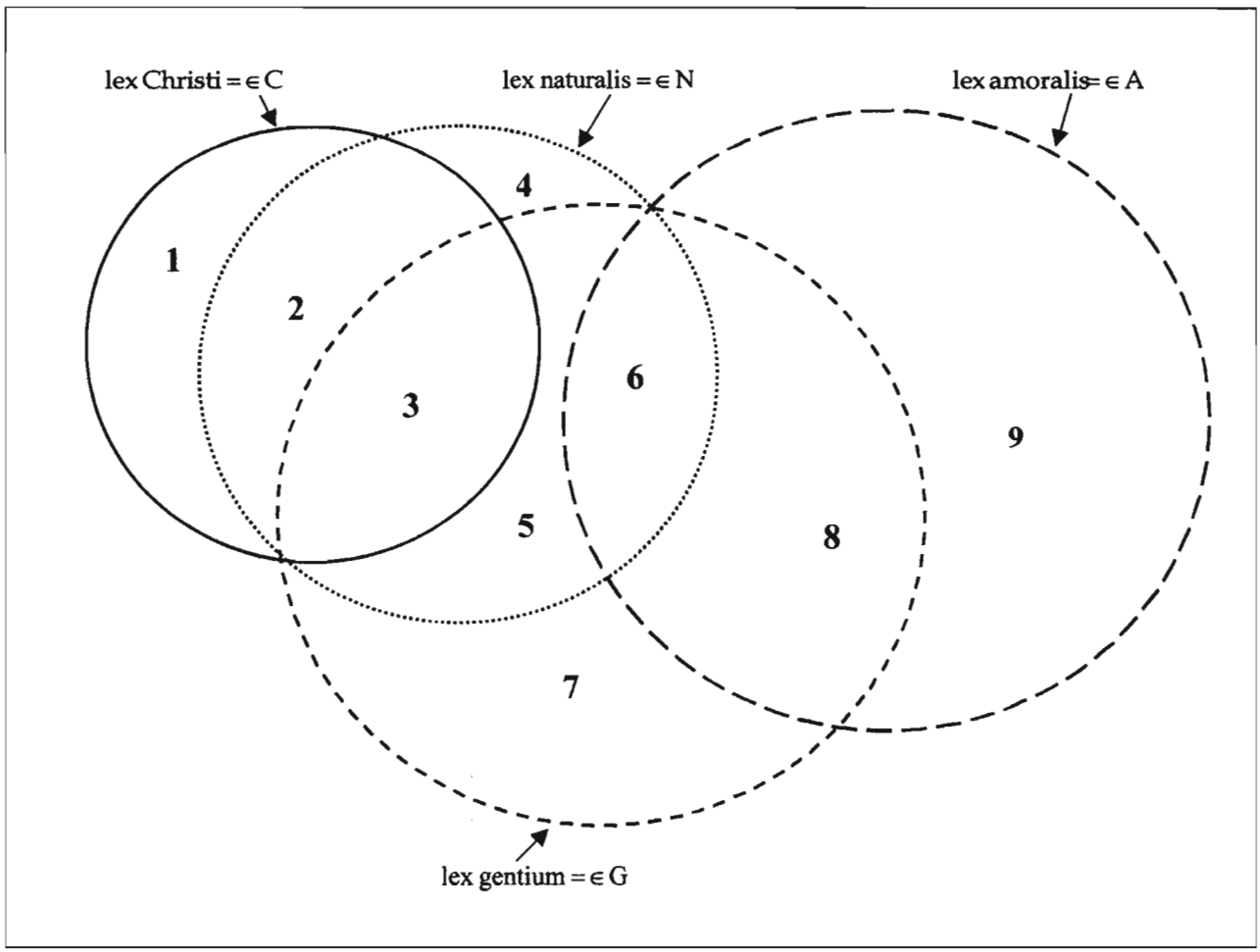
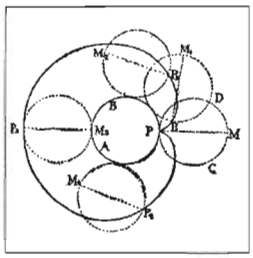


Fig. 1. **Graphic description of relationships of various forms of law in theological ethics with the help of Venn's circles.**



Communication

Venn's Diagram in Mathematics and Its Application to Theological Ethics

Section 1 of the diagram shows that certain ethical axioms belong to the realm of lex Christi, *and it is not possible to find them in any other kind of law. ... Yet there are some ethical axioms that are common to the Sermon on the Mount and natural law. That is Section 2.*

I shall not use the analogy of Venn's circles in the same sense that Thomas is using *analogia entis*. Thomas is making ontological claims about God and the world and I am proposing to use Venn's circles for illustrations and for pedagogical clarity about important ethical matters. Venn's circles can illustrate the complicated relationships among the four normative systems that I cite.

1. *Lex Christi*

Section 1 of the diagram shows that certain ethical axioms belong to the realm of *lex Christi*, and it is not possible to find them in any other kind of law. We can use the command to love our enemies as an example (Matt. 5:43–48). This command belongs first to the individual ethics of the Christian life. It means a Christian cannot use sword and severity for his own sake. He must be the person of mildness and kindness in relationship to his neighbor. The Church also cannot use the inquisition of, and the pressure for spreading the Christian faith as an excuse to be intolerant and hostile to people of another conviction. Christ's law also must impact the Christian community. We cannot place it with social ethics, which is governed by *lex naturalis* principles, shown in Section 2, even though the extreme Anabaptists at the time of the sixteenth-century reformation and Lev Nikolajevic Tolstoj tried to place it there by refusing to use the sword in society at all.

However, the shadow of *lex Christi* must fall also on *lex naturalis*. It must be *lex naturalis humanisata* not only *lex naturalis stricta*. It is similar to Christ's command forbidding divorce (Matt. 5:31–32). It is not possible to make this a legitimate norm for state law, because state law must be valid also for non-Christians. State law must contain divorce laws, unless we want our society to be a mess and have the government system become a clerical one. But due to Christian love, *lex naturalis* must be humanized. In humanized *lex naturalis*, there is no place for free divorces without limitations, but the state law must strive to allow only relatively necessary divorces. Christ's law must supersede the law of governments, where it is possible (Matt. 19:8).

Another example is Christ's command not to take an oath (Matt. 5:33–37). This command also belongs to the individual ethics of the Christian life and within the area of the Church. As a Christian, I should speak only truthfully and authentically, without the necessity of taking an oath. But in the area of state ethics, regulated by *lex naturalis* principles, a Christian also has to take an oath, for example, when he or she enters military service, becomes a state employee, or even a future president. Some ethical commands are valid only in Section 1 and not, at the same time, valid in Section 2.

2. Relative unity of *lex Christi* and *lex naturalis*

Yet there are some ethical axioms that are common to the Sermon on the Mount and natural law. That is Section 2. Examples are the equality of men and women and the equality of different nations. The Apostle Paul understood the law of Christ in this way, prophesying in ancient times: "There is no longer Jew or Greek, there is no longer slave or free, there is no longer male and female; for all of you are one in Christ Jesus" (Gal. 3:28; compare Col. 3:11). *Lex Christi* and *lex naturalis* are relatively the same in this respect, although it was not the same in the time of Plato and Aristotle, because of the imperfect understanding of *lex naturalis* in ancient philosophy.

The likeness of *lex naturalis* and *lex Christi* can be seen in the use of passive resistance in some cases of social ethics. Mahatma Gandhi and Martin Luther King were supportive of this kind of idea. There is no difference between *lex Christi* and *lex naturalis* understood in a human way. Therefore Section 2 exists in ethics where *lex Christi* and *lex naturalis* are relatively the same.

3. Relative unity of *lex Christi*, *lex naturalis* and *lex gentium*

Section 3 contains not only *lex Christi* where it intersects with *lex naturalis* but also the ethical principles of *lex gentium* (in other words, conventional morality). During the ethics lectures with students, we can discuss which ethical norms carry these signs. Of course, the commandment "Do not steal" belongs here, and many other ethical commandments.

4. *Lex ultranaturalis*

Section 4 is very interesting. Look closely at the diagram. It is neither a demand of Christ nor a demand of conventional morality; and yet some Christians and non-Christians consider it to be high human ethics. Is it possible

that something like this exists in ethics? I think so. I call this section "*lex ultranaturalis*." People who emphasize the ethical demands of this section think that their actions are highly human and especially moral. Abstaining from alcohol belongs here. Christ did not proclaim abstention from alcohol; therefore, it cannot belong to *lex Christi*. Christ himself turned water into wine by performing a miracle, and his enemies called him "a drunkard" (Matt. 11:19). Many Christians, and even some non-Christians, think their abstinence from alcohol has special ethical meaning. We can use some other examples, such as excessive mercy shown to criminals. I have in mind the highly human act of President Havel, who gave freedom to many prisoners, but later on, it was clear that this was not such a good idea. The highest humanity does not always pay off when applied to ethics, as Section 4 of Venn's diagram tries to show us. Even Jesus does not support it. Consider, for instance, his act of casting the moneychangers out of the temple (John 2:13–16). Even the rationality of *lex naturalis* does not support this idea.

The highest humanity does not always pay off when applied to ethics, as Section 4 of Venn's diagram tries to show us. Even Jesus does not support it.

We also can consider extreme pacifism, the refusal to defend one's own homeland with weapons in hand, to be "ultra human." But Bonhoeffer is right when he says—although with a very different situation in mind—that the one who wants to keep his hands clean and does not want to violate the commandments even if it is necessary, that one serves the devil in the end.[5] Extreme pacifism and ultra humanity can be manifested in avoiding all possible conflict with everybody, even with the evil one, and trying to remain nice and kind to everybody. The result is that evil grows bigger and bigger. It seems as though this kind of Christian believes in some other Christ, one who is far away, not involved with the world, a constantly smiling Christ, and not the Christ who confronted evil when it was necessary. That is why we have to be careful about ethical Section 4, which seems to be human but in reality is an exaggerated humanity.

5. The mixture of *lex naturalis* and *lex gentium*

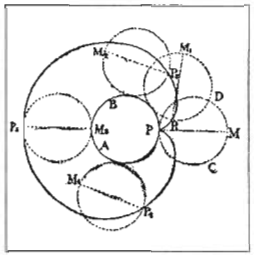
Now let us look at the ethical actions of a person who acts in accordance with *lex naturalis* together with *lex gentium*, with no support from *lex Christi*, but at the same time his action cannot be described as immoral. This is Section 5. It contains such things as a necessary divorce, meaning a divorce that comes after a marriage has been morally dead for a long time. Orthodox and Protestant ethics, and also some Roman Catholic theologians,[6] talk about the moral death of a marriage, which ends in divorce. Although divorce is not in accordance with *lex Christi*, it is necessary to keep in mind that we live in a sinful world, that there are valid secular ethics, and that we cannot live according to *lex Christi* here. In a world like ours, a more relative *lex naturalis* is valid and state law allows a necessary divorce. This is also in accordance with conventional morality, which people consider rational. It would not be logical to forbid divorce even if the marriage has been morally dead for a long time. Alfred de Quervain, a Swiss professor of ethics, is convinced that there are some cases of marriage that are no longer God's will. God's will for such a marriage is divorce. In Venn's diagram, the action belongs to Section 5.

6. The mixture of *lex naturalis* and *lex amoralis*

There might be a problem with Section 6. It belongs to the realm of *lex naturalis* and it is in accord with conventional morality—*lex gentium*—but the action is ethically immoral. During an ethics lecture, there might be discussion of what belongs here. Certainly the idea of the inequality of men and women in ancient times belongs here. According to Plato and Aristotle's understanding of *lex naturalis*, women are inferior to men in social life. Our understanding today of the equality of men and women says that this position of Plato and Aristotle is ethically immoral (we can say it is *lex naturalis historica*, an old antique understanding of *lex naturalis*). They had an imperfect understanding of *lex naturalis*, because *lex naturalis* can never be connected to *lex amoralis*. Many other issues could belong to Section 6, for example, the question of slavery.

7. Conventionalistic ethics

In Venn's diagram, section 7 means ethical action that is commanded neither by *lex Christi* nor by *lex naturalis*, that is not immoral, and yet is considered by civil morality to be very important and having some ethical validity in civil actions. Our question is: What is it with respect to ethics? Here is another topic for discussion. In my personal thinking, this is where I would place temporary, changing social conventions or fashions. Certainly Marxist ethics, but also the ethics of some Christian denominations, emphasize particular temporary and changing conventions or fashions. There was a time during the Marxist regime, for example, when male students were not allowed to have long hair, because it was considered effeminate. In certain Slovak Baptist churches, having a "thick knot on the tie" was not allowed. In the time of the Apostle Paul, women had to have their heads covered with a scarf (1 Cor. 11:5). Islam has a lot of such temporary conventions. We have to keep this section of ethics in mind and remember that these conventions always are temporary. It is the price that



we have to pay for progress in our society and in our churches.

8. The mixture of *lex gentium* and *lex amoralis*

What is interesting about Section 8 is that it has to do with immoral actions that society nonetheless tends to accept and even support. What could that be? Could it be something like usury, interest rates for loaning money that are too high? Could it be charging prices that are too high for new products that people want and need? Could it be ways that students find to cheat on examinations? Certainly it would be frivolous divorce, one that people get for no important reason. Abortion for personal convenience would also belong here. Here is another area for discussion, as we try to clarify our ethical standards.

9. *Lex amoralis*

The last section of Venn's diagram remains. It very clearly includes such specific immoral acts as murder, rape, and pedophilia. We certainly can think of other immoral acts of this kind.

Conclusion

There are many other ethical questions that I have not mentioned. These other problems might generate some good discussion, for example, where in Venn's diagram should we place such questions as euthanasia, homosexuality, the use of 14-day-old embryos for therapeutics? Other vexing particular questions, of course, could be added. Furthermore, a significant area for inquiry would be to explore how Venn´ circles could help to illuminate the ethical orientation of several important contemporary Anabaptist theologians like John Howard Yoder, Stanley Hauerwas, and Glenn Stassen. It is clear that not only does mathematics have its particular problems to be solved; ethics has them too, problems that must be judged and evaluated correctly. ⁂

What is interesting about Section 8 is that it has to do with immoral actions that society nonetheless tends to accept and even support.

Notes

[1]Paul Tillich, *Systematische Theologie* I (Stuttgart: Evangelisches Verlagswerk, 1956) 299.

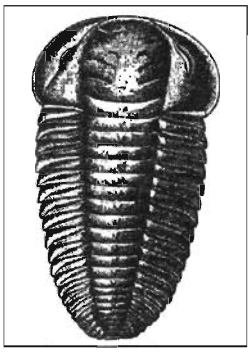
[2]See Barth, *Kirchliche Dogmatik* I/1, 178–80; compare with the critique of Paul Althaus written about Karl Barth, *Die christliche Wahrheit*, (Gutersloh, Gerd Mohn, 1990), 97.

[3]This paper was presented at the international symposium "Mathematics and Theology" at the Evangelical Theological Faculty of Comenius University, Bratislava, Slovakia, on May 3, 2002.

[4]E.g., J. Klein under the heading *Analogia entis, Religion in Geschichte und Gegenwart*, 3rd ed., 1, 348–50.

[5]Dietrich Bonhoeffer, *Ethik* (Munchen: Chr. Kaiser Verlag, 1982), 65.

[6]For example, Bernhard Haering in *Bez vychodiska?* (Presov, 1997), 26 (Slovak translation).



A History of Trilobites as "Living Fossils"

Linda A. Ritterbush

Deep down in each of us, even the most scientific straight arrow, is the desire to find an ostensibly extinct creature alive and well. Egged on by the well-known discovery of the coelacanth, or the less well-known *Neopilina*, we hope for the dinosaur in the Congo, or the plesiosaur in Loch Ness. As a trilobite paleontologist, I admit to the occasional fantasy of my boogie board pinning a rare but healthy scuttling three-lobed one.

None of these dreams is likely to be realized. On the other hand, such resurrections have been the hope of some "scientific creationists"—thus illustrating the lengthy historical continuum of a brand of obscure but fascinating reasoning. On an anecdotal level, I have been surprised by the number of "scientific creation" enthusiasts I have met, who, upon learning that I study trilobites, refer to them as *supposedly* extinct, or ask if I think they might one day be found alive, perhaps as "living fossils."

"Living fossils" is not, of course, a scientific term. In popular parlance, it means one of two things: either a taxon with a fossil record terminated before the present which is found (surprisingly) extant; or (less precisely) an organism with a long fossil record which appears morphologically nearly identical to its distant ancestors. Examples of the former include coelacanth fish and monoplacophoran mollusks; examples of the latter include certain sharks, and the inarticulate brachiopod *Lingula*.

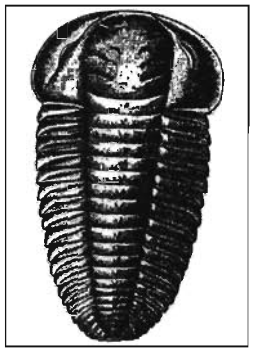
Modern evolutionary theory does not find the presence of either version of the phenomenon disturbing. Because preservation of a fossil is an exceptional event, a taxon falling below a certain level of abundance is unlikely to leave a fossil record. Extant examples of this type of "living fossil" are likely to be "reclusive"—at low abundance, living in remote environments, or having an extremely limited geographic distribution in the present. Forms like *Lingula* exhibiting extreme morphologic conservatism over time are generally thought to be superbly adapted to a specific niche, which has been available throughout their geologic range.

Early European geologists, some of whom struggled mightily with the concept of extinction,[1] did not express such nonchalance. Seventeenth-century naturalist John Ray worried that extinction would imply an imperfect Creation, so he hoped seemingly extinct marine creatures would be found. British physician Robert Woodward was particularly perplexed by the giant coiled ammonoids. Perhaps, he explained, ammonoids were not truly extinct: they may yet prosper in some obscure environment, perhaps the deep sea. Living long before the aqualung and the deep-sea submersible, not to mention Robert Ballard, Woodward thought some future intrepid explorer would visit the depths and bring the ammonoids to light. It was not until eighteenth-century

Linda A. Ritterbush

Deep down in each of us ... is the desire to find an ostensibly extinct creature alive and well.

Linda A. Ritterbush *(Ph.D. Geology, University of California, Santa Barbara) is a professor of geology at California Lutheran University, where she teaches paleontology, historical geology, and environmental science. Her primary research interests are trilobite extinction patterns, and biometrics and morphology in agnostid trilobites. She lives with her husband and two daughters in Thousand Oaks, California. In her spare time, she enjoys hiking all over the Southwest and studying theology at Fuller Theological Seminary. She is an active member of Holy Trinity Lutheran Church in Thousand Oaks. Linda may be contacted by email at: ritterbu@clunet.edu*



Communication

A History of Trilobites as "Living Fossils"

Lutheran pastor Byron Nelson, writing his 1931 The Deluge Story in Stone, *revived the living fossil argument, quoting a 1695 John Woodward treatise extensively. Nelson then introduced the trilobite as a likely candidate for rediscovery in the deep sea.*

French anatomist Georges Cuvier monographed mammoths and mastodons that the reality of extinction was accepted.

Enter the "scientific creationists" of the twentieth century. As elaborately detailed by Numbers,[2] the modern debut of deluge geology followed a two-step process: (1) the writings of Seventh-Day-Adventist founder Ellen White, and subsequent advocacy of flood geology by Seventh-Day-Adventist geology enthusiast George McCready Price in the 1920s; and (2) the Price-inspired revival among fundamentalists and evangelicals highlighted by Whitcomb and Morris' *The Genesis Flood*[3] and related works in the 1960s and following. A chronologically intermediate figure, Lutheran pastor Byron Nelson, writing his 1931 *The Deluge Story in Stone*,[4] revived the living fossil argument, quoting a 1695 John Woodward treatise extensively. Nelson then introduced the trilobite as a likely candidate for rediscovery in the deep sea. He wrote:

> Modern oceanographers confess that they have reason to believe that they catch in their nets but the smallest part of the forms of life which are in the depths of the sea. There may now dwell the Trilobites ... whose remains are so abundant in the strata of many parts of the world, and which *are supposed by modern geologists to have evolved and died out* in the very earliest ages (emphasis mine).[5]

Likewise, a caption to a figure apparently showing Burgess Shale arthropods reads:

> Fossil trilobites from a stratum in the mountains of British Columbia. These creatures are *supposedly extinct* but may live abundantly at present in the depths of the seas (emphasis mine).[6]

Whitcomb and Morris echoed Nelson's use of the trilobite. Their timing was fortuitous. Among the American public, awareness of the "living fossil" phenomenon had been heightened by the discovery in China in 1944 of the Dawn Redwood *Metasequoia*, at just the time that prominent scientists were agitating for the preservation of the California Redwoods. The explosion in oceanographic research that followed WWII, revealing for the first time the topography and fauna of the deep sea was also stoking popular imagination. The discovery of the coelacanth, a lobe-finned fish believed to be closely related to the ancestors of amphibians, was a low-tech affair based on a fisherman's 1938 catch. Marine expeditions in the mid-twentieth century, however, brought new shipboard and submarine technology to the search. The year 1952 marked the discovery of *Neopilina*, a genus of the monoplacophoran mollusks, a group thought to be extinct for hundreds of millions of years.

In a section on Living Fossils, Whitcomb and Morris described the beakhead reptile *Tuatara*, the coelacanth, and *Metasequoia*, all to advance the implication that the appearance of a change in life through time may be an artifact of ignorance. Species deemed extinct may just be not-yet-found. And thus they re-introduced the trilobite:

> It would not be surprising if even the famous trilobite, perhaps the most important "index fossil" of the earliest period of the Paleozoic, the Cambrian, should turn up one of these days. A creature very similar to it has already been found.[7]

Whitcomb and Morris did not credit Nelson with this idea; although clearly aware of his writings, they may or may not have recalled his use of the trilobite in this context. But Whitcomb and Morris were armed with news. They cited the popular science magazine *Science Digest*'s account of the discovery of a living fossil so similar to the trilobite that, according to the magazine, it was stimulating hopes of finding extant trilobites.[8]

Popular science magazines, like the mass media generally, often pick up stories from scientific meetings or journals and popularize them with a "spin" they think to be of interest to the readership. The primary literature on which the extremely brief and non-illustrated *Science Digest* items were based was not cited by Whitcomb and Morris, but it indeed was related to an important discovery: the location and first description, in 1954, of the Cephalocarida, a previously-unknown subclass of crustacean arthropods.[9]

Crustaceans are not trilobites, although both are arthropods. Multiple paired, jointed appendages are common to all arthropods. Compared with members of the extinct Trilobita, each group within the Crustacea generally have a unique suite of limbs, some of which have specialized functions (anten-

nules and antennae for sensing; mandibles for biting; maxillae for food manipulation, and so on), although there is some variation among groups, especially in the posterior limbs.[10] Trilobites, by contrast, though morphologically diverse in many other ways, had remarkably generalized limbs; except for a single pair of antennae, the limbs are nearly identical in form to each other.[11] Most free-living crustaceans have an exoskeleton wrapping around the soft parts dorsally and laterally; many have a narrow, elongate shape. In contrast, trilobites were flattened, ovoid, covered only dorsally by a carapace, which is differently divided than that of crustaceans. Where eyes are present, the crustacean eye differs from the trilobite eye.

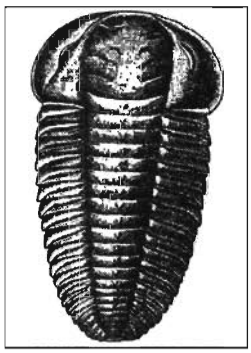
Whitcomb and Morris [in 1961] echoed Nelson's use of the trilobite. Their timing was fortuitous.

If trilobites and crustaceans were so different, why would the discovery of a new crustacean evoke comment on trilobites? As with any extinct group, attempts to understand the trilobites' functional morphology and mode of life depend on parallels drawn from similar, but extant, forms—usually found among their closest living relatives.[12] For trilobites, the choices for such analogies would include certain crustaceans and the Xiphosura ("horseshoe crabs"), members of yet another arthropod group. (Debates about whether trilobites are more closely related to crustaceans or to horseshoe crabs are long-standing and unresolved.) Given the unspecialized limbs of trilobites, interest focuses on those modern arthropods with the most "generalized" morphology—especially with respect to limbs.[13] Among the Crustacea, the best candidates are the Cephalocarida, the Anostraca, and the Remipedia.[14] Discovery of the "simple" cephalocarids, with their generalized morphology and horseshoe-shaped head shield, thus provided another possible analogue for trilobite function. Of course, there are many differences: almost all cephalocarids are eyeless, while most trilobites had eyes; cephalocarids are long and slender, have many trunk segments, and are significantly smaller (between two and four millimeters, compared with trilobites that averaged a few centimeters, with a few reaching half a meter). The size is particularly significant because of the implications for their function in feeding and locomotion. For example, at such tiny limb sizes, the ratio of inertial to viscous forces renders cephalocarids unable to swim actively. In fact, it was probably the small size, as much as the depth at which they were first found, that made the cephalocarids "elusive."

So here is the genealogy of an enduring trilobite "urban legend." Oceanographers discovered a new taxon of crustaceans, the Cephalocarida, which they duly reported in the professional literature. Arthropod specialists were quick to recognize the value of a model for a "primitive" crustacean. Writers of a popular science magazine, who played up the sensational connection in two one-or-two paragraph "page filler" items, noticed analogies between the new taxon and a different class of arthropods, the well-known fossil group of trilobites. They used the term "living fossil," even though the case to which they referred did not carry the usual meanings of a living fossil: cephalocarids had no fossil record, and trilobites were (and still are!) extinct. Whitcomb and Morris picked up the story, probably from *Science Digest* (if they were aware of the scientific source, they did not cite it; alternatively, they did not cite it because it makes no reference to trilobites at all.) Whitcomb and Morris featured the tiny popular items, thus keeping the "living fossil" moniker attached to trilobites. Their discussion linked discovery of a "living fossil" to Nelson's (and more distantly, Woodward's) prophecy, by repeating the *Digest*'s claim that scientists are hot on the trail of the living trilobites. Works of "scientific creationists"[15] continued to repeat the possibility of finding living fossils like trilobites, which are "*presumably* extinct," without alerting readers to the Crustacean affinities of the discovered taxon or subsequent research on it.

They cited the popular science magazine Science Digest's *account of the discovery of a living fossil so similar to the trilobite that, according to the magazine, it was stimulating hopes of finding extant trilobites.*

Repetition by popular speakers keeps the misunderstanding alive. Possibility can even morph into certitude with distance, as Morris claimed as recently as 2000: "Other famous living fossils include the tuatara ... and even the trilobite (chief index fossil of the even more ancient Cambrian Period)."[16]



Communication

A History of Trilobites as "Living Fossils"

As a varied and fascinating group with an extensive fossil record, and as a "charismatic" animal with popular name recognition, trilobites themselves are symbols of evolutionary life history.

Contemporary "scientific creationists" may continue using the rhetoric of suspicion regarding trilobite biostratigraphy, even when correctly describing trilobite morphology. For example, DeYoung as recently as 2002 repeats published details of visual systems in the trilobite *Phacops rana* to support his own inferences:

> Yet this creature *supposedly lived during the Paleozoic Era,* ... trilobites are *considered to have been an index fossil* ... this *theoretical ancient time span* is *assumed* to have elapsed before the dinosaurs came into being ... (emphases mine).[17]

Trilobite visual systems are indeed amazing, and the objective morphologic details cited by DeYoung are accurately reported; but they have no bearing on trilobites' utility as index fossils, their antiquity, or their stratigraphic position relative to dinosaurs.

Why is there interest in trilobites and extinction in "scientific creationist" literature? As a varied and fascinating group with an extensive fossil record, and as a "charismatic" animal with popular name recognition, trilobites themselves are symbols of evolutionary life history. Sowing doubt about the extinction of trilobites might seem to put evolution in a more suspicious light. If purportedly extinct taxa are actually or potentially "living fossils," they reason, is extinction a pseudo-phenomenon? If life history consists of numerous originations and extinctions, has the "extinction" side been exaggerated, or can it be lightly regarded? Huge numbers of extinct taxa belie this possibility. To claim immanent discovery of tens of thousands of forms strains credulity. Still, any fossil organism literally *could* be found extant at any time. My toe is still in the surf, waiting to be bitten. ⁂

Notes

[1]Martin J. S. Rudwick, *The Meaning of Fossils* (Chicago: University of Chicago Press, 1976).

[2]Roland L. Numbers, *The Creationists* (Berkeley, CA: University of California Press, 1991).

[3]John Whitcomb and Henry H. Morris, *The Genesis Flood* (Phillipsburg, NJ: Presbyterian and Reformed Publishing, 1961).

[4]Byron C. Nelson, *The Deluge Story in Stone* (Minneapolis, MN: Bethany, 1931).

[5]Ibid., 32.

[6]Ibid., 33.

[7]Whitcomb and Morris, *The Genesis Flood*, 179.

[8]The two items from *Science Digest* are each bottom-of-the-page magazine "filler" items with no author listed. They do not appear in the indexes at the front of the monthly issues, but do appear in the annual indexes for their respective years: "'Living Fossil' Resembles Long-Extinct Trilobite," *Science Digest* 42 (Dec. 1957): 59; and "Start Search for Living Trilobites," *Science Digest* 46 (Aug. 1959): 81. The latter item is incorrectly referenced in Whitcomb and Morris as appearing in September 1959, p. 81 (no volume number given.) Some awkward changes in the magazine's numbering system probably caused the confusion.

[9]Howard L. Sanders, "The Cephalocarida, a New Subclass of Crustacea from Long Island Sound," *Proceedings of the National Academy of Sciences* 41 (1954): 61–6.

[10]Richard C. Brusca and Gary J. Brusca, *Invertebrates: Phylum Arthropoda: The Arthropod Bauplan and the Trilobites* (1990): 461–92; *Phylum Arthopoda: The Crustaceans* (1990): 595–770. I have minimized the use of taxonomic ranks within the text because of variation in their use. Brusca and Brusca's usage is common: The Subphylum Crustacea has numerous classes, including the Class Remipedia, Class Cephalocarida, and Class Branchiopoda, which includes the Order Anostraca. The Order Xiphosura belongs in the Subclass Merostomata and the Class Chelicerata. Trilobites are placed in the Subphylum Trilobitomorpha.

[11]H. B. Whittington, "Morphology of the Exoskeleton: The Trilobite Body," in H. B. Whittington, et al, *Arthropoda 1: Trilobita*, Revised: *Treatise on Invertebrate Paleontology Part O* (Boulder, CO: Geological Society of America, 1997), 1–132. Contemporary paleontological usage, for which the *Treatise* is authoritative, places trilobites in the Class Trilobita but discourages the use of Trilobitomorpha.

[12]Matthew A. Wills, "Crustacean Disparity Through the Phanerozoic: Comparing Morphological and Stratigraphic Data," *Biological Journal of the Linnean Society* 65 (1998): 455–500.

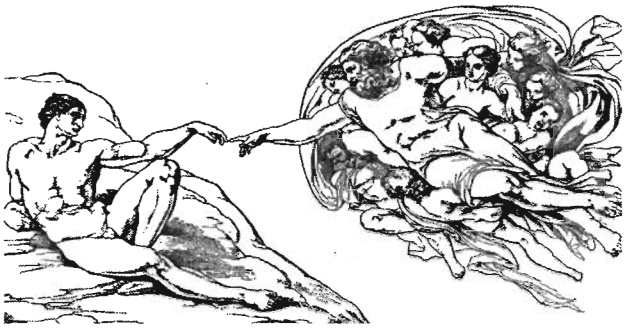
[13]I have avoided cladistic vocabulary because of its technical nature. In cladistic terminology, the concept here represented as "generalized arthropods" would be better expressed as "living plesiomorphic representatives of the aquatic clades" (Derek E. G. Briggs and Richard A. Fortey, "The Early Radiation and Relationships of the Major Arthropod Groups," *Science* 246 [1989]: 241–3).

[14]The Remipedia, latest darlings of the "urcrustacean" set, was first described in 1981. They are even "simpler" than cephalocarids—they lack any trunk tagmosis (J. Yager, "Remipedia: a New Class of Crustacea from a Marine Cave in the Bahamas," *Journal of Crustacean Biology* 1 [1981]: 328–33).

[15]Henry Morris, ed., *Scientific Creationism* (San Diego, CA: Creation-Life, 1974), 88–9.

[16]Henry H. Morris, "The Profusion of Living Fossils," *Acts and Facts* 29, no. 11 (2000): Online Issue no. 3.

[17]Don B. DeYoung, "Vision," *Creation Research Quarterly* 38 (2002): 190–2.



Is Adam for Real?

Dick Fischer, ASA Member; President, Genesis Proclaimed Association, PO Box 50111, Arlington, VA 22205
dickfischer@earthlink.net

The man Adam was either a real-life, flesh and blood, God-fearing human being, or he was not. There is no intermediate position. Either we have Adam wearing his fig leaf, or we have Adam who was only a figment. As much as the issue can be couched in theological mumbo jumbo, i.e. theological truth but historical myth, etc., there is no escaping a fundamental fact. Adam existed in the flesh, or he did not.

When we began to discover enough about the world to see that it was impossible to specifically identify the first human being, who may have lived millions of years ago, an historical Adam was rejected by many denominational Christians, and the presumption was embraced that there was no human Adam at all.

Is Adam a Figment of our Imagination?

For the sake of argument, let us assume Adam did not exist for a moment. Besides the Old Testament narrative in Genesis, let us look at the New Testament, and see what the effects would be.

- Luke 3:38: "... which was the son of Enos, which was the son of Seth, which was the son of [non-existent] Adam, which was the [non-existent] son of God." Did Seth have no father? Maybe Seth was non-existent too? How about Enos? We could ask that question all the way to Christ himself. At what point could the real persons be phased in with those who had no life, but only fill some hypothetical, theological niche?
- Romans 5:14: "Nevertheless death reigned from [non-existent] Adam to Moses, even over them that had not sinned after the similitude of [non-existent] Adam's transgression, who is the figure of him that was to come." How can death come to a non-existent life. Plus, how did he sin if he was never born? How can an Adam who never was be the figure of him who died for us? By implication, this calls into question the legitimacy of the death and resurrection of Christ.
- 1 Corinthians 15:22: "For as in Adam all die, even so in Christ shall all be made alive." Humans who do not live do not die. So just as a non-existent Adam could not die, therefore we will not die, and do not require being saved by Christ! What a wonderful theological premise that is.
- 1 Corinthians 15:45: "And so it is written, The first man [non-existent] Adam was made a living soul; the last Adam was made a quickening spirit." How could Adam, if he did not exist, become a living soul? Would we conclude that since the first man was not, therefore he was not made a "living soul," and "the last Adam" therefore was not made a "quickening spirit"?
- 1 Timothy 2:13: "For [non-existent] Adam was first formed, then Eve." Would that make any sense at all? A non-existent Adam begs a non-existent Eve. Who needs a wife if you are not alive to appreciate her?
- 1 Timothy 2:14: "And [non-existent] Adam was not deceived, but the [non-existent] woman being deceived was in the transgression." Adam could not be deceived if there was no Adam to deceive. No man, no woman, no deception, no transgression, no sin. It would seem, if there was no Adam, that the ones deceived were Luke and Paul! Apparently they believed there was such a person as Adam.

The pertinent point is this: Taking Adam off the list of historical Bible personalities in order to salvage some Bible respectability solves nothing at all. We cannot climb into an ivory tower, take an inconsistent theological position, and escape the consequences. A fictitious Adam is fraught with unsavory theological implications.

Did Adam Wear a Fig Leaf?

So instead of ruling Adam out of the Bible, why not rule him in? Let us assume that the writer of Genesis, upon whom the gospel writers relied, got his facts right, and that Adam of Genesis, the ultimate father of Christ, was a real-live human being. That position is not exactly without difficulty either. The other part of the problem is that traditional, conservative, Christian beliefs about Adam are based not entirely upon scriptural evidence, but also upon an apparently erroneous assumption. Conservative Christians see Adam as both a flesh and blood human being, and as the father of all humanity.

The presumption that Adam was the first father of human beings everywhere likewise is fraught with difficulties. Remains of early humans and our precursors have been found dating back millions of years. A recent hominid skull found in Chad has been dated by scientists to over six million years ago. A possible solution to this conundrum comes directly from Genesis. The cultural surrounding of Genesis 2–11 places Adam and his immediate successors after the Stone Age and at the threshold of the Bronze Age. References to tents, farming, livestock, musical instruments, and implements of bronze, and even iron, give us valuable historical perspective. Such a person living in the area of the Tigris and Euphrates would have lived about 6–7,000 years ago. There is no trace of human settlement in that area prior to 10,000 years ago.

Placing Adam in history ... places him in the stream of humanity, not at the apex as has been commonly assumed.

Placing Adam in history also places him in the stream of humanity, not at the apex as has been commonly assumed. To trace the biological roots of humankind using DNA markers and archeological findings may eventually arrive at a specific person at a specific locale. But whoever that may turn out to be, he will be forever nameless.

A Potentially Satisfying Answer

A potentially satisfying answer to the historical and theological question of Adam is to recognize the historical Adam as the father of the Adamites-Semites-Israelites-Jews. To be sure there would be pockets and traces of humanity that could claim Jephethite or Hamite ancestry, and both Arabs and Jews regard Abraham as their father. But there are billions of people living all over the globe today whose ancestors cannot be traced to the Tigris and Euphrates, the cradle of civilization in the region of ancient southern Mesopotamia—the home of Adam.

A likelihood that has virtually been ignored by the theological establishment is that no person who lived roughly 7,000 years ago could have been the ultimate father of all of the people who presently inhabit the globe. When we allow for that, some of the creation-evolution difficulties disappear.

Where humankind came from remains a scientific question which has no implications for the authority or inspiration of Scripture. Genesis appears less concerned about where humankind came from, and simply concerned about presenting the origins and some of the history of the line of promise leading to Christ. ⁂

A Call for Works in the Arts!

We are seeking original, previously unpublished submissions which may be in the form of poetry, musical score, drawings, cartoons, photography, short prose or meditative thoughts. Ideally the work in art depicts the relationship between science and Christian faith.

Guidelines for submissions:

- All submissions must have a title and be less than 300 words.
- Photographs and artwork must be black-and-white or grayscale. No color accepted.
- Three copies of each submission must be on single sheets of plain white paper.
- One copy must be in digital file form (Word document for text, JPG or TIFF for artwork) sent on a PC-formatted floppy disk or as an e-mail attachment.
- Submissions will be peer-reviewed prior to publication.
- Send submission with a cover letter indicating that the submission is intended for the "Art Eyes Science" section to:

Roman J. Miller, Editor
4956 Singers Glen Road
Harrisonburg, VA 22802

millerrj@rica.net
540-432-4412

Book Reviews

ANTHROPOLOGY & ARCHEOLOGY

THE REAL EVE by Stephen Oppenheimer. New York: Carroll & Graf Publishers, 2003. 440 pages, appendices, notes, index. Hardcover; $25.00. ISBN: 0786711922.

Geneticist Stephen Oppenheimer is a member of Green College at Oxford. This is Oppenheimer's second book on human evolution and genetics. Its purpose is to illuminate the peopling of the world by anatomically modern humans (AMH) through the mtDNA and Y-chromosome lineages. The seven chapters start with explaining the Out-of-Africa Theory and then move through the change from archaic hominids to moderns, the first steps into Asia and Australia and the peopling of the Americas.

Oppenheimer presents a great argument against the view common among Christian apologists that intelligent, rational humans arose suddenly within the past 60,000 years in Europe, where there was a flowering of art and Upper Paleolithic tools. If this had happened, then everyone on earth who can speak, draw, or write must have descended from the Europeans. Not only is this a terribly Eurocentric idea, it is also impossible based upon the genetic evidence. MtDNA and Y-chromosome trees are rooted in Africa, not Europe. Besides, art first appears on earth, not in Europe but in Australia. Oppenheimer argues that those humans who left Africa 100,000 years ago were speaking. Thus all of their descendants—those of us alive on earth now—could speak as well.

When it comes to the peopling of the New World, Oppenheimer presents some interesting ideas for explaining the genetic distribution and variations seen among Native Americans. Americans in the north, where they were supposed to have lived the longest, have the least genetic diversity. Americans living farther south have much greater genetic diversity. Oppenheimer explains this by suggesting that the last glaciation forced people south and then after the glaciation, limited groups with limited diversity moved back north.

Other interesting ideas in the book are that language existed 2.5 million years ago, and existed in two different genera—*Homo* and *Paranthropus*. Oppenheimer vigorously defends the concept that the human intellect did not suddenly flower 35,000 years ago. He also chides anthropologists for engaging in that time-honored human tradition of finding one group and denigrating them. In this case, it is the Neanderthals whom Oppenheimer says were basically like us. He also demonstrates a huge mtDNA genetic divide between peoples west of India from those farther east. He ascribes this divide to the eruption of Toba, which was the largest volcanic explosion in the past 100,000 years. It turned India into a wasteland of ash, dividing the peoples.

One weakness of the book is that Oppenheimer tries to follow too many genetic lineages. Trying to follow a logical argument with sentences like, "As I mentioned in Chapter 5, A, C and Z are characteristic of North Asia ..." is very difficult. One must have the memory of an elephant to follow such an argument. And it does not end there. Each Y-chromosome and mtDNA lineage is given the name of a mythical person and that does not seem to help either.

Oppenheimer is a committed Out-of-Africa proponent although initially he does not sound like one. Early on, he reminds his readers that the vast bulk of our nuclear genes come to us from hominids on earth long before anatomically modern humans appeared. He then notes (p. 49) that it is very difficult to construct genetic trees from nuclear DNA so evidence of AMH and archaic hominid interbreeding could be found. This clearly sounds like the words of a multiregionalist, an anthropologist who believes that there was gene flow between the ancients and AMH. But then, inconsistently with his own words, Oppenheimer proceeds to discount any possibility of archaic genes and interbreeding, stating over and over that the archaics went extinct without passing on any of their genes to us. This is a disappointment because it is so illogical and this illogic is so foundational to the book.

The book is worth having if only as a reference for following the mtDNA lineages. It would have been better had the discussion of those lineages been clearer.

Reviewed by Glenn R. Morton, 10131 Cairn Meadows Dr., Spring, TX 77379.

ADAM, EVE, AND THE GENOME by Susan Brooks Thistlethwaite, ed. Minneapolis, MN: Fortress Press, 2003. 193 pages. Paperback; $20.00. ISBN: 0800636147.

Thistlethwaite is the president of Chicago Theological Seminary (CTS). She has co-authored several books including *Casting Stones: Prostitution and Liberation in Asia and the US*, and *Lift Every Voice*, and *Sex, Race and God*. This book is the outcome of a class at CTS on the intersection of the Human Genome Project (HGP) and theology. Eight authors cover the history of science, Mendelian genetics, post Mendelian genetics, theological anthropology, the implications of the HGP to Adam and Eve, racism in American culture, the search for the violence gene, and the Chemistry of Community.

There is no coherent theme through the book. The authors return many times to similar topics. Thistlethwaite notes that humans have 99.9% identical DNA and that this is what unites humanity. Theodore Jennings then goes one step further proclaiming that the redemption depends upon our genetic unity as a species. And this, of course, raises the question, at least in my mind, about why 99.9% unity allows redemption but 98% similarity with the chimps does not include them. It seems a bit odd to define redemption based upon DNA similarity. Is 1.9% theologically significant?

The most interesting issues are those involving ethics. Do we have an obligation to give a kidney to a brother simply because he will tolerate our organ? What are we to do with knowledge derived from genetic testing which tells

us information about others? If we find we have a single copy of a gene for a genetic disease which had to come from our parents, what do we owe to those more distantly related whom we have never met? If we are tested in an attempt to donate blood or an organ to a friend, and then many years later we find that our blood or organ is needed by a stranger in another land, what is our moral obligation? How much danger should we be required to expose ourselves to?

One interesting discussion concerns the image of God. Most argued that the classic idea that the image of God is somehow related to reason is wrong. Thistlethwaite said that this is a way to subjugate those judged as being inferior. Jennings notes that we are who we are because of our DNA and our bodies and that we cannot separate the image of God from our bodies.

There are discussions of the dangers of modern genetic knowledge. Ken Stone notes the ambivalence among the gay community for finding a "gay gene." Fears that a fetus carrying such a gene would be aborted are held by about half of the gay community. One wonders what happened to a woman's choice when Thistlethwaite decries the use of modern genetic knowledge to choose the sex of children in China, which has led to 50 million missing women! Jennings notes the Eurocentric nature of the HGP since the sequenced genome was taken from European employees of the NIH, implying that all other sequences are deviations from the norm. There is some truth in this claim.

The article on "African American Skepticism" by Lee Butler, was mostly a history of the atrocious mistreatment of Blacks in the past. Butler hardly discussed the HGP and how it shows we are closely related to each other. He also missed an opportunity to discuss from his viewpoint the misuses of the data coming out of the HGP. Such a discussion would have been welcome and interesting but as it was, I felt this chapter was out of place.

There are some strange (at least to this non-theologian) claims in the book. Liberation theology runs through the book. Jennings (p. 109) seems to claim that capitalism is the original sin. Thistlethwaite suggests that original sin is the societal structures in which we find ourselves embedded (pp. 156–7).

This book is an attempt to construct a dialogue about the implications of the HGP to theology. It suffers from the weakness of addressing these issues from only one side of the theological spectrum. It would have been interesting to hear the views of a broader range of theological positions on this very important topic.

Reviewed by Glenn R. Morton, 10131 Cairn Meadows Dr., Spring, TX 77379.

ETHICS

CAN WE BE GOOD WITHOUT GOD? Biology, Behavior, and the Need to Believe by Robert Bruckman. Amherst, NY: Prometheus Books, 2002. 278 pages. Hardcover; $22.00. ISBN: 1573929743.

Bruckman is a cancer specialist and a professor in the department of medicine at the University of Toronto. He was the president of the Humanist Association of Canada when this book was published and he co-authored another book entitled *Magic or Medicine?* He has also hosted his own television program on medical subjects in Canada and England. In the next to the last chapter of this book, Bruckman describes his Jewish upbringing and his subsequent rejection of theism. He also explains his two main reasons for rejecting theism. One reason revolves around his difficulty in reconciling a view of the world in which a god controls all human events, with the apparent arbitrariness and randomness of real human life. The second reason, which is his main reason for writing the book, is that belief in God is often closely associated with destructive acts and the slaughter of fellow human beings (the events of September 11, 2001 are cited in the preface).

The book is divided into three main sections. Part one, entitled "To Believe is Human," describes the evolutionary development of religious belief, the problems associated with interpreting communal myths and legends as revealed truths, and the neurology behind religious belief. In the chapter on the neurology of religious belief, Bruckman argues that "the structure of the human brain is such that experiences of God and heaven are hardwired into it" (p. 107). Part two, entitled "Belief and Behavior," includes an extensive explanation of the behavior of groups in chapter five. This is followed by two chapters which survey the constructive and destructive effects of communal religious belief. Part three consists of a single chapter in which "alternative gold standards" for human behavior are proposed. These ten core principles summarize the nontheist or atheist basis for trying to maintain "good" behavior.

Bruckman states in the first sentence of the first chapter that "this book is not a debate about the existence of God." Yet throughout the book, theistic beliefs are attacked and maligned while nontheistic explanations are preferred. While various concepts of God are presented in the introductory chapter, it is the image of God as an "architect and controller" that is the main target of Bruckman's attack. Many theists also reject this image of a God who micromanages the events of human history as well as the lives of individual human beings. It is unfortunate that other, less controlling images of God are not even considered as viable options to the "Divine Regulator" model that Bruckman so vehemently rejects.

Another problem with the book is the author's use of evidence to support his conclusions in the chapter on the neurology of belief. He concludes chapter four with the following statement: "It has been demonstrated, unequivocally and unambiguously, that the experience of God is built into the human mind. The God of mind is undeniable; the mind of God will forever remain a matter of personal belief" (p. 109). However, when discussing the research that leads to this conclusion, statements like "much of what follows is conjecture," "this is an area of very active research and some controversy," and "this is of course science in its infancy" makes the reader wonder if the statement at the end of the chapter can be adequately supported.

Similar statements pervade the following chapter on the behavior of groups. While Bruckman warns that "the leap from animal behavior to human conduct is fraught with speculations" (p. 126), much of the evidence used

to explain human group behavior is extrapolated from research with animals. While arguing that pheromones are responsible for certain aspects of human crowd behavior, statements like "this area of human biology is still in its infancy" and "there are large gaps in our understanding of how precisely this works" make one wonder if any of the author's conclusions are valid.

ASA members and other Christians will find little that is helpful in this book. Even the chapter on the constructive effects of religious belief is designed to undermine theism. The author argues that belief in an external deity is simply a coping strategy that is a fundamental component of the human psyche. The concept of God is described as nothing more than a human creation, developed during our evolutionary past to help humans deal with their fear of the unknown. While acknowledging that religious beliefs can provide certain social and psychological benefits, these benefits are compared to the various objects (teddy bears, security blankets, etc.) that bring temporary comfort to children. Just as these transitional objects are abandoned as children mature, adults should also learn to abandon the concept of God, as believing in God is comparable to the function of these transitional objects in the lives of children.

What is the answer to the question that is raised in the title of the book? Can we really be good without God? According to the author, all we need is a little bit of psychotherapy. We first need to be aware of the psychological forces that shape our behavior and then be aware of the consequences of our behavior. If we can identify our emotions, recognize their causes, and make an "empathic" response, then we can be "good" without God. We need to move toward moral codes that are "based firmly on rational thought than on religious belief and revelations, which are neurologically closer to limbic drives" (p. 264). It is these instinctive limbic drives, which are so closely associated with destructive religious beliefs, that we need to overcome. While psychotherapists, humanists, and atheists will enjoy reading this book and agree with these conclusions, Christians and other theists certainly will not.

Reviewed by J. David Holland, Associate Professor of Life Science, Nyack College, One South Boulevard, Nyack, NY 10960.

FAITH & SCIENCE

THE MIRACLES OF EXODUS: A Scientist's Discovery of the Extraordinary Natural Causes of the Biblical Stories by Colin J. Humphreys. San Francisco: Harper-Collins Publishers Inc, 2003. 362 pages. Hardcover; $24.95. ISBN: 0060514043.

The Miracles of Exodus is the decade-long culmination of a scientist's search to understand the details of how Moses led the Israelites out of Egypt and on to Mount Sinai. Humphreys is a professor of material science who uses a combination of logic, biblical exposition, and science—primarily geology, biology, and archeology—to suggest scientific mechanisms for the Exodus miracles. The detective writing style reveals an amateur investigator visiting ruins and dusty library shelves to scour out details that shed light on one of the most significant people movements in history.

The Miracles of Exodus is a curious collection of ideas. Humphreys' premise appears to be that armed with a resourceful set of commentaries, Hebrew dictionaries, an atlas or two, and the occasional wisdom of a tour guide, anyone can unravel the biblical discrepancies of the Exodus which have plagued theologians for centuries. A few of the arguments are well constructed and make for interesting reading despite being frustratingly repetitive. For example, in "Crossing the River Jordan" (chap. 2), Humphreys locates an earthquake fault running near the town Adam, where the Jordan was blocked while the Israelites crossed the river (Josh. 3:15–16), and suggests the providential timing of an earthquake-induced mudslide at Adam, as has been recorded "... in 1906, 1834, 1546, 1534, 1267, and 1160" (p. 21). This is the essence of the eleven-page chapter which would have been significantly improved at half the length.

Humphreys moves on to reveal "... what really happened ...," —another repetitious phrase (pp. 15, 24, 27 ...)— at the burning bush, during the Egyptian plagues, during the Exodus, and in locating Mount Sinai. Critical to understanding the book is Humphreys' conception of what constitutes a miracle. He states: "In this book I've suggested that the miracles of the Exodus were natural events but nevertheless still miracles because of timing" (p. 271). Consequently the miracles of Humphreys' God are constrained to common experience, leading to some remarkable explanations such as volcanic activity at Midian for releasing "gas coming up from the ground under the burning bush to keep it burning, rather like the natural gas that keeps my coal effect gas fire burning" (p. 73). Moses would have been best to keep his shoes on if he were truly standing on top of an active volcano!

Another miracle is Humphreys' proposition that manna is tree gum exuded in the regions where the Israelites camped (p. 290), although Humphreys does not calculate how many trees would be required to continually feed 20,000 people and why the trees fail to leach syrup on Sundays. In contrast, Humphreys' following explanation for the Israelites' feast of quail based on an exhausting migration using current flight patterns is interesting. Discontinuities continue to appear in other theories, such as the suggestion that the pillar of cloud and fire that the Israelites followed through the wilderness was actually a volcano, Mount Sinai, although there is no discussion of how the volcano moves from being in front of the Israelites on their escape to the Red Sea, to being behind the Israelites, in forming a screen from the pursuing Egyptians (Exod. 14:19–24).

Similarly disturbing is the circular logic, such as during the placing of Etham. "In fact, all the major biblical scholars regard the location of Etham as unknown" (p. 207). Humphreys equates Etham with Shur by comparing lists of stopping places in Exodus (12:37–15:27) with those in Numbers (33:3–9) and then reasoning that since Shur means wall, and high mountains rise up like a wall around Shur, and geological rifts cause high mountains, "[t]hus, using the insights of science, in particular geology, we can say that the third mentioned place on the Exodus route, Shur, if the name means natural wall, is probably located on a rift valley" (p. 218). Incidentally, the *Zondervan Pictorial Bible Dictionary* locates Etham in the same region as Humphreys, although admittedly coming to the same con-

clusion in only one short paragraph rather than eighteen pages.

Humphreys has obviously enjoyed compiling *The Miracles of Exodus*. Unfortunately the few interesting ideas are too heavily buried among repetitious dross, limiting the audience to those few wanting to hone their skills in hunting for a few gems among many grey stones.

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

RE-ORDERING NATURE: Theology, Society and the New Genetics by Celia Deane-Drummond, Bronislaw Szerszynski, and Robin Grove-White, eds. New York: T & T Clark, 2003. 368 pages, index. Hardcover; $100.00. ISBN: 0567088960. Paperback; $29.95. ISBN: 0567088782.

Numerous books have appeared over the past few years dealing with Christian attitudes to emergent technologies and their applications in the biosciences. These issues are discussed in this well-ordered series of essays by leading experts from England and Scotland across a range of disciplines. The first four chapters feature essays and responses from a colloquium on "Re-ordering Nature: Theology and the New Genetics" held at Lancaster University in 2000. The remaining eleven chapters, with one exception, are entirely new essays produced for this volume. The fifteen contributors include well-known participants in science and theology dialogue, philosophers, theologians, historians, scientists, sociologists, and others. The eclectic mix, sometimes represented well in a single individual, makes for a very stimulating set of papers covering such topics as genetically modified organisms, risk, wisdom ethics, just experimentation, and the responses of youth to these issues.

The book starts with the widespread angst and skepticism of the public in Britain toward genetically modified organisms in particular and biotechnology in general. It affirms the need for scientists and theologians to recognize core issues that animate public perception and calls for a conscious descent from the lofty, self-created perch of the experts to engage with clear public concerns. The book challenges experts to understand the content and source of concerns and to address them in a serious and publicly engaged, rather than dismissive, manner.

At the same time, the book also performs a very important task by showing explicitly how theological resources drawn from within the Christian tradition can provide means to reframe and reinvigorate public debate about these emerging biotechnologies and their import. The authors collectively criticize the common tendency for theology to takes its cues from the sciences in how to frame public policy issues and suggest that the metaphysics that underlie scientific endeavors may prove inadequate to challenge the interface of science and society. Cost-benefit analysis and its stepchildren should not be the only criterion by which bioscience applications should be measured and decisions rendered.

Important issues raised include the ways the new biosciences will challenge traditional theological, religious, and societal conceptions about what it means to be a person; what it means for something to be "natural"; what limits, if any, should be imposed on advancing technologies; and how limits of any kind might be justified. While these essays will not be the final word on the subject, they raise many important issues for consideration by thinking Christians across the sciences, humanities, and theology. The paucity of attention to these issues within standard systematic theologies, for example, results in a failure to equip future leaders in Christian circles from engaging effectively with issues that are paramount within the wider culture. The authors are to be congratulated for raising a clear set of issues in a compelling and focused manner. University classes across a range of disciplines could fruitfully engage with these essays as part of their curriculum and thinking Christians everywhere will benefit from careful reading and consideration of the arguments presented here.

Reviewed by Dennis W. Cheek, Vice President for Venture Philanthropy Innovation, John Templeton Foundation, Radnor, PA 19087.

THINGS A COMPUTER SCIENTIST RARELY TALKS ABOUT: Interactions Between Faith and Computer Science by Donald E. Knuth. Stanford, CA: CSLI Publications, 2001. 230 pages, index, notes. Hardcover; $35.00. ISBN: 1575863278.

On October 6, 1999, Knuth, professor emeritus of the Art of Computer Programming at Stanford University, "The Father of Computer Science," stood before a critical audience at the Massachusetts Institute of Technology (MIT). He began a series of six lectures on how his Lutheran viewpoints on God and his devotion to his craft had intersected in his life, in particular when he composed a devotional book titled simply *3:16* (1990).

This book is written from his lecture transcripts, including the question/answer sessions which took place after his prepared remarks. It also contains an excellent Foreword by Anne Foerst of the MIT Artificial Intelligence Laboratory and an edited transcript of a panel discussion between Knuth and four other computer scientists (Harry Lewis of Harvard, Guy Steele Jr. of Sun Microsystems, Manuela Velosa of Carnegie Mellon, and Mitch Kapor, founder of Lotus Development Corporation). The subject of the panel discussion was "Creativity, Spirituality, and Computer Science."

Computer science, with mathematics, stands in a way outside other sciences, which deal with causality in the material world. The artifacts of computer science are all manmade, and the outsider might well think of the discipline as only another branch of engineering. After reading this fine volume, I think most people will be persuaded otherwise. Knuth explores the faith/vocation interface, and how a career in computer science led to both a unique and a deeper understanding of God. The "3:16 Project," a labor of love, led Knuth into a study of aesthetics, language translation, and theological history. His journey is told in gripping terms; one quickly senses a deeply humanistic and religious man as the story unfolds.

Two quotations serve to illustrate Knuth's thinking: (1) "... I learned that the policy of continually asking and trying to answer the difficult and unanswerable questions is far better, from God's point of view, than the alternative

of ignoring those questions" (p. 146); and (2) "The important thing to me ... is not the destination, but the journey. ... the real purpose of playing golf is not to put the ball in the hole" (p. 148).

This book is "required reading" for those who are both curious and serious about their faith, particularly those who see in the discipline of computer science more than just another "gee whiz" technology. It is a great book, written by a great person, written from his heart. Please do not miss it.

Reviewed by John W. Burgeson, 1114 East 4th Ave, Durango, CO 81301.

SCIENCE AND CHRISTIANITY: Conflict or Coherence? by Henry F. Schaefer III. Watkinsville, GA: Apollos Trust, 2003. 202 pages, index. Paperback; $15.00. ISBN: 097429750X.

In a sense, this book took twenty years to write. In 1984 Schaefer mentioned in passing in a UC Berkeley lecture that he had been in church the previous Sunday. Surprised students asked him why a chemistry professor believed in God, and ever since he has built an expanding roster of lectures answering that query from various angles.

Schaefer is an ASA Fellow who has been nominated several times for a Nobel Prize (*U.S. News*, December 23, 1991), has published more than 900 technical papers and has lectured widely on campuses worldwide. He writes authoritatively, yet accessibly and with enough humor to hold even a sleepy reader's interest. This book is ideal for curricular or extra-curricular reading by students at graduate or undergraduate levels, yet with content deep enough that even seasoned ASA veterans can learn from it.

Chapters include:

- "Scientists and Their Gods." This chapter counters Andrew Dixon White's *The History of the Warfare of Science with Theology* by pointing out that many pioneering scientists were Christians, and quoting an array of contemporary scientists. One of the many citations he uses in debunking the common idea that science forces one to atheism is Richard Feynman's statement, "Many scientists do believe in both science and God, the God of revelation, in a perfectly consistent way."
- "The Non-Debate with Steven Weinberg." This section recounts Schaefer's public exchange of views with the Nobel physicist at Baylor in 2000. Schaefer points out that several of Weinberg's writings seem to hint at cracks in his atheistic profession.
- "The Big Bang, Stephen Hawking, and God."
- "Climbing Mount Improbable: Evolutionary Science or Wishful Thinking." This chapter debunks the common impression that young-earth creationism and atheistic evolution are the only alternatives. He introduces readers to the mediating positions of progressive creationism and theistic evolution, and points out that his wife's and his differing opinions have not marred the happiness of their thirty-seven years of marriage.
- "Quantum Mechanics and Postmodernism." This chapter points out that Heisenberg's Uncertainty Principle does not justify the claim that truth is unknowable, or excuse a student for getting lost on a freeway en route to class!
- "C.S. Lewis on Science and Scientism."
- "The Ten Questions Intellectuals Ask about Christianity."
- "From Berkeley Professor to Christian." This section focuses on his own spiritual pilgrimage, demonstrating ways professors and pastors had moved him patiently and incrementally from skepticism to salvation.
- "The Way of Discovery." This gentle, concluding chapter nudges a seeker of truth to "seriously consider" four questions that the late Francis Schaeffer asked of visitors to L'Abri.

In covering this wide range of subject matter, Schaefer avoids the pedantic polysyllables to which some professors are prone. This is one of those rare books that combines solid substance with understandable style, spiced with humor. I read some books for amusement, others to stretch my mind. This book does both.

Reviewed by Dave Fisher, editor of Trans World Radio's "Truth in the Test Tube" broadcast and co-editor of the Newsletter of the ASA and CSCA, *285 Cane Garden Circle, Aurora, IL 60504.*

SCIENCE AND CHRISTIANITY: Conflict or Coherence? by Henry F. Schaefer III. Watkinsville, GA: Apollos Trust, 2003. 202 pages, index. Paperback; $15.00. ISBN: 097429750X.

Over the past twenty years, Schaefer, an ASA fellow, has been traveling the university circuit delivering public lectures on science and religion. These lectures, defending the reasonableness of being a scientist and a Christian, have been captured in print to form a very readable book. The scientific topics range from evolution to the big bang. Included is a chapter of responses to questions that have repeatedly been asked after his lectures and personal testimony. Schaefer has an impeccable record as a physical chemist, specializing in computational quantum chemistry, and has been recognized with numerous awards and is speculated to be "a five-time nominee for the Nobel Prize."

The book is a good primer for college students struggling with the truth claims of Christianity or the popular notion of science being antagonistic to Christianity. A glance at Schaefer's smiling picture on the back cover, and diving into the book, one can almost hear the chapters being delivered from a stage. The style is light, but engaging, and peppered with snippets from the many influential scientists, primarily chemists and physicists, that Schaefer has interacted with. As a series of transcribed lectures many ideas are simply stated without elaboration or references, but for those who might read the book before passing it on to a young acquaintance, the reward will be in the several excellent quotes for science and religion courses.

Schaefer has striven to show the reasonableness of being a Christian and a scientist, in part by showing that "many distinguished contemporary scientists have found the truth claims of Jesus Christ to be intellectually compelling" (p. 136). The engaging, humorous style makes the book ideal for undergraduates, Christian and otherwise, who are wrestling through the integration of science with Christianity.

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

LIGHT FROM THE EAST: Theology, Science, and the Eastern Orthodox Tradition by Alexei V. Nesteruk. Minneapolis, MN: Fortress Press, 2003. 287 pages, bibliography. Paperback; $22.00. ISBN: 0800634993.

Apart from some who are drawn to notions of top-down causality, it is fair to say that the overwhelming majority of scholars working in the field of science and religion adopt a bottom-up approach. It is not co-incidental that one of the towering figures in the field, John Polkinghorne, subtitled his 1993–94 Gifford Lectures *Reflections of a Bottom-Up Thinker*. The prevailing mindset in today's academy certainly favors approaches that, in Polkinghorne's words, "move from the particularities of experience to the generalities of understanding."

What would a discussion of science and religion look like from the top-down, Christian Platonistic perspective of Eastern Orthodoxy? Unfortunately, the literature dealing with science and theology from the Orthodox perspective is very slim, reflecting the fact that there is nothing comparable to the extensive engagement between science and Western theology in the Orthodox context. Obviously, a single book cannot correct the imbalance, but with *Light from the East* quantum physicist and cosmologist Alexei Nesteruk has done a remarkable job of exploring how Orthodox theology can uniquely inform our understanding of the scientific enterprise.

This is an important addition to the literature of science and religion. *Light from the East* continues the trend of exploring the rich variety and complexity of interactions between science and religion in specific traditions, places, and times. And in that respect Nesteruk provides valuable insight into how the theology and dogma of Eastern Christianity led to a different approach to the natural sciences from that of the Latin Church. The Greek Fathers understood natural processes theologically in terms of Platonic regularities and symmetries (laws) rather than empirically. Whereas Western Christianity saw science as a handmaiden of theology largely devoid of deeper spiritual meaning, the Greek Fathers maintained a liturgical view of science. Nesteruk concedes that this essentially Platonistic approach to science stunted experimental methodology; nevertheless, he maintains that from the Orthodox perspective the scientific enterprise as a whole acquires a sacred quality that offers a more satisfactory understanding of creation in relationship to God.

It is impossible to summarize adequately this often very demanding book in a brief review. Nesteruk, who studied with Roger Penrose and Ilya Prigogine and is preparing for the Orthodox priesthood, ranges with confidence over some very steep intellectual terrain—from Greek Patristic thought, to Kantian philosophy, to highly technical aspects of quantum cosmology. But this book, despite its dense argumentation, is not just for specialists. It contains many insights and challenging notions that have the potential to enliven science and religion discussions, at least those centering on Christianity.

One of the most important and challenging aspects of Nesteruk's project is his bold questioning of the assumption of symmetry between science and theology. He observes that the experiential approach to theology—"theology as worship or liturgy, as participation in the mysteries of the church" (p. 57)—is missing from most discussions of science and religion. Nesteruk suggests that in order to put theology and science on the same level, the mystical dimensions of theology have been eliminated and discursive reason, detached from "the spiritual intellect," has assumed ascendance over both science and theology. While it facilitates comparative analysis, the assumption that science and theology are epistemologically and ontologically uniform is naive, at best. Discursive reasoning, Nesteruk argues, cannot grasp the inner essences of things or the Divine. The Greek Fathers knew this and stressed "natural contemplation" as a mode of spiritual knowledge, which leads to the domain of "learned ignorance." There is a profound apophaticism (theology of negations) at the heart of Orthodox theology: discursive reasoning can point to God's existence but cannot penetrate God's mystery.

Nesteruk's project—and there is no simple way to put this—is to illustrate how theological apophaticism can be combined with cataphatic affirmations in dialectical antinomial fashion to form the basis for a more satisfactory mediation between science and theology than that provided by discursive reasoning. There is insufficient space to do justice to Nesteruk's nuanced maneuver here, but it seems to work when the science under consideration is quantum cosmology or some other theoretical field where high-level mathematical modeling dominates. One does wonder, however, how well Nesteruk's approach translates to less abstract scientific inquiry.

It is refreshing to come across a book that looks at the field from a very different perspective. When that book combines impressive erudition with an unwillingness to kowtow to prevailing intellectual fashions, it is downright bracing. In bringing the outlook of Eastern Orthodoxy to the science and religion discussion, Nesteruk may not reorient the field, but he has produced a book that warrants careful consideration and certainly rewards the effort.

Reviewed by Donald A. Yerxa, editor of Historically Speaking: The Bulletin of the Historical Society, *656 Beacon St., Mezzanine, Boston, MA 02215-2010, Professor of History, Eastern Nazarene College, 23 E. Elm Ave., Quincy, MA 02170.*

GENERAL SCIENCE

TECHNOLOGY AND HUMAN BECOMING by Philip Hefner. Minneapolis: Fortress Press, 2003. xi + 97 pages. Paperback; $6.00. ISBN: 0800636082.

This brief book contains a series of addresses delivered at the 2001 conference of the Institute on Religion in an Age of Science. It begins with images of technology as alien to humanity and its role in the world, or as consistent with them. It ends with a series of proposals: that technology is a sacred space, a medium of divine action and one of the major places today where religion happens and where we wrestle with the God who comes to engage us. The argument along the way is stimulating but very optimistic about technology, sometimes even subjugating the notion of revelation by God to the notion of imaginative search by humans.

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

ORIGINS & COSMOLOGY

GOD IN THE EQUATION: How Einstein Became the Prophet of the New Religious Era by Corey S. Powell. New York: The Free Press, 2002. 277 pages. Hardcover; $24.00. ISBN: 0684863480.

This could have been a good book. Powell, an editor at *Discover* and an adjunct professor of science writing at New York University, has material for a history of modern scientific cosmology with some insights that go beyond standard treatments. The ways in which developments in cosmology have influenced religious beliefs, with emphasis on the role of Einstein's distinctive pantheism, would have been an appropriate part of that discussion.

Unfortunately what Powell has produced is, on balance, a bad book. Its title and subtitle describe an overstated attempt to picture Einstein as a religious "prophet" with lambda, the cosmological constant, playing the role of "God."

What justification is there for such notions? Modern cosmology has influenced religious beliefs and thinking in important ways, and Einstein's own science and religion were inseparable because of his belief in Spinoza's pantheism. (The reference to "the deist god of Spinoza" on p. 44 is one of a number of errors.) While it was generally believed in 1917 that the universe was static, Einstein's acceptance of this idea, which required the use of a cosmological constant in his gravitational theory, may have been strengthened by identification of the universe with the immutable deity of Spinoza. But that hardly singles out the cosmological constant as "God."

Powell tries to give plausibility to his thesis by sprinkling the book with religious terminology like "apostles," "cardinals" and "promised land." The difference between the Einstein and de Sitter models was supposedly like the split between the Essenes and the Pharisees (p. 84), the Curtis-Shapley debate was the Diet of Worms of cosmology (p. 100), and Cecelia Payne-Gaposchkin was "a sort of Mary Magdalene" (p. 119). By giving its physics prize to Penzias and Wilson for their measurements of the microwave background radiation, the Nobel Committee "had now officially converted to the faith of sci/religion" (p. 181). Examples could be multiplied. The use of analogies and metaphors is fine, but these are forced and overdone to the point of absurdity.

But what is "the faith of sci/religion" supposed to be anyway? It is essentially science *as* religion which "blends elements of the experimental and the mystical" (p. 3). Certainly there is such a faith, but Einstein did not found it and the number of people, scientists or not, who accept his form of Spinozistic pantheism is relatively small. One does not convert to a "Church of Einstein" by appreciating the importance of the microwave background, and when astronomical discoveries evoke in Jewish or Christian scientists the kind of awe and wonder expressed in Psalm 8, they are not thereby abandoning biblical faith for something new.

The divinity of the cosmological constant is a lame rhetorical device. As Powell admits, Einstein himself rejected it. Cosmic expansion now does seem to be speeding up, something that can be explained with a positive value of lambda, but most cosmologists consider that a stop-gap and are looking for explanations in terms of dark energy.

Not surprisingly, Powell shows disdain for "old-time religion" which he thinks has been made obsolete. The Christianity of cosmologists like Lemaître and Milne is seen as a kind of embarrassment. He thinks (p. 207) that Augustine was speaking "evasively" in saying that before creation God was making hell for those who pry into mysteries. In reality the bishop was quoting a joke, and went on to give the serious answer that God created time—which Powell cites, apparently without understanding its significance.

The book of course describes the important developments in modern cosmology—the use of general relativity, the discovery of cosmic expansion, emergence of the big bang and steady state models, the microwave background, inflationary theories, and accelerating cosmic expansion. But there are better treatments that do not require the reader to wade through pseudo-theological jargon. Mark William Worthing's *God, Creation and Contemporary Physics* (Fortress, 1996) is a serious treatment of cosmology and theology, and Max Jammer's *Einstein and Religion* (Princeton, 1999) is an excellent treatment of the real "Church of Einstein" (if one must use that phrase). Leave *God in the Equation* aside.

Reviewed by George L. Murphy, St. Paul's Episcopal Church, 1361 W. Market St., Akron, OH 44313.

UNDERSTANDING THE PATTERN OF LIFE: Origin and Organization of the Species by Todd Charles Wood and Megan J. Murray. Nashville: Broadman and Holman Publishers, 2003. 256 pages, endnotes, glossary, bibliography, index. Paperback; $24.95. ISBN: 0805427147.

Wood is an assistant professor at the Center of Origins Research and Education at Bryan College in Dayton, Tennessee. Murray has worked in journalism and human resources and is currently pursuing her elementary teaching certification in Michigan. This book is a textbook intended for Christian colleges committed to a young-earth, six-calendar-day creationism (YEC). It is not an apologetic for YEC; that is an unquestionable given. Nor is it an anti-evolutionary book; evolution is ignored. What it is is an exposition of *baraminology*, a YEC approach to biosystematics.

Baraminology takes its name from the YEC concept of the *baramin*. Frank Lewis Marsh, a Seventh-Day Adventist professor of biology some fifty years ago, coined the word *baramin* by combining the Hebrew words for *create* and *kind*. Marsh believed that the Bible does not teach special creation, i.e., the direct creation of each extant and extinct species, but rather the creation of basic kinds (baramins) which have varied over the 6,000+ years since the creation of the world to produce species as we know them. A baramin might correspond to a family or genus in modern taxonomic terms.

Understanding the Pattern of Life surveys modern baraminology, a creationist biosystematics based on a refined

baramin concept. The chief contributors to the development of baraminology have been Walter ReMine and Kurt Wise. Wise, who did his doctoral work under the late Stephen Jay Gould, is a professor at Bryan College and the general editor of the series of books which includes this text. Modern baraminology seeks to determine on empirical grounds the relationships that exist or existed between species and so to reconstruct the original baramins. This book presents the concepts and methods of modern baraminology and then applies those concepts and methods to the questions of design in nature, biological imperfection, diversification since the Flood, and the geographical distribution of baramins.

Understanding the Pattern of Life contains some surprises for those who believe that all YECs are stuck in the past. We learn that baraminologists accept speciation and microevolution by natural selection; we also find that they accept stratigraphic evidence of ancestry (how they reconcile that with the Flood geology they also accept is not clear). They use homology, molecular homology, the loss of organs and structures, and genetic sequencing as evidence of relationship and degrees of relationship between modern and extinct species. Baraminology shows some affinities with modern cladistics in that it seeks to establish degrees of relationships between taxa without constructing family trees. It should be noted, however, that the authors reject cladistics as well as traditional systematics.

On the other hand, the reader should not be surprised to learn that baraminologists are willing to entertain the wildest speculations regarding earth history. They propose that the Flood was followed by great outpourings of lava beneath the sea, resulting in an increase in ocean temperature of 20° and the consequent formation of a giant hurricane over the north Atlantic which raged for decades. Then, as the oceans cooled, a single ice age resulted. Meanwhile, giant volcanoes erupted all over the world and profound climatic changes occurred. Great mats of vegetation floated on the surface of the oceans, eventually becoming beds of peat and coal. The authors also propose an accelerated version of plate tectonics, "catastropic plate tectonics." No empirical or scriptural evidence is offered in support of any of these speculations; the sole purpose for proposing them seems to be the desire to maintain the young earth hypothesis.

This book is enlightening regarding contemporary efforts of young-earth, six-calendar-day creationists to do justice both to their understanding of the Bible and the empirical evidence in an intellectually honest way. Still, only a reader with a prior commitment to YEC would find this book valuable.

Reviewed by Robert Rogland, Science Teacher, Covenant High School, Tacoma, WA 98465.

GOD AND DESIGN: The Teleological Argument and Modern Science by Neil A. Manson, ed. New York: Routledge. 376 pages, index. Paperback; $25.95. ISBN: 0415263431.

Manson is visiting assistant professor of philosophy at Virginia Commonwealth University in Richmond, and a former Gifford Fellow in Natural Theology. He has collected here nineteen essays dealing with various aspects of the arguments for and against the thesis that the universe in general, and this world in particular, are the products of design rather than chance. The list of contributors is impressive including Elliott Sober, John Leslie, Del Ratzsch, Paul Davies, William Lane Craig, Martin Rees, William Dembski, Michael Behe, Ken Miller, Michael Ruse, and Simon Conway Morris. It should be noted that of twenty-two contributors, fifteen are philosophers. The reader should be prepared for a lot more philosophy than science.

Manson has divided the essays into four categories: general considerations, physical cosmology, multiple universes, and biology. Since I find it impossible to summarize all nineteen essays in a review of less than one thousand words, I will make some general remarks and then comment on a few of the essays I consider particularly worth reading.

Only Craig is willing to assert that the arguments from "fine tuning" to the existence of a Creator are sound; most of the philosophers deny that any certain conclusion regarding the existence or non-existence of a designer can be inferred from the empirical data, even the data indicating fine tuning. None of the contributors denies outright that fine tuning is a characteristic of our universe. Most are unwilling to draw positive conclusions regarding the existence of a designer from the fact of fine tuning. Several of the philosophers present hard to follow logical and/or mathematical arguments for or against the probability of a designer (e.g., Sober, Craig, While). All seem to agree that the hypothesis that multiple universes may exist (1) has no empirical backing, but (2) is proposed primarily to get around the argument that the incredible fine tuning of the physical constants of the universe leads to the hypothesis that the universe was designed. And the majority seem to believe that if there is a Creator, he made a universe with a robust formational economy such that his will was accomplished through the operation of purely natural processes over the course of time. The majority of contributors reject the notion of divine intervention in either the universe as a whole or in the biosphere during the course of natural history.

Though a majority of the essays are philosophical, they may still be of interest to the Christian working in the sciences. I especially recommend the essay by Sober, "The Design Argument," in which he points out the important difference between *likelihood* arguments (which he finds promising though not logically compelling) and *probabilistic* arguments (which he finds inherently flawed). Those who write about the improbability of this or that biological structure or physical constant being what it is, unless it is the product of a creative mind, would do well to read this essay. Ratzsch's essay offers a refreshingly different perspective: Ratzsch maintains that in most cases design is immediately and innately perceived, not recognized as the logical inference to be drawn from the phenomena. Those who follow Ratzsch will find the work of Intelligent Design theorists unnecessary, though not necessarily unsound. D. H. Mellor presents a cogent critique of the multiple universes hypothesis, which should be read by all who are tempted to adopt it as an easy solution to the fine tuning argument for a designer. The essays by Behe, Miller, and Ruse, while cogent summaries of their previously stated views, break no new ground.

A few of the essays are disappointing and a few others are too turgid to be worth plowing through, but the majority of them are worth the read. The Christian who wants to know what contemporary philosophers (especially) and scientists think of the arguments for design would profit from reading this book.

Reviewed by Robert Rogland, Science Teacher, Covenant High School, Tacoma, WA 98465.

LIFE'S SOLUTION: Inevitable Humans in a Lonely Universe by Simon Conway Morris. Cambridge: Cambridge University Press, 2003. 464 pages, index. Hardcover, $29.95. ISBN: 0521827043.

Conway Morris is one of the world's leading experts on palaeobiology. He is also a Christian. His recent book is a remarkable synthesis in the area of evolutionary biology. In particular, it is perhaps the most thorough treatment ever given to the topic of biological convergence, the ability of life to chart a path around all of the obstacles that would bring it to an end or hamper its development and arrive at a solution. As if his synthesis were not grand enough, Conway Morris includes discussions of planetary development and the formation of the solar system to set the stage for a discussion of life on earth. This is scientific creativity at its finest in the hands of a first-rate practitioner and there is a great deal to be learned from such a work. In addition, the readers of this journal will find fascinating the way in which Conway Morris holds his faith in the course of the discussion.

Conway Morris is professor of evolutionary palaeobiology at Cambridge University (a position created for him in 1995). He has received an array of honors, medals and degrees from, among others, the National Academy of Sciences, the Paleontological Society of the United States, Yale University, the University of Uppsala, the European Union of Geosciences and the Geological Society of London. He was elected Fellow of the Royal Society in 1990 and has delivered a host of guest lectureships from The Selby Visiting Fellow for the Australian Academy of Sciences (1992) to The Royal Institution Christmas Lectures (1996) in London. His previous book, *The Crucible of Creation: The Burgess Shale and the Rise of Animals* (Oxford: University Press, 1998), established Conway Morris as a—perhaps the—leading authority on animal life in the Cambrian period.

In the first five of twelve chapters, Conway Morris probes the mystery of the improbability that biological life exists at all, given all of the conditions that have to be just right and all of the processes that must work just so. But, of course, life has done more than just survive; it has thrived and proliferated even in extreme conditions. This fact alone is noteworthy. But even more so, for Conway Morris, is that fact that, along the way, many divergent life forms have developed similar or identical survival strategies—and have done so independently, that is, by way of separate evolutionary paths.

The case Conway Morris makes is that the significance of convergent features is to infer "constraint." Evolution is not free to go in all the directions that more contingent views of the evolutionary process (such as are sometime attributed to S. J. Gould, among others) would have us believe. In chapters six through ten then, Conway Morris details an impressive set of examples that he believes would exhibit this idea of constraint or of convergence. As examples, he identifies chlorophyll and photosynthesis and suggests that replays of evolution (if they were possible) or life systems on another planet (if found) would almost certainly contain a remarkably similar if not identical set of molecules. To develop the case that convergence implies constraint, he pulls out all the stops, arguing that evolutionary convergence is an almost ubiquitous phenomenon. He illustrates with examples from vision, olfaction, echolocation, and intelligence, to name just a few.

What remains in chapter eleven is to ponder the significance of the phenomenon of convergence and to develop a "theology of evolution." He argues that for all of its theoretical improbability, in the actual working out of natural processes, the deck looks stacked: somehow, the evolutionary process seems to be driven inevitably toward only a small range of solutions. Though he offers little evidence beyond the observation of convergence and the implication of constraint, he concludes that these things suggest an underlying structure and purpose—something that is consistent with a creation.

Conway Morris intended this work to challenge several aspects of evolutionary theory. On his Cambridge University web page he says: "It is anticipated that this book will make a considerable impact, as it throws severe doubt on a number of fashionable presuppositions in evolution." The title he originally proposed for the work also focuses on his critique of evolutionary theory: "The Paradoxes of Evolution: Inevitable Humans in a Lonely Universe." But it must be very clear that Conway Morris is no fundamentalist. He has as little patience for anything that smacks of "creation science" as he does for Stephen J. Gould and his notion that if you could roll back evolution and play it again, the outcome would be entirely different. For all of his critique, Conway Morris offers a constructive message and one that is breathtakingly courageous given his context. He asserts that we need to "reunify the scientific world-view with the religious instinct." To do so, he says, "will be our lifeline" (p. 328).

Whether you find yourself agreeing with the overall argument or not, *Life's Solution* is a magnificent work and bound to stimulate scientist and theologian alike.

Reviewed by Steve Delamarter, Professor of Old Testament, George Fox Evangelical Seminary, Portland, OR 97223 and Paul Brown, Asst. Professor (Environmental Studies – Chemistry and Biology), Trinity Western University, Langley, BC, Canada, V2Y 1Y1.

THE COSMOS IN THE LIGHT OF THE CROSS by George L. Murphy. Harrisburg, PA: Trinity Press International, 2003. 213 pages, bibliography, index. Hardcover; $45.00. ISBN: 1563384175.

I have come to believe that theological issues are more important than scientific ones in today's science/faith controversies. Discussions tend to focus on scientific questions (or on biblical interpretation, which at least gets closer to the root problems) while underlying theological issues are ignored. Murphy's *The Cosmos in the Light of the Cross* is therefore a welcome contribution.

Murphy, a physicist, Lutheran pastor and ASA fellow, offers a theological understanding of God's work in the world that science describes. His framework is the "theology of the cross" that was advocated by Luther (and, one could argue, by the Apostle Paul). Rather than starting with human ideas of how we think God should be (which results in idolatry), the theology of the cross looks to God's self-revelation in Jesus Christ, especially the humiliation in which God, in Bonhoeffer's words, "lets himself be pushed out of the world on to the cross." As Paul pointed out, this is scandalous to human preconceptions about God, but it is consistent with the humble, self-sacrificing love revealed in Christ.

With a theology of the cross, we could expect God's action in nature to be masked, so that we need not invoke God to plug explanatory gaps in natural science. This contrasts with a "theology of glory" that expects God to leave "fingerprints all over the evidence." Natural theology is a false theology of glory if it tries to find God by studying nature independently of his self-revelation, but a dependent view, in which what Christ reveals about God provides the context for reading the "book of nature," may be fruitful.

In addition to applying the theology of the cross to understanding God's hiddenness in his creation, Murphy offers insight on the suffering and death that some object to in evolution (and that most of us find objectionable in our own lives). While he does not claim to offer a solution to the "problem of evil," the cross is where theodicy must start, and it is a helpful insight that God confounds human expectations by working his will and ultimately triumphing through suffering and death, both in Christ and in creation.

Later chapters insightfully apply the theology of the cross to ethics and environmental stewardship, particularly as they relate to science and technology. I was less moved by the final chapters on eschatology and worship.

The book is well written, with thoughtful, biblically based theology and scientific insight. Sometimes these are cleverly combined, as when Lamarckian evolution is described as "a kind of biological works righteousness." While the book does not require advanced scientific or theological expertise of the reader, it does require a willingness to give mature and careful thought to the issues and arguments. Those looking for a more introductory book (perhaps for a college student first considering science/faith issues) could turn to Murphy's earlier *Toward a Christian View of a Scientific World*.

A possible deficiency is that the book does not fully address issues of Adam and the Fall, which for some are big obstacles to accepting evolution as God's means of creation. This omission may leave more conservative Protestant readers dissatisfied. Such readers may also be turned off by citations of Old Testament apocrypha and Lutheran and Roman Catholic liturgies. I would encourage my conservative friends to read the book anyway, and not let these items distract them from the biblically sound insights about how Christ and his cross reveal God's nature. This moderate Presbyterian found it very worthwhile.

While some participants in modern science/faith discussions are especially notorious for dodging theological issues, all of us could benefit from deeper theological grounding. *The Cosmos in the Light of the Cross* offers a promising framework for viewing God's work in nature. Its arguments deserve consideration even by those who disagree with Murphy, and I highly recommend the book to anyone who desires to think more deeply and clearly about these issues.

Reviewed by Allan H. Harvey, 1575 Bradley Dr., Boulder, CO 80305.

PHILOSOPHY & THEOLOGY

THE ADVANCEMENT: Keeping Faith in An Evolutionary Age by L. Russ Bush. Nashville, TN: Broadman & Holman, 2003. 142 pages. Paperback; $19.99. ISBN: 0805430342.

Bush is academic dean and professor of Christian Philosophy at Southeastern Baptist Theological Seminary. He holds a Ph.D. from Southwestern Baptist Theological Seminary, has authored two books, and is past president of the Evangelical Philosophical Society and the Evangelical Theological Society. Thus, he has the credentials to address this subject.

The book's title requires a little explanation. The last two hundred years of philosophical writings have been referred to as "modern" and more recently as "postmodern." The author contends that the era of the twenty-first century is ripe for a new descriptive word. He thinks "modern" seems strangely old-fashioned and "postmodern" is surely a temporary name. Perhaps the era through which we are passing could be dubbed the "advancement." Whether this name will be accepted by twenty-first century philosophers remains to be seen. Bush assures us the conflict between the naturalistic world view and the Christian theistic world view will continue.

One feature of this book I especially appreciate is the endnotes (38 pages). Bush makes extensive comments in this portion, and I learned almost as much from them as from the main text. A sample of the chapter headings will give an idea of how thoroughly Bush has prepared for this book: The Rise of Advancement Science; The Theory of Knowledge; Keeping Faith in an Evolutionary Age; and Modern Theistic Alternatives.

Bush concludes the book with a statement of three fundamental truths (speaking from a Christian theistic world view): (1) God exists; (2) the world exists (world = universe); and (3) Jesus, the God-man, exists and is Lord. I found this summarizing statement to be very striking:

> Atheistic philosophy always tends toward relativism, and absolutes are lost in every aspect of intellectual life. Without God as the purposeful Creator of the human mind, that perceptive ability which humans have is itself only a fortuitous result of natural processes. As a product exclusively of natural cause and effect processes, the human mind cannot be free to make an objective value judgment of any kind. Writings by perceptive thinkers such as Camus and Sartre illustrate this point. There is no exit if there is no God. The naturalistic room is sealed without a seam.

Small wonder that postmodern writers tend to believe there is no such thing as absolute truth.

Bush's writing style is concise, clear, and easy to follow. He has extensive knowledge of the main themes he treats. I enjoyed reading the book, and enthusiastically recommend the book to all ASA members.

Reviewed by O. C. Karkalits, McNeese State University, Lake Charles, LA 70609.

DARWIN'S CATHEDRAL: Evolution, Religion, and the Nature of Society by David Sloan Wilson. Chicago, IL: The University of Chicago Press, 2002. 233 pages, notes, bibliography, index. Paperback; $14.00. ISBN: 0226901351.

Over one hundred years ago, psychologist William James delivered his Edinburgh Gifford Lectures on "The Variety of Religious Experience" (TVORE). A committed empiricist, James respectfully examined a wide variety of individual experiences, remaining agnostic (see lecture XX, [New York: Random House, 1929], 509), if not atheistic. It was not until six years later, in his book *A Pluralistic Universe*, that he came to a different stance, as William Dean describes in chapter 4 of his recent book, *The American Spiritual Culture*. (See my review of Dean's book in *PSCF* 55, no. 3 [September 2003]: 207.)

Wilson, professor of biology and anthropology at Binghamton University, offers a companion book to James, investigating religion using the tools of evolutionary biology. Seeing all culture as an organism, he argues that individual religious bodies within it are best analyzed as adaptive groups. (Four other competing models are discussed and rejected). Claiming that symbolic thought is what separates humanity from the animal kingdom, he differentiates between two types of realism, factual and practical. Science, he argues, has chosen factual realism as its "god," but evolution indicates that following practical realism, even though it may not be based on "facts," is often a superior course of action.

This book is heavy reading (as is James' TVORE), but it is well worth studying. One need not agree with Wilson's assessment of the gospels as "poor history" to gain the same kind of understanding of religious organizations as James provided of religious experiences. Wilson's conclusions appear on page 228:

> Those who regard themselves as nonreligious often scorn the other-worldliness of religion as a form of mental weakness. ... This stance can itself be criticized for misconstruing and cheapening a set of issues that deserves our most serious attention ...
>
> In the first place, much religious belief is not detached from reality ... Rather, it is intimately connected to reality by motivating behaviors that are adaptive in the real world ... It is true that many religious beliefs are false as literal descriptions of the real world, but this merely forces us to recognize two forms of realism: a factual realism based on literal correspondence and a practical realism based on behavioral adaptedness. An atheist historian who understood the real life of Jesus but whose own life was a mess as a result of his beliefs would be factually attached to and practically detached from reality.
>
> In the second place, much religious belief does not represent a form of mental weakness but rather the healthy functioning of the biologically and culturally well-adapted human mind. Rationality is not the gold standard against which all other forms of thought are to be judged. Adaptation is the gold standard against which rationality must be judged, along with all other forms of thought. Evolutionary biologists should be especially quick to grasp this point because they appreciate that the well-adapted mind is ultimately an organ of survival and reproduction. If there is a trade-off between the two forms of realism, such that our beliefs can become more adaptive only by becoming factually less true, then factual realism will be the loser every time (Wilson 1990). To paraphrase evolutionary psychologists, factual realists detached from practical reality were not among our ancestors. It is the person who elevates factual truth above practical truth who must be accused of mental weakness from an evolutionary perspective.
>
> In the third place, disparaging the otherworldly nature of religion presumes that nonreligious belief systems are more factually realistic. It is true that nonreligious belief systems manage without the gods, but they might still distort the facts of the real world ... We know that this is the case for patriotic versions of history, which are as silly and weak-minded for people of other nations as a given religion for people of other faiths.

In Wilson's analysis, there is much of value. I recommend this book highly; it is another "keeper." Unlike James, Wilson did not include comments on his own religious beliefs. I wish he had done so. Such a practice was more acceptable in years past, but in this case the reader must speculate on his own.

Reviewed by John W. Burgeson, 1114 East 4th Ave., Durango, CO 81301.

CONTEMPORARY DEBATES IN PHILOSOPHY OF RELIGION by Michael L. Peterson and Raymond J. Vanarragon, eds. Williston, VT: Blackwell Publishing, 2004. 353 pages. Paperback; $34.95. ISBN: 0631200436.

If you like debates, if you like pros and cons, if you like trenchant reasoning, and if you like rebuttals, this book is for you. Don't let the word "philosophy" in the title put you off, because the topics explored are germane to *PSCF* readers since they are very much related to science and Christian faith.

The twelve topics explored are divided into three main divisions. There are helpful footnotes, notes on contributors, and an index but no bibliography. Each debate topic is presented from two sides with follow-up replies to each presentation. This makes for especially interesting and satisfying reading since controversial points are challenged rather than left dangling.

I will mention just three topics discussed in this book, one from each of the three divisions, although all of the book's topics are relevant, well chosen, and skillfully debated. From division one ("Attacks on Religious Belief"), the age-old Achilles' heel of theism is explored,

namely, "Is Evil Evidence Against Belief in God?" William L. Rowe, philosophy professor at Purdue University, says yes; Daniel Howard-Snyder, philosophy associate professor at Western Washington University, and Michael Bergmann, philosophy assistant professor at Purdue University, say no.

From division two ("Arguments for Religious Belief"), the cosmogonic question is discussed, i.e., "Is God's Existence the Best Explanation of the Universe?" Bruce R. Reichenbach, philosophy professor at Augsburg College affirms; Richard M. Gale, philosophy professor at the University of Pittsburgh, denies.

Division three ("Issues Within Religion") considers the conundrum "Does God Take Risks in Governing the World?" William Hasker, philosophy emeritus professor at Huntington College says "yes," to the question which he forms this way: "God takes risks if he makes decisions that depend for their outcomes on the responses of free creatures in which the decisions themselves are not informed by knowledge of the outcomes" (p. 219). "God Does Not Take Risks" writes Paul Helm, theology and philosophy professor at Regent College.

I will mention three more debate topics that you may find appealing. John Worrall thinks "Science Discredits Religion." Del Ratzsch doesn't think so in his "The Demise of Religion: Greatly Exaggerated Reports from the Science/ Religion Wars." Stephen Davis argues it is rational for Christians to believe in the resurrection; no, it isn't says Michael Martin. Dean W. Zimmerman contends "Christians Should Affirm Mind-Body Dualism"; "Christians Should Reject Mind-Body Dualism" responds Lynne Rudder Baker.

The arguments presented are sometimes quite detailed, finely nuanced, and very difficult to follow. In the end, neither side can claim victory since no conclusions are reached within the book. However, whatever your position on these issues, to explore them with curiosity and an open mind will substantially reward you. I recommend this book to all those interested in exploring philosophy, science, theology, and questions which have confronted humanity from antiquity.

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

A PHILOSOPHICAL, SCIENTIFIC, AND THEOLOGICAL DEFENSE FOR THE NOTION THAT A GOD EXISTS by Hal Flemings. Lanham, MD: University Press of America, 2003. 136 pages. Paperback; $28.00. ISBN: 0761826475.

Flemings formerly taught Hebrew at Foundation College in Dan Diego. He now teaches insurance and securities at the Pioneer School of Insurance. His religious journey extends from being a "'Born Again' Baptist, then to a skeptic, and finally to one of Jehovah's Witnesses" (p. x). Flemings writes this book from an overtly theistic viewpoint: "Make no mistake, I am a Christian theist" (p. 55).

This book presents a parsimonious history of the debate/question on whether God exists. In doing this, Flemings defines "God," presents options offered by theists, pantheists, atheists, and agnostics, gives a history of the debate from ancient to modern times, distills the negative and positive arguments, gives answers to objections raised by atheists and agnostics, deals with the problem of evil, presents a non-circular argument for God's existence, and argues for the uniqueness of the Bible in deciding the question.

The book has eleven relatively short chapters with name and subject indices. Some flaws mar the book. The page numbers in the index are incorrect. For example, "Upanishads" is referenced to page 181, but there are only 136 pages in the book. An antecedent is missing for "they reject theology" (p. 18). "Soon" (p. 19) should be "some" and "if" (p. 90) should be "is." Despite the publisher's contention, Flemings does not present the problem of evil from a new perspective.

The problem of evil and/or suffering is often considered the Achilles heel of theism. Flemings states it this way: "How can a loving and all-powerful God tolerate evil?" (p. 89). His answer will not satisfy some readers. Many evangelicals will object to Flemings' position which denies God's omniscience, omnipresence, and eternal punishment of the wicked (pp. 93–6). Atheists will accuse him of retreating to the "God in the gaps" position of "we don't know the reason why God doesn't stop the suffering in the world, but he must have one."

Flemings' book has many good features. For one, it is concise. He gets to the point quickly and with trenchant quotes. For another, he fairly presents other viewpoints: "in this work, I do not wish to muffle the voices of those at odds with me" (p. 55). And he doesn't. He allows them to present their positions, often in their own words. Finally, in presenting his convictions, Flemings' rhetoric is irenic and non-inflammatory.

Overall, I liked the book. Flemings' arguments are easy to follow, and he includes some terrific quotes. This book has something to offer to both the neophyte and scholar. With the considerations in this review in mind, I am pleased to recommend it.

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

RELIGION AND CHRISTIAN FAITH

DOUBT: A History by Jennifer Michael Hecht. San Francisco, CA: Harper Collins Publishers, 2003. 551 pages. Hardcover; $27.95. ISBN: 0060097728.

A philosopher wrote that if he could say one thing to God (god), it would be: "Not enough evidence." Hecht echoes this sentiment when she writes that "there is no universally compelling, empirical, or philosophical evidence for the existence of God, a purposeful universe, or life after death" (p. xi). Thus, the ambiguity of the evidence provides fodder for this book's theme, namely, doubt versus faith. Friedrich Heinrich Jacobi expressed this inner conflict when he stated his own view: "I ... am a heathen in my reason and a Christian with my whole heart."

Hecht traces doubt from antiquity to modern times. Thus she includes, among many others, Confucius,

Socrates, Wang Ch'ung, Hypatia, Marie Curie, Ludwig Wittgenstein, Margaret Sanger, and Frank Zappa. The subtitle of the book is "the great doubters and their legacy of innovation from Socrates and Jesus to Jefferson and Wittgenstein." She even includes "The Scale of Doubt Quiz" to allow readers to determine where they might fall on the scale of hard-core atheist, rationalist materialist, agnostic, or believer.

Is a book review on "doubt" appropriate for a journal with the word "faith" in its title? Yes, because doubt is merely the mirror reflection of faith. (It is sometimes contended that despair is the opposite of belief, but do most atheists exhibit despair?) Or to put it another way, faith is the other side of the same coin. Doubt is a somewhat more subtle expression of faith, i.e., doubt requires faith that what you doubt is erroneous. Hecht's book could just as accurately be titled "Faith." In order to have doubt, there must be something to question. The Skeptics would have had no ammunition for doubt if not for the Epicurean, Stoics and Neo-Platonists. Further support that faith is always at play in doubt is Hecht's inclusion of Jesus, Paul, and Augustine as examples of doubters. The Skeptics considered those who held other viewpoints "dogmatists," a sure indication that faith was in play on both sides.

Some of the conclusions Hecht documents, which other writers have trumpeted, are: (1) most people have always believed in god (gods); (2) many people have sought to placate god via worship and sacrifice; (3) the arguments used for theism and atheism are ancient; (4) Jews and Christians are the only people who have believed in a bodily resurrection; (5) doubters have often driven science (they seek sense via empiricism and not via religion or tradition); (6) humanity's origin, meaning, and destiny have always haunted thinkers; (7) religion often supports patriotism and public order; and (8) people experience pain by not being accorded significance: "The experience of feeling important but not being treated as important by the universe is the source of much woe" (p. 111).

Hecht is a historian and poet who teaches at Nassau Community College. Her other books include *The End of the Soul* and *The Next Ancient World*. In advance of its publication in November 2003, *Doubt* received many accolades including one from Lake Wobegon's Garrison Keillor who thinks the book is "a bold and brilliant work and highly readable ... it's the world religions course you wish you'd had in college." This book will strike a chord for those who like to study theology, philosophy, science, and history. And if like Thomas, the reader has experienced both doubt and faith, this book may have an added attraction by providing insight and/or affirmation.

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

LUTHER: Biography of a Reformer by Frederick Nohl. St. Louis, MO: Concordia Publishing House, 2003. 250 pages. Hardcover; $14.99. ISBN: 0758606516.

This is a book for those who want to brush up on the issues involved in the Protestant Reformation without an elongated treatment of subsidiary points. For example, how did Luther's movement come to be called the Protestant Reformation? This came about when the Edict of Worms required Catholic teachings in Lutheran states. The Lutheran princes demanded that Lutheran lands remain strictly Lutheran with the statement: "We *protest* before God and before men." From that time on Lutherans were known as the Protestors or Protestants.

One of the benefits of the Protestant Reformation was the liberating of the individual to pursue an individual faith based on conscience. This had obvious benefits to the scientific community which freed from dogma could pursue empiricism. Other Reformation dividends included worship services which use the vernacular (instead of Latin) presentation of the sacramental.

The Counter Reformation was an acknowledgment that a cleansing and reforming of the church was needed. The Protestant Reformation had a salutary effect on the sacraments including the eliminating of indulgences, the reinterpretation of the meaning of the Eucharist, and the provision of marriage for reformed priests. The church is the beneficiary of Luther's commentaries, hymns, catechisms, sermons, and courageous stands.

The publication of this book was timed to coincide with the release of a theatrical presentation of Luther. By the time this review sees print, the film will most likely be available on video which will visually dramatize some of this book's events. (The book includes some photographs from the film.) This biography provides enjoyable, interesting, relevant, and concise reading about a man who made an enormous impact on his time and ours.

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

CELEBRATING BIBLICAL FEASTS by Martha Zimmerman. Minneapolis, MN: Bethany House, 2004. 191 pages. Paperback; $12.99. ISBN: 0764228978.

This is a neat little book than can provide help in celebrating the Christian faith. A paper completed for a seminary course eventually motivated Zimmerman to write this book. Her search for materials to use in educating her children led her to "the marvelous truths of the Old Testament with New Testament understanding" (p. 10).

In this book, Zimmerman gives advice on how to celebrate these Old Testament Jewish celebrations: Sabbath, Passover, the Omer, Shavouth, Rosh Hashanah, Yom Kippur, and Sukkoth. If you do not recognize the names or significance of these festivals, if you desire to educate yourself, if you desire to increase your celebratory experiences, this book could help. The author explains the meaning of each celebration, provides guidance in worship, and even includes food recipes and diagrams where appropriate.

To those who question the wisdom of observing or celebrating Jewish feasts, Zimmerman comments: "... celebrating the feasts are not to be a legalistic set of rules to earn God's favor but are to be used as teaching tools ..." (p. 16). The Apostle Paul also spoke to this topic: "Some think that Christians should observe the Jewish holidays ... but others say it is wrong ... On questions of this kind everyone must decide for himself" (Romans 14, TLB).

Jewish scholar David H. Stern praises this book and perhaps best summarizes its thrust and appropriateness: "Why should we Jews have all the fun? This book shows Christians how to incorporate the joy, wisdom and human interrelating of biblical celebrations into their family and communal life" (p. 1). Good advice.

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

SOCIAL SCIENCE

THE FRACTURE OF GOOD ORDER: Christian Antiliberalism and the Challenge to American Politics by Jason C. Bivins. Chapel Hill, NC: The University of North Carolina Press, 2003. 181 pages, notes, bibliography, index. Paperback; $18.95. ISBN: 0807854689.

This interesting book looks at a growing phenomenon in the USA, the rise of protest against the political order and civil authority of government by organized groups claiming Christian grounds for their actions. This is not a "right" vs. "left" set of issues, but one which transcends both. The term "antiliberalism" denotes a rebellion against the modern state, against the political tradition usually associated with John Locke, Adam Smith, John Stuart Mill, and others. Christian antiliberals are often greatly disparate from one another. Nevertheless, all share three convictions: (1) an aversion to the centralization of power; (2) a belief that politics is hostage to the elite; (3) and a conviction that the government is hostile to Christian morality.

Bivins, assistant professor of religious studies at North Carolina State University, closely examines three very different antiliberal groups: the Sojourners, whose cause is the poor; the New Christian Right, whose cause is individual ethics; and the Berrigans, whose cause is the making of war machines. Each of these, operating out of a sense of what they see as a particular Christian position, believe that society's trends in the past fifty years have made it very difficult to practice religion faithfully. Each group questions governmental legitimacy, arguing that the present political order lacks legitimacy on two counts: (1) a lack of moral authority; (2) and a lack of sufficient opportunity for citizen input.

What do these three groups have in common? In chapter 1, Bivins suggests that all three confront governmental power by the practices of disobedience, disruption, and conflict as public witness against what each sees as injustice. For them, "the terrain of the political is inseparable from the terrain of religion" (p. 34). They are "... particularly agonistic, directly confrontational, and willfully out of step with expectations about what it means to be religious" (p. 10). Bivins posits four defining antiliberal features: (1) "political illegibility," which simply means that the reigning paradigm of "right vs. left" is of no value in understanding them; (2) "the sacred register of politics," which observes that each group politicizes their own understanding of Christianity, generally claiming for themselves "a kind of religious righteousness" (p. 162); (3) "ritual protest," which draws on each group's power to perform religious rituals (group prayers, etc.) in the public places they feel are hostile to their understandings of Christian moral codes; and (4) "*koinonia*," their efforts to create communal places of refuge from what they see as an alien socio-political structure. Bivins examines each of these features in each of the groups in chapters 2, 3 and 4. Chapter 5 summarizes his findings.

What should our reaction be to an antiliberal group? Should we marginalize it by ignoring its message and refusing it a place at the political dialog table? Bivins argues that this is what is generally done (witness the courts' refusal to let the Berrigans state their grounds for their actions), and that such a course of action is precisely wrong. In modern culture, there are "... tacit assumptions about what constitute socially acceptable religion, assumptions that function to exclude certain forms of religion from the conversation" (p. 167). Bivins contends that the resulting animosity can be addressed, and at least partially overcome, by a fuller public engagement with antiliberal group spokespeople. At the very least, such actions would address a key antiliberal criticism against the political culture. Bivins draws on the writings of Stephen Carter for support. Both argue that religions ought not be dismissed as illegitimate participants in political discourse. He writes:

> Liberalism's goals are worth protecting, but the effort ... has too often employed antidemocratic mechanisms that constrain participation ... Liberalism can better survive ... by welcoming multiple forms of action ... Such an approach may actually better serve to protect individual liberty and public civility ... (p. 174).

This book is not an easy read; it requires one to enter into the author's word definitions and think about society and politics from an unfamiliar stance. By selecting three very different groups to analyze, Bivins has successfully been able to go deep into the gut issues of Christian identity movements, focusing on their commonality. I recommend it highly.

Reviewed by John W. Burgeson, 1114 East 4th Ave, Durango, CO 81301.

THE BEETHOVEN FACTOR: The New Positive Psychology of Hardiness, Happiness, Healing, and Hope by Paul Pearsall. Charlottesville, VA: Hampton Roads Publishing Company, 2003. 258 pages. Hardcover; $22.95. ISBN: 1571743979.

Pearsall thinks that reflection on the good life should not be left to the philosophers, poets, and novelists. Positive psychology, which took root in Akumal, Mexico, in 1999, should have a role. A small group of psychologists wanted to emphasize what is "strong, right, and wonderful about the human spirit" (p. xiii). This was a new direction for a psychology which had traditionally been about repairing misfunction. Positive psychology seeks to address people's ability to flourish and savor life despite the chronic suffering often involved. Positive psychology builds on the work of pioneers such as Eric Erickson, Abraham Maslow, Carl Rogers, and many others who have addressed people's positive proclivities.

A leader in the new movement is E. P. Seligman, former president of the American Psychological Association,

founder of the Positive Psychology Network, and author of *Authentic Happiness*. Seligman and others continue writing and research on the nature and potential for improvement of human coping abilities. How can people best transcend the "slaughterhouses and indecencies of the human condition," "the serial suffering of multiple miseries" (p. xxvi)?

Pearsall asks "Why Is There Suffering in the World?" and then gives this answer: "life is made difficult so it can be made more authentic, real, and intensely meaningful" (pp. xxvii–xxviii). What does Pearsall say to readers who respond that they prefer their run-of-the-mill, common denominator, hum-drum, non-authentic, painless life? Such lives, Pearsall contends, are less authentic, less real, and less meaningful.

The Beethoven Factor's two main sections ("Thriving through the Tough Times" and "A Thriver's Manual") contain 12 chapters with endnotes, a glossary, a bibliography, and an index. Each chapter begins with a pithy quote such as Longfellow's observation that "the lowest ebb is the turn of the tide." William James is succinct in describing the positive, overcoming attitude: "All natural goods perish; riches take wings; fame is a breath; love is a cheat; youth and health and pleasures will vanish. Ultimately, the skull will grin at the banquet, but there are those who live habitually on the sunny side of their misery line." (James' thought is reminiscent of 1 John 2:16–17: "The world and its desires pass away ...")

All of the suggestions in *Beethoven* for living on the positive side can be found in the writings of ancient philosophers. Paul's epistles are robust with positive concepts such as how to thrive, how to find meaning in misery, and how to nurture hardiness, resilience, and hope. Pearsall's book conceptualizes, illuminates, and illustrates these time-tested principles. This book, easily understood, fits into the category some people label "pop psychology" or "self-help" (Pearsall claims his book does not fit this category). But what good is psychology if it does not help improve the human condition?

Pearsall is a psychological pragmatist, but he bases his conclusions on tried and true philosophical, psychological, and for the most part, principles congruent with biblical content. Although this book is not overtly written from a Christian perspective, Pearsall thinks that humans are equipped with a "God-given talent for thriving" (p. xxxi). And he quotes a thriver who says, "God sometimes tears at the fabric of our life so that we may learn to be better weavers ..." (p. xxviii). Prayer is also included in a thriver's repertoire.

By the way, the title of the book is based on Beethoven's ability to thrive despite handicaps. Beethoven, although "gravely ill and totally deaf" was able to conduct the premiere of his Ninth Symphony, the *Ode to Joy*. "At that moment, and not only in spite of but because of his adversity, Beethoven had discovered the art of thriving." This book holds out the invitation, inspiration, and direction for its readers to do the same.

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

THE BONE MUSEUM by Wayne Grady. New York: Four Walls Eight Windows, 2000. 291 pages. Paperback; $14.99. ISBN: 1568582048.

Nature writer Wayne Grady and paleontologist Phil Currie set out on a quest to learn about dinosaurs. What they discover and observe in their travels becomes entertaining reading.

There are three main easily read sections: an introduction, a dig in Patagonia, and a visit to the Badlands to study fossils. The author is a layman who introduces the reader to a number of scientists pursuing their specialized interests. Grady notes the bonhomie amongst this team, isolated at a bone site.

There is a useful discussion relating to the bird-like and the lizard-like dinosaurs. Grady relates modern postulates to this history, uncovered by the paleontologists. His story also concerns extinctions in nature. Some of Grady's digressions will be of limited interest except to fellow Americans.

Some corrections need to be made. He quotes the cliché that ontogeny recapitulates phylogeny, but Ernst Haeckel's fudging of his reported results is now well known. It should be noted that at an early stage of fetal development in the human there are no gill slits. The pharyngeal arches found belong to the normal mammalian pattern of growth. Another correction relates to the abutting of the African landmass against Europe. When this caused closure of the strait at Gibraltar, the Mediterranean Ocean did not drain away but the waters evaporated, leaving a vast salt deposit that again is now covered by the sea.

Grady is interested in why people are intrigued with dinosaurs. This is the premise of his book which is enjoyable reading. The book has a clear typeface, an attractive cover and a sound binding. The lack of references, except for the occasional one in the text limits it usefulness for other purposes.

Reviewed by Ken Mickleson, pediatrician, 105 St. Andrews Road, Epsom, Auckland 1001, New Zealand.

UNLIMITED LOVE: Altruism, Compassion, and Service by Stephen G. Post. Philadelphia: Templeton Foundation Press, 2003. 232 pages. Paperback; $24.95. ISBN: 1932031316.

The John Templeton Foundation in 2001 provided funds for starting the Institute for Research on Unlimited Love. The goal of the Institute and this book is to define unselfish love and its relationships to science, ethics, and religion. The first sentence of the Institute's statement provides a definition of unlimited love: "The essence of love is to affectively affirm as well as to unselfishly delight in the well-being of others, and to engage in acts of care and service on their behalf ..." (p. vii).

How can science play a role? Science cannot fully explain why people "live in ways more or less consistent with unlimited love. Perhaps the most important thing we can do is simply to tell the stories of unlimited love as these brighten the world in which we live. Love is less taught didactically or studied scientifically than it is *transmitted*

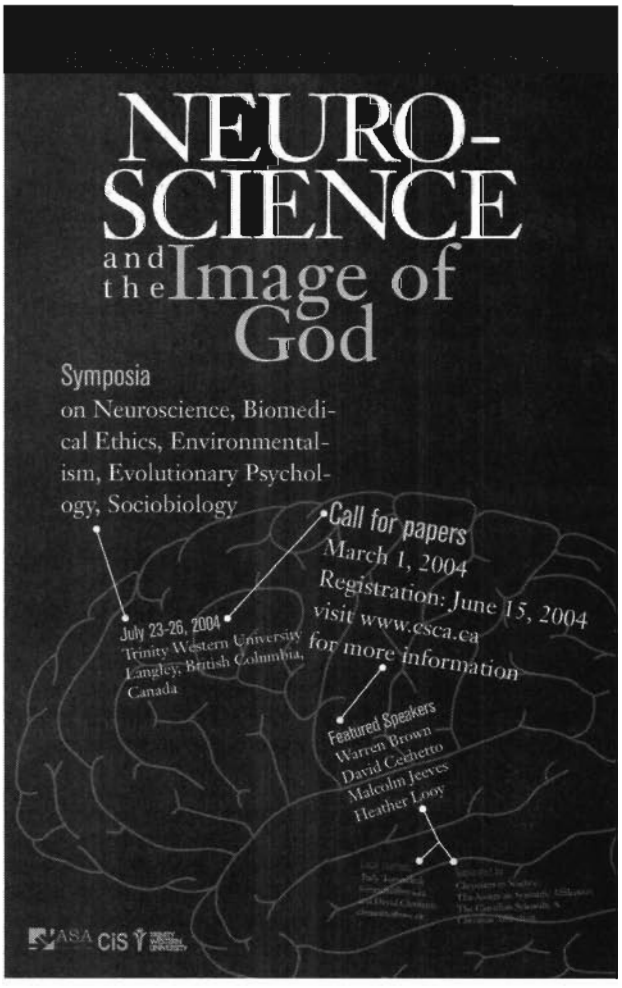
through models" (p. x). Teilhard de Chardin observed that the scientific understanding of love would be as significant as the discovery of fire.

The titles of the book's three parts best describe its contents: what is unlimited love; scientific, ethical, and religious perspectives; and, developing a scientific field. The last of eleven chapters lists the 21 funded projects (at a cost of $1,730,000) selected from 85 submissions. Notes and an index complete the volume.

A companion volume to *Unlimited Love* is entitled *Research on Altruism and Love: An Annotated Bibliography of Major Studies in Psychology, Sociology, Evolutionary Biology, and Theology.* This book contains four annotated bibliographies: (1) religious love and science; (2) current research on personality and altruism in social psychology; (3) altruism and love in biology and evolutionary psychology; and (4) helping behavior, religious organizations, and voluntary associations.

Post is president of the Institute for Research on Unlimited Love, professor of bioethics in the medical school at Case Western Reserve University, and author of *The Moral Challenge of Alzheimer's Disease.* He thinks that "In the final analysis, unlimited love is what God has for each and every one of us, and this is good news" (p. xii).

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



Patriarchal Ages in Genesis

I was very interested to read Carol Hill's article "Making Sense of the Numbers of Genesis" (*PSCF* 55, no. 4 [Dec. 2003]: 239–51), and I would fully support her conclusions. However, I feel that she has considerably *understated* the case for a symbolic interpretation of the ages in Genesis 5 and 11 by failing to notice various other mathematical patterns in which the number 7 is prominent. I explored these in detail in my MA Dissertation *The Genealogies of Genesis: A Study of their Structure and Function* (London Bible College, 1989, unpublished), and at a popular level in *Discovering Genesis: Crossway Bible Guide* (by Richard and Tricia Johnson [Leicester: Crossway Books, 2001], 46–7; 62–4). Let me briefly mention the relevant facts, although for the sake of simplicity I will only look at the patriarchal ages "at death."

It should be noted that ages are given, or can be calculated, for each generation between Adam and Moses. These are as follows:

Genesis 5		Genesis 11		Elsewhere	
Adam	930	Shem	(600)	Abraham (Gen. 25:7)	175
Seth	912	Arpachshad	(438)	Isaac (Gen. 35:28)	180
Enosh	905	Shelah	(433)	Jacob (Gen. 47:28)	147
Kenan	910	Eber	(464)	Levi (Exod. 6:16)	137
Mahalalel	895	Peleg	(239)	Kohath (Exod. 6:18)	133
Jared	962	Reu	(239)	Amran (Exod. 6:20)	137
Enoch	365	Serug	(230)	Moses (Deut. 34:7)	120
Methuselah	969	Nahor	(148)		
Lamech	777	Terah	205		
Noah	950				

The ages in brackets are those which are not given directly in the text, but which can easily be calculated.

If one adds these 26 generations together, the total is 12,600 (= 70 x 180); this backs up Carol Hill's point that the symbolism of the figures reflects both the sexagesimal (base 60) system of Mesopotamia and the Hebrew sacred number 7 (or 70). (Incidentally, for the mathematicians, 12,600 is the lowest number with precisely 70 factors; or 72 if 1 and itself are included).

However, the really interesting pattern emerges if one concentrates on the first and third columns, which each begin and end with a character with whom God made a significant covenant (Adam/Noah/Abraham/Moses). Here are the key features of the pattern:

1. The ages in Gen. 5 add up to 8575 (= 25 x 7 x 7 x 7)
2. The 7 ages in the third column add up to 1029 (= 3 x 7 x 7 x 7)

If we combine these two columns together, thus making a "list" of 17 ages:

3. These 17 ages add up to 9604 (= 4 x 7 x 7 x 7 x 7);
4. The middle age is that of Lamech (777);
5. Remarkably, the 7 ages on either side of Lamech add up to a total of 7777. The fact that this is intentional can be seen in the way this figure of 7777 is itself divided up:
6. The ages either side of Lamech (i.e. Methuselah and Noah) add up to 1919 (19 x 101);
7. The 6 ages preceding Methuselah (i.e. Seth to Enoch) add up to 4949 (7 x 7 x 101), of which the first three (Seth/Enosh/Kenan) add up to 2727 (3 x 3 x 3 x 101);
8. The 6 ages after Noah (Abraham to Amran) add up to 909 (3 x 3 x 101)

There are clearly other patterns which have also been incorporated into the system; for example, one which has been long recognized is the following, for the major patriarchs:

Abraham	175 (= 7 x 5 x 5)
Isaac	180 (= 5 x 6 x 6)
Jacob	147 (= 3 x 7 x 7)

James Williams (in his article "Number Symbolism and Joseph as Symbol of Completion," *Journal of Biblical Literature* 98 [1979]: 86–7) suggests that Joseph (whose age of 110 is [5 x 5] + [6 x 6] + [7 x 7]) completes this sequence: "Joseph is the *successor* in the pattern (7 → 5 → 3 → 1) and the *sum* of his predecessors ($5^2 + 6^2 + 7^2$)."

It would not be possible to demonstrate other patterns in this letter, but if I may conclude with several brief observations:

1. Given the knowledge of mathematics in the ancient Mesopotamian world it would not be difficult for a mathematician to have devised this pattern; in my dissertation I reconstruct a possible path that might have been followed;
2. If only one age was different by even 1 year, the entire system would collapse. This gives good grounds for assuming the reliability of the MT figures. The LXX and the SP have both "adjusted" the MT figures, but in doing so have created chaos; in the LXX Methuselah actually dies 14 years *after* the flood!
3. The key theological points that the system demonstrates are:
   (a) The period from Adam to Moses was regarded as in some ways a "complete" period of time, characterized by the number seven;
   (b) *None* of the ages reach 1000, which, in the ancient world, would have symbolized some degree of divinity;
   (c) *None* of the characters achieved immortality on earth (as again occurs in the legends of the cultures surrounding Israel). As Paul says: "Death reigned from the time of Adam to the time of Moses" (Rom. 5:14).

I trust that these observations will further reinforce Carol Hill's conclusion that "the symbolic ... view is sacred because that is how the original biblical author(s) intended for it to be" (p. 250).

Richard Johnson
Head of Biblical Studies
Redcliffe College
Wotton House
Horton Road
Gloucester, UK GL1 3PT
rjohnson@redcliffe.org

Interpreting Numbers in Genesis

Thank you for publishing Carol A. Hill's article, "Making Sense of the Numbers of Genesis" (*PSCF* 55, no. 4 [December 2003]: 239–51). Carol has done a magnificent job in showing us how the early scribes of Israel were beholden to the Mesopotamian culture in their different use of "numbers." This is just another example of how much of the early biblical books of Genesis and Exodus are a product of a "post-exilic period" in which Israeli scribes, being newly released from captivity in Babylon, set about putting a jumbled collection of local ancient legends and myths into some sort of coherent order. Carol's conclusion is right on: "Ironically, by interpreting the numbers of Genesis "literally" Christians have created a mythological world that does not fit with the historical or scientific record."

Arlan Blodgett
554 NE 63rd Street
Salem, OR 97301
arlanbb@yahoo.com

"Genesis Age Gaps?"

Carol Hill's articles on Genesis topics make interesting reading, but her most recent one contains arguments that I challenge. In "Making Sense of the Numbers in Genesis" (*PSCF* 55, no. 4 [Dec. 2003]: 239–51), she tries to show (p. 248) that certain biblical genealogies are condensed by omitting names and thus creating gaps of time in the lineage. She then asks: "How far back in time can biblical genealogies be stretched, assuming that legitimate gaps exist" (p. 249). The gaps she mentions amount to 370 years, but she stretches that by saying: "The known gaps can push biblical chronology back at least several hundred years and up to one thousand years or so at most" (p. 249).

Hill's "most notable example" of a gap is in Matt. 1:8, where Uzziah is listed as the son of Joram (Jehoram), omitting the names of three kings of Judah in between them, for a possible gap of 70 years. However, Matthew was simply repeating the condensation of Joram to Uzziah found in 2 Kings 15:32. This has no effect on biblical chronology because scholars like Bishop Ussher (1650) or Reece (1977) have recourse to detailed information about the omitted kings earlier in 2 Kings (8:25; 12:1; and 14:1).

Hill's other example involves Exod. 6:16–20, which indicates that Moses was a grandson of Kohath, who was "born before the descent into Egypt" (p. 248). Hill believes there must be names omitted from that line because the

"children of Israel" were in Egypt 430 years, and Moses was 80 when he led the exodus. So Hill states that Moses "must have been born ... 350 years after Kohath, who consequently could not have been his grandfather" (p. 248). Hill counts this as a gap of 300 years in biblical chronology, assuming that Kohath was around 50 when he begat the line of Moses. However, this gap does not exist because Hill's conclusion is based on a faulty premise: that the 430 years began when Jacob and his sons went to Egypt to join Joseph. According to Paul (Gal. 3:16–17), they began more than 200 years earlier when Abram and Sarai went to Egypt. This interpretation by Paul, a student of Gamaliel, was duly followed in "Reece's Chronological Bible" (1977) and by Bishop Ussher (1650), as noted by James Barr in "Archbishop Ussher and Biblical Chronology" (*Bulletin of the John Rylands University*, Library of Manchester, 67: 575- 608). Reece, for example, has Jacob and his sons moving to Egypt 135 years before Moses' birth, which presents no problem fitting the male line of Levi → Kohath → Amram → Moses into that time frame. If Levi went to Egypt when he was 46 (approx. 7 years older than Joseph) and his son Kohath was 3, then Kohath could have begotten Amram 66 years later, at age 69, and Amram could have begotten Moses at age 69, and therefore 135 years (66 + 69) after the move to Egypt.

Hill does not mention a different problem associated with Moses' mother. Jochebed was a daughter of Levi (Num. 26:59) and a sister of Kohath (Exod. 6:20), which means her husband Amram was her nephew. Presumably she was younger than Amram's 69 (+ or -) years when Moses was born. That would make Levi an advanced senior citizen when he begat her. For instance, if she was 46 at Moses birth, Levi would have been 135 at her birth, which would have been 135 years after the move to Egypt (135 + or -46). Abraham was at least 137 when he began to beget six sons with Keturah, whom he took as a wife sometime after Sara died at age 127 (Gen. 23:1; 25:1–2), he being 10 years older (Gen. 17:17).

And so Hill's gaps of 70 and 300 years disappear. The next problem she mentions about "begat" (p. 248) also disappears on scrutiny. In arguing that "begat" may not indicate descent from father to son, she cites as an example Kohath's sons: "the third, fourth, and fifth names represent brothers, not sons, as shown by comparing Exod. 6:24 with 1 Chron. 6:36–37" (p. 248). These verses do not relate to Kohath's sons or brothers. Exodus 6:24 lists three sons of Koreth, who was a grandson of Kohath. Kohath's four sons are listed in Exod. 6:18 as Amram, Izhar, Hebron, and Uzziel. This information is repeated in 1 Chron. 6:2 and again in 6:18; it is not contradicted in 1 Chron. 6:36–37, which deals with Kohath's descendants thru Izhar.

Hill uses this mistaken example involving Kohath to support her contention that "When it is said (Gen. 5:9) 'and Enosh lived ninety years, and begat Kenan' ... perhaps Enosh was ninety ... when his grandson or great-grandson Kenan was born ... how do we know that Kenan was the immediate son?" (p. 248). Well, we know because Gen. 5:9 says so, quite clearly by giving Enosh's age when he begat Kenan. But even if there were a gap of a name or two in between Enosh and Kenan, there is still a period of 90 years between them, and not a gap in time that could "push biblical chronology back several hundred years ..." (p. 249).

Hill not only challenges (unsuccessfully) the age at, and sequence of begetting by patriarchs but also their longevities as recorded in Genesis. She cites as evidence against Shem's great longevity that he "would have survived Abraham by 35 years, but where does the Bible indicate ... these men were coeval?" (p. 244). The answer is simple: In Genesis, in the very verses that Hill used to calculate that they were coevel! Perhaps Hill requires a Bible story about Abraham visiting Shem. Maybe a visit did occur. The absence of evidence (of a visit) is not necessarily evidence of absence.

There is an absence of convincing evidence for inconsistencies in the Bible concerning the patriarchal ages and begetting sequence in Hill's article. However, Hill does point out that all of these ages appear to be based on multiples of 60, which underlies the "sacred" sexigesimal system used in Mesopotamia. A major point of her article is that none of these ages end in 1 or 6, a highly significant departure from expectation by chance alone. This is as amazing, statistically, as the ages themselves (compared to nonpatriarchs).

One hypothesis to explain this phenomenon is that somebody slightly modified each age by + or -1 or a few years so that they became sexigesimal multiples, and not ending in 1 or 6. Hill's hypothesis is that much more extensive changes were made, extending the ages by decades or centuries, which is why she devotes much of the article in trying to show inconsistencies in the Bible relative to these names. She puts it this way:

> Whatever the ... intent of the biblical writer for each of the patriarchal ages ... the overall purpose ... was to preserve the harmony of numbers ... the patriarchal ages in Genesis are not real numbers ... Were these numbers "assigned" to the patriarchs on the basis of their ... relationship with God?" (p. 244).

The above quote suggests, but passes by an alternative hypothesis, that God assigned the patriarchal ages. Psalm 139:16 puts it this way: "All the days ordained for me were written in your book before one of them came to be," and I trust that applies to the patriarchs as well.

Those interested in a detailed treatment of biblical numbers may want to examine a recent book not included in "Notes" at the end of Hill's article. *Genesis Numerology* 2d ed. (2003, ISBN 965 90620-0-1), by Meir Bar-Ilan has the title and brief chapter summaries translated into English but it is written in Hebrew.

From Jerusalem,

William H. Gilbert
ASA Member
Professor Emeritus
Simpson College (IA)
gilbert@storm.simpson.edu

Apparent Age

Dick Fischer, in "Young-Earth Creationism: A Literal Mistake" (*PSCF* 55, no. 4 [December 2003]: 222–31), rejects the Young-Earth Creationists (YEC) "appearance of age" argument as "flawed" mainly on the grounds that it makes God a liar. Although I am not a YEC, I propose that Fischer's total rejection of the concept of apparent age may

ultimately entail rejection of any supernatural creation regardless of when or in what form.

Scientific estimates of age are based on the backward projection of natural changes whose rates are known. Consider that a gray-headed person is observed to have a somewhat wrinkled face and a hesitant gait. One might guess the person's age to be perhaps eighty years. We do this by knowing something about the rate of the aging process and judge that it would require about eighty years for a normal person to reach this condition. Similarly, knowing the rate for formation of tree rings, we project backward to estimate the age of a tree. Knowing the C14 content of an object and the rate of decay to C12 we can estimate the age of certain organic artifacts. The assumption underlying this procedure is that an unbroken chain of natural events lies back of whatever entities we observe.

In the case of a supernaturally created entity, there is not an unbroken line of natural events leading to its present state. Applying otherwise valid scientific methods, the determination of age will inevitably lead to a false conclusion. Thus when Jesus turned water into wine, the guests considered it the best wine served at the party. They made the natural assumption that the usual series of fermentation events had taken place, a process requiring time. However, Jesus had performed a supernatural act, which bypassed the usual sequence of events and produced good wine within the hour. Without the testimony of witnesses about what had been done, the guests would have been "deceived."

If the heavens and earth were ever created at any time or in any stage, there is no way in which scientific methods could arrive at the conclusion that they came into existence by a supernatural act outside the scope of science. The scientist will always assume that a series of natural events produced whatever entity is being evaluated for its age. Therefore unless the concept of supernatural creation is abandoned there will inevitably be the "appearance of age" for whatever was created. If the act of creation is pushed back to the "Big Bang" the scientific approach will assume there were as yet unknown precursors. Modern science is unwilling to assume a creative act that is forever beyond understanding.

Given the inevitability of a conflict between scientific estimates of age and the "true" age of created entities, it is improper to accuse God of lying since the problem lies in the inherent limitation of scientific methods applied to supernatural events. God has told us that he is the Creator of all things. Jesus was not a deceiver when the wedding guests believed they were enjoying normally aged wine since the witnesses could testify about what happened. I do not know the solution to the problem, but to reject apparent age out of hand is to leave the door open to the abandonment of the concept of supernatural creation.

Earle H. West
425 Southwest Drive
Silver Spring, MD 20901
eandt.west@worldnet.att.net

Mature Creation

One way of trying to reconcile Genesis and modern science employs the idea that when God created the universe it had the appearance of age (trees had rings, pebbles were smooth, stars shone, and so forth).[1] In his recent paper on young-earth creation, Dick Fischer criticizes this idea on the ground that it makes God dishonest.[2] Many others have taken the same view.[3] This criticism, however, presupposes that God would have made a young universe without the appearance of age.

Let us suppose that the universe is a completely determined dynamical system, such that its state at noon GMT tomorrow can, in principle, be predicted from its state at noon today. Then its state (as represented by the positions of its elementary components) can be expressed as a continuous function of time, $f(t)$, where $t = 0$ is the time of creation. Now since f is a continuous function, states can be calculated from f for $t < 0$. Thus, when, at $t = 0$, the system is created, it inevitably appears to have had a previous history. Not even God can create it without it having this appearance. The only exception is if f has a singularity at $t = 0$, as on the big bang model.

A simple example is a pendulum. When a pendulum is made and set in motion, it immediately appears to have been in motion before this. There is nothing its maker can do to prevent this, short of attaching a label stating the time at which he or she set the pendulum going.

If the universe is not a completely determined system (as Bohr understood the quantum theory to imply, but Einstein resisted), the picture is more complicated. A system can now have more than one possible history. Consider, for example, a uranium mineral in a rock. This can have an infinite number of possible histories, depending on which atoms have disintegrated, and when. For many systems, however, there still can be only one macroscopic history. This is the case for a uranium mineral. This has a history in which atoms, collectively, have disintegrated at a constant rate. The universe at $t = 0$, therefore, will appear to have an infinite number of quantum histories, but a smaller number of macroscopic ones.

Here I have interpreted the quantum theory pragmatically. There are other, more radical interpretations. According to one, even recent history is only apparent.[4]

That a mature creation does not make God dishonest was argued by the late Donald M. MacKay in reply to Charles Kingsley. He wrote:

> ... whatever the peculiarities of Gosse's view, the point apparently missed by Kingsley is that some kind of inferable past is inevitably implicit in any ongoing system, whether with fossils or without, so that to speak of falsehood here is to suggest a non-existent option ... If the creator in the Genesis narrative were supposed to make the rocks without fossils, this would not have helped, for nothing could have prevented the rocks from having some physically inferable past; their past simply would have been different and moreover inconsistent with the rest of the created natural history. On Kingsley's argument, pressed to its logical conclusion, God ought not to have created any matter at all, since even molecules cannot help having some inferable past history.[5]

MacKay himself went further than Gosse and suggested that creation is the bringing into being of the *whole* of our space-time: past, present, and future.

Other arguments against the idea of a mature creation are: (1) that one could equally well say that the universe was created last Thursday[6]; and (2) since the idea cannot be tested, it is useless.[7] The answer to (1) is that God has *told* us when he created the universe. The answer to (2) is that the usual scientific assumption, that the universe has been in existence for as long as it appears to have been so, is equally untestable.

To incorporate the idea of a mature creation into the interpretation of Genesis, allowance has to be made for the Fall. The design of the universe after the Fall was different from its design before the Fall (Gen. 3:14–19). Any apparent age of the universe relates to its *post*-Fall design (just as the apparent history of the wine Jesus made from water relates to the wine not the water). I discuss this fully in my book *Big Bang, Small Voice*.[8] I also consider other ways of reconciling Genesis and modern science.

Notes

[1]This idea goes back to François-Auguste Chateaubriand, *Génie du Christianisme* (Paris: Migneret, 1802), part 1, book 4, chap. 5; Granville Penn, *A Comparative Estimate of the Mineral and Mosaical Geologies* (London: Ogle, Duncan and Co., 1822); Philip Henry Gosse, *Omphalos: An Attempt to Untie the Geological Knot* (1857; reprint, Woodbridge, CT: Ox Bow Press, 1998).

[2]Dick Fischer, "Young-Earth Creationism: A Literal Mistake," *Perspectives on Science and Christian Faith* 55 (2003): 222–31.

[3]See John W. Burgeson's review of *Omphalos*, *Perspectives on Science and Christian Faith* 53 (2001): 127–8.

[4]See J. S. Bell, *Speakable and Unspeakable in Quantum Mechanics* (Cambridge: Cambridge University Press, 1987), paper 15. Interestingly, Bell cites Chateaubriand and Gosse.

[5]See John W. Burgeson, "Notes on *Omphalos*," www.burgy.50megs.com/gosse.htm

[6]See John W. Burgeson's review of *Omphalos*, *Perspectives on Science and Christian Faith* 53 (2001): 127–8.

[7]S. J. Gould, *The Flamingo's Smile* (London: Penguin, 1985), 110-1.

[8]P. G. Nelson, *Big Bang, Small Voice: Reconciling Genesis to Modern Science* (Latheronwheel, Caithness, Scotland: Whittles, 2003), chaps. 9–10. I can supply copies of this on request.

Peter G. Nelson
25 Duesbery Street
Hull, HU5 3QE
England
P.G.Nelson@hull.ac.uk

Ultimate Proof or Ultimate Flood? Response to Paul Seely

Paul Seely gave an excellent summary of the GISP2 Greenland ice core and its relevance to theories of Noah's flood (*PSCF* 55, no. 4 [Dec. 2003]: 252–60). However, there are at least two reasons why Seely should not claim an "ultimate proof" against a global flood. First, if one demands a fully natural event, the possibility of a floating ice sheet has not been eliminated. Second, in regards to theology, Noah's flood remains a candidate for hand-of-God, interventionist-style, miraculous action. The universe is magnificently "robust" in "formational economy," but this natural endowment cannot claim all our conceptions—not if we believe that God raised Jesus Christ from the dead.

Apparently, no large, but otherwise ordinary, flood has occurred over Greenland in the past hundred thousand years or so. This finding is significant and challenging to global flood theory. However, our present knowledge cannot encompass the concept of an *exceptional and singular* flood. Science can only hope to: (1) demonstrate that a global flood *did* occur—thus far, a fruitless, but informative and fun, adventure; (2) *tentatively* show by negation that a global flood could not occur "naturally"; (3) evidentially support the idea of a regional flood fulfilling the requirements of the story; or (4) demonstrate that the story is probably fictitious. Seely is simply out of bounds in attempting to prove that a (possibly miraculous) global flood is beyond the power of our Creator. This is like proving that virgins cannot give birth to saviors.

Aside from the miraculous possibilities, the case against a natural flood is incomplete. Consider a remarkably unique (or amazingly coincidental, or fantastically robust) set of events that must nonetheless seamlessly mesh with ordinary earthly reality. For starters, there is the still-open question of a possible origin (and subsequent disappearance) of enough water for a global flood. Seely seems to focus on rain, and he seems to presume that Gen. 7:4, 12 requires extraordinary precipitation over all flooded regions. But this is not the case; the text only requires a forty-day rainy period (of unspecified severity) in the ark's region. More importantly, an ordered priority is given to "the fountains of the deep" (Gen. 7:11). The Quran goes further by referring to water that "gushed forth from the Oven" (11:40 and 23:27) and by specifying that the earth was subsequently commanded to "swallow up your waters" (11:44). Both Genesis and the Quran seem to point to water from beneath the lithosphere. Until science can constrain the earth with the presently unknown boundaries of plate tectonic dynamics, internal water cannot be eliminated as a possible source (and outsource).

Given the absence of a significant melt layer within the glacier, it seems Seely is correct in eliminating the possibility of flooded ice. This means we are left with the singular possibility of the Greenland ice sheet floating in the floodwaters. But, since the ice sheet may or may not have *come from Greenland*, we actually have two possibilities. If the ice sheet is foreign in origin, this would (backwardly) fulfill Seely's requirement that an ice sheet must "float away" due to ocean currents. If the ice is indigenous, it must be sitting (crudely or exactly?) where it used to be. This later case, in turn, presents two possibilities: either the ice sheet floated in a topological "circle" or the ice sheet "hovered" above the continent. Each of these possibilities moves further toward the exceptional, but none are presently proven to be "unnatural." If the ice sheet floated freely and then landed in position over Greenland, this outrageous detail merely requires one more "edge of the coin" toss to be added to the Creator's impressively long list.

Seely describes the ice sheet as being "exactly" in position. However, his assumption of rigidity appears excessive. He has not produced evidence that would adequately constrain the plastic behavior of a glacier or characterize a long-term stasis at the interface of ice and continent. Instead, Seely has acknowledged that "the ice below 2,850 meters may be disturbed."

With regard to the ice core's lack of a "marine" character at its (possibly disturbed) underside, Seely has not secured his extrapolation of ice shelf characterization into the realm of glaciers suspended for a few months in water of unknown composition and temperature and then

placed on top of terrestrial materials and subjected to several thousand years of physical and chemical dynamics at a glacial/terrestrial interface. Seely is stretching our present knowledge too far.

Geology has consistently shown us only one thing about Noah's flood: If it was global, it must have been unlike any other flood. If we have erred in looking for global flood evidence, this error relates to our tendency to look for what we expect: the usual suspects of deposition and erosion. This may turn out to be equivalent to looking for the medium that propagates light waves. The absence of *ordinary* evidence may ultimately prove to be a positive part of the demonstration of an *exceptional* flood.

There is a sublime interplay between faith and the evidences of our Creator. If we think we are ready to close the door on global flood conceptions, we must consider every possibility, especially the unexpected. Many fine scientists lived in a recent world where it would have been inconceivable to suggest that God made the Himalayas by slamming the Indian subcontinent into Asia.

The Genesis flood story has compelled us to look for easy and obvious evidence. In failing to find such evidence, we have become uncertain about the story. This is a necessary step in our evolution, and we cannot foresee the final outcome. The only mistake we can make is to base our faith on a demand that God's creation matches our tiny and temporary human conceptions. We do not have to decide that a global flood never occurred. The phrase "appears naturally improbable" suits both our science and our theology much better.

Derek Eshelbrenner
3657 CR 1500
Havana, KS 67347

On Del Ratzsch's article

I appreciated Del Ratzsch's article, "Design: What Scientific Difference Could It Make?" (*Perspectives on Science and Christian Faith* 56, no. 1 [March 2004]: 14).

Definitions make the difference when juxtaposing methodological naturalism and design. The fundamental question is: "Does methodological naturalism describe how the universe *usually* works or does it describe how the universe *exclusively* works?" To know that methodological naturalism describes how the universe exclusively works would require knowledge of the cause of every physical event for the history of the universe. Since such knowledge is lacking, methodological naturalism is merely a presupposition, which can never be proven. Further, it is disproved by a single miracle.

Methodological naturalism does remain a reasonable basis for scientific investigation and is probably the ultimate definition of science. If data fall within boundaries established by methodological naturalism, the enterprise can be labeled as scientific. If the data fall outside the boundaries of methodological naturalism, the enterprise is not scientific. Macroevolution and biological origins are singular events, which were not observed and cannot be experimentally reproduced. Does the probability of their occurrence fall within the boundaries established by methodological naturalism?

John Reidaar-Olson and Robert Sauer from MIT used amino acid substitutions to calculate the probability of the random assembly of a λ repressor in *E. coli* bacteria. They determined that the probability of the random assembly of a λ repressor is about one chance in 10^{63} for each new protein segment made up of 92 amino acid residues.[1] The expectation that every *E. coli* in any given collection would have a new segment of DNA coding for a new protein composed of 92 amino acid residues is an extreme improbability. A collection of 10^{50} *E. coli*, each with such a new segment of DNA, would have only one chance in 10 trillion of containing one *E. coli* with a λ repressor. A collection of 10^{50} *E. coli* has never existed. Such a collection could fill a hole that is 70% of the volume of planet Earth every day for more than 3.5 billion years. As a corollary of interest, a total of fewer than 10^{50} individual organisms from all species have existed on planet Earth over the past 3.5 billion years. The expectation that random assembly or naturalistic macroevolution would produce an *E. coli* with a λ repressor is a highly irrational scientific hypothesis. Time, matter, a suitable environment, food supply, and good luck are all insufficient for accomplishing this one step in macroevolution.

The amino acid, histidine, is produced by *E. coli* when it is in short supply.[2] When histidine is in short supply, a segment of DNA, which codes for nine unique enzymes, is copied. These nine enzymes are required for the assembly of the histidine molecule. Each of the nine enzymes involved in histidine production is a complex enzyme. The best probability for the naturalistic assembly of a complex enzyme is about one chance in 10^{65} per try.[3] The best probability for the naturalistic assembly of all nine enzymes is about one chance in $[[10^{65}]^9]/9!$ per try or about one chance in 10^{579} per try. With fewer than 10^{50} tries from every species, the best overall probability of ever assembling all nine enzymes is less than one chance in 10^{529}. If a wager were made of one hydrogen atom at the odds of one chance in 10^{529}, a win would net all of the atoms in over 10^{449} universes.

The probabilities of the naturalistic macroevolution of a λ repressor or of the nine enzymes needed for the assembly of histidine fall outside the boundaries of methodological naturalism. Naturalistic macroevolution is a highly irrational scientific hypothesis.

Methodological naturalism explains neither macroevolution nor biological origins. Such events are not scientific but are adequately explained by supernatural genetic engineering, supernatural biotechnology and/or progressive creation.

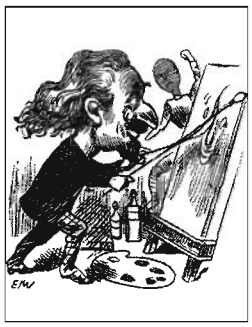
Notes

[1]J. F. Reidaar-Olson and R. T. Sauer, "Functionally Acceptable Substitutions in Two α-Helical Regions of λ Repressor," *Proteins: Structure, Function, and Genetics* 7, no. 4 (1990): 315.

[2]L. Gonick and M. Whellis, *The Cartoon Guide to Genetics* (New York: Harper Perennial, 1983), 172.

[3]H. P. Yockey, "A Calculation of the Probability of Spontaneous Biogenesis by Information Theory," *Journal of Theoretical Biology* 67 (1977): 387.

Fredric P. Nelson, MD
ASA Member
2801 Island Avenue, Suite 2
Philadelphia, PA 19153



Art Eyes Science

Heraclitus Talks with Chauncey Wright

Heraclitus Talks with Chauncey Wright

Ben Carter

Think of the universe as fire, as storm,
Not as a chain but as a web of cause.
If space is an aggregate expressed through time,
Note how we puzzle to discern its laws.
I tell you our knowledge of them will forever be
Expressions of quantified subjectivity.

Grasp that image! And know you shall never know
All that scrambles across your fettered gaze.
Know that whirl is lord, and that all things cohere,
In an overlap, from myriad ways.
Catching a piece, you will forget more than you learn
And what gallops past is gone and shall not return.

The former and the future are both held here
In this slippery instant that you scan.
Gauge their churning fragments while they split and blend.
Graph their principles if you think you can.
Beginning and end are hidden from your full view,
So fire and storm is all that is left to you.

Ben M. Carter *earned a B.A. in economic history at the University of Wisconsin-Milwaukee, an M.A. in theological studies from Wheaton College, an M.Th. in Christianity in the Non-Western World from the University of Aberdeen, Scotland, and a Ph.D. in Christianity in the Non-Western World from the University of Edinburgh in Scotland. He has published four books and a variety of articles and reviews. Ben is married to Salma Carunia from South India, and is currently employed through the Dallas/Ft. Worth Hospital Council. Correspondence may be sent to him at: bcarter@dfwhc.org.*

Theistic Existentialism

Leland P. Gamson

The is that is is not
The ought I thought I sought
"But wait," said God
For the will be to be
"For it is I who wrought
The thought of ought
You think you sought."

Leland Gamson *received a B.A. in Comparative Religion & Psychology from Hiram College (Ohio), M.Ed. from the American University (Washington, DC) and a M.S.W. from The Catholic University of America (Washington, DC). Currently, Leland is a clinical social worker with the VA Northern Indiana Health Care System in Marian, IN. He is active in the drama group of the First United Methodist Church in Marion and exercises daily at the local YMCA. Correspondence may be sent to him at: lbgamson@bpsinet.com.*

ASA Application/Subscription Form

(Subscribers complete only items 1, 2 & 8)

American Scientific Affiliation, PO Box 668, Ipswich, MA 01938-0668

1. Name (please print): _____ Date: _____

2. Home Address: _____

_____ Zip: _____

Office Address: _____

_____ Zip: _____

Home phone: _____ Office phone: _____

FAX: _____ E-mail: _____

I prefer my ASA mailings sent to: ❑ home ❑ office

I give permission to publish my home phone number in the membership directory: ❑ yes ❑ no

3. Sex: ❑ male ❑ female 4. If married, spouse's name: _____

5. Academic Preparation:

Institution	Degree	Major	Year

Field of Study (broad): _____ Concentration (2-word limit): _____

Briefly describe your present or expected vocation: _____

_____

_____

6. How did you learn about the ASA? _____

I am interested in the goals of the American Scientific Affiliation. Upon the basis of the data herewith submitted and my signature affixed to the ASA Statement below, please process my application for membership.

Statement of Faith

I hereby subscribe to the Doctrinal Statement as required by the Constitution:

1. We accept the divine inspiration, trustworthiness and authority of the Bible in matters of faith and conduct.
2. We confess the Triune God affirmed in the Nicene and Apostles' creeds which we accept as brief, faithful statements of Christian doctrine based upon Scripture.
3. We believe that in creating and preserving the universe God has endowed it with contingent order and intelligibility, the basis of scientific investigation.
4. We recognize our responsibility, as stewards of God's creation, to use science and technology for the good of humanity and the whole world.

Signature: _____ Date: _____

(required for Full Member, Associate Member, Student Member, Student Associate status)

7. If you are an active overseas missionary, please give the name and address of your mission board or organization to qualify for complimentary membership.

Mission Board: _____

Street: _____

City: _____ State: _____ Zip: _____

8. I have enclosed in U.S. funds (Please check one):

_____ $60, Full Member _____ $60, Associate Member _____ $60, Friend of the ASA

_____ $20, Student Member _____ $20, Student Associate _____ $10, Spouse

_____ $35, Subscriber

MasterCard or VISA: ❑❑❑❑-❑❑❑❑-❑❑❑❑-❑❑❑❑

Expiration Date: _____ Signature: _____

Name as it appears on your credit card: _____

(Please print)

Please mail to: American Scientific Affiliation, PO Box 668, Ipswich, MA 01938-0668

What Is the American Scientific Affiliation?

The American Scientific Affiliation (ASA) is a fellowship of men and women in science and related disciplines, who share a common fidelity to the Word of God and a commitment to integrity in the practice of science. Founded in 1941, the ASA has grown significantly since then. The ASA's stated purposes are: "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."

How Do I Join The ASA?

Anyone interested in the objectives of the Affiliation may have a part in the ASA.

Full membership is open to all persons with at least a bachelor's degree in science who can give assent to our statement of faith. Science is interpreted broadly to include anthropology, archeology, economics, engineering, history, mathematics, medicine, political science, psychology, and sociology as well as the generally recognized science disciplines. Philosophers and theologians who are interested in science are very welcome. Full members have voting privileges and can hold office.

Associate membership is available to interested nonscientists who can give assent to our statement of faith. Associates receive all member benefits and publications and take part in all the affairs of the ASA except voting and holding office.

Full-time students may join as **Student Members** (science majors) with voting privileges or as **Student Associates** (non-science majors) with no voting privileges.

Spouses may qualify for a reduced rate. **Full-time overseas missionaries** are entitled to a complimentary membership.

An individual wishing to participate in the ASA without joining as a member or giving assent to our statement of faith may become a **Friend** of the ASA. Friends receive all member benefits and publications and take part in all the affairs of the ASA except voting and holding office.

Subscriptions to *Perspectives on Science & Christian Faith (PSCF),* are available at $35/year (individuals), $55/year (institutions) and $20/year (students).

American Scientific Affiliation
55 Market Street, Suite 202
PO Box 668
Ipswich, MA 01938-0668

Phone: (978) 356-5656
FAX: (978) 356-4375
E-mail: asa@asa3.org
Web site: www.asa3.org

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

American Scientific Affiliation

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

Canadian Scientific & Christian Affiliation

A closely affiliated organization, the Canadian Scientific and Christian Affiliation, was formed in 1973 with a distinctively Canadian orientation. The CSCA and the ASA share publications (*Perspectives on Science and Christian Faith* and the *ASA/CSCA Newsletter*). The CSCA subscribes to the same statement of faith as the ASA, and has the same general structure; however, it has its own governing body with a separate annual meeting in Canada. Contact CSCA by writing to: Canadian Scientific and Christian Affiliation, PO Box 40086, 75 King St. S., Waterloo, ON N2J 4V1 or visit their web site at: www.csca.ca.

On the Web

Some **ARTICLES** published in *PSCF* are posted on our web site <www.asa3.org> under Topic Collections. Topics include:

About Science
Apologetics
Astronomy-Cosmology
Bible & Science
College Teaching & Research
Creation-Evolution
Dialogues
Education
Environment
Essay Reviews
Ethics
Historical Studies
Mathematics
Origin of Life
Philosophy
Physical Science
Psychology-Neuroscience
Science & Technology Ministry
World View
Youth Page

BOOK REVIEWS published in *PSCF* from 1990 are posted on our web site <www.asa3.org>.

For issues related to our **web site**, contact:
Web master Terry Gray: grayt@lamar.colostate.edu
Web editor Jack Haas Jr: haas.john@comcast.net

Indices to Back Issues

INDICES to back issues of the *Journal of the American Scientific Affiliation (JASA)* later named *Perspectives on Science and Christian Faith (PSCF)* are published as follows:

Vol. 1–15 (1949–1963), *JASA* 15 (1963): 126–32
Vol. 16–19 (1964–1967), *JASA* 19 (1967): 126–28
Vol. 20–22 (1968–1970), *JASA* 22 (1970): 157–60
Vol. 23–25 (1971–1973), *JASA* 25 (1973): 173–76
Vol. 26–28 (1974–1976), *JASA* 28 (1976): 189–92
Vol. 29–32 (1977–1980), *JASA* 32 (1980): 250–55
Vol. 33–35 (1981–1983), *JASA* 35 (1983): 252–55
Vol. 36–38 (1984–1986), *JASA* 38 (1986): 284–88
Vol. 39–41 (1987–1989), *PSCF* 42 (1990): 65–72
Vol. 42–44 (1990–1992), *PSCF* 44 (1992): 282–88
Vol. 45–47 (1993–1995), *PSCF* 47 (1995): 290–96
Vol. 48–50 (1996–1998), *PSCF* 50 (1998): 305–12
Vol. 51–53 (1999–2001), *PSCF* 54 (2002): 71–78

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

Articles appearing in *Perspectives on Science and Christian Faith* are abstracted and indexed in the *Christian Periodical Index; Religion Index One: Periodicals; Religious & Theological Abstracts*, and *Guide to Social Science and Religion in Periodical Literature*. Book Reviews are indexed in *Index to Book Reviews in Religion*. Present and past issues of *PSCF* are available in microfilm form at a nominal cost. For information write: University Microfilm Inc., 300 North Zeeb Rd., Ann Arbor, MI 48106.

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

Volume 56, Number 2 **June 2004**