

PERSPECTIVES on Science and Christian Faith

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In this issue ...

Understanding Medical Relationships
through a Covenantal Ethical Perspective

What General Revelation Does (and Does Not) Tell Us

Darwinism, Fundamentalism, and R. A. Torrey

Arthur Holly Compton:
The Adventures of a Citizen Scientist

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

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Arie Leegwater

Living as Part of the Story

When reading Richard Dawkins' most recent book, *The Greatest Show on Earth* (New York: Free Press, 2009), I was struck by the audacity of the phrase, "greatest show," describing the primrose path to macro-evolution. Questions immediately formed in my mind. How does this story (or show) relate to the grand story or narrative that Christians hold to be the case and that forms the history of all there is: the dynamic cosmic movement from creation, fall, redemption to consummation? It is a story of God, who has done great things in the past and present, and, one may trust, who will do the same in the future. In addition, one can also raise the existential question that N. T. Wright often poses—how do we find our place in this story, in our professional life, in the ASA, and in solidarity with other Christians worldwide?

But to the point in question, how do we fuse these two stories? Is it sufficient, or fully satisfying, to assert that there are no irreconcilable conflicts between science and faith in Christ, a thought often captured by the adage that "all truth is God's truth," in the words of Arthur F. Holmes? This claim is echoed in the recent formulation of the Biologos Declaration signed by a distinguished number of Christian pastors, theologians, scientists, and scholars:

We affirm that the truths of Scripture and the truths of nature both have their origins in God, and that further exploration of all these truths can enrich our joyful and worshipful appreciation of the Creator's love, goodness, and grace.¹

Making these truth claims can be helpful, particularly for a Christian community which often experiences the latest scientific findings as a threat to its faith. Holmes has claimed that all truth is God's truth, wherever it may be found. Consequently, we do not need to fear the truth, because the truth comes from

God and is a coherent whole: "If all truth is God's truth and truth is one, then God does not contradict himself, and in the final analysis there will be no conflict between the truth taught in Scripture and truth available from other sources."² We do not need to be afraid of advances in scholarship and scientific research.

However, weighing the inherent connectedness of these truth claims is a far more difficult, pressing, and problematic issue. Holmes further held that knowing the truth about something is a matter of thinking God's thoughts after him. God has perfect knowledge of everything we will ever seek to know. Although God is not subject to the laws of logic, these laws describe how God thinks. Since we are created in his image, we are to think like God. God's character insures that truth is inherently coherent and that it forms a unity.

For others, these truth claims are less closely linked, since we are dealing with two different sources of revelation. For example, the historian of science Reijer Hooykaas stated,

[T]he founders of modern science strove for a methodological separation of science and religion. With Kepler (a devout Christian), astronomy was made independent of Bible texts, but metaphysical notions still interfered in his method; with Pascal and Boyle (both apologists of Christianity), this separation has become complete. In their scientific work, one does not find a word about religion, although their strictly rational-empirical method certainly formed an organic unity with their Christian faith.³

Although Hooykaas argued for a methodological separation of faith and science, he seems to assume some ontological connection of science and faith, namely, an "organic unity." This phrase was never explicated by him. Once he even described the

Editorial

Living as Part of the Story

interrelationship between general revelation and scriptural revelation as one of independence: "Christian faith acknowledges two independent sources of revelation: Scripture and Nature."⁴

Another approach, closely related to the position of independence, is one which identifies new discoveries in the natural sciences as adding to, rather than disclosing, God's revelation in nature. In a recent essay, Joseph L. Spradley writes,

A more fruitful and historically accurate approach to the relation between science and Christianity is one of cooperation and convergence rather than confrontation and conflict. This view emphasizes the Augustinian idea that 'all truth is God's truth' and that advances in science should be seen as adding to God's revelation in nature. In such a view, the content of Christian theology will sometimes influence and motivate scientific work, and discoveries in the natural sciences will sometimes clarify and correct Christian thought.⁵

Whichever position one takes on the integrality of truth and its assumed foundation, one thing is clear: we need a far deeper and richer reflection on these matters, as we find our place in the grand narrative awaiting Christ's next advent.

Writing this editorial during Advent and singing advent hymns such as "View the Present Through the Promise,"⁶ I was struck once again by how often our reflection, discussions, and scientific practices frequently do not display a deep sense of the drama that Scripture portrays. We tend to focus on the present with an ever increasing sense of foreboding and despair, resulting in a loss of hope. But the story of the Bible moves to a conclusion in which God's redemptive work restores the whole of creation, even our human cultural and scientific work. The certain hope and promise of a new heaven and a new earth—the culmination of Christ's second Advent—should shape, pattern, and color all our scientific investigations and technological practices. As contemporary Christians we need to inhabit this story, to make it our own, to bear witness to its promise, and allow it to be our life's story. ☉

Notes

¹Biologos webpage: <http://biologos.org/news-events/signed-statement-from-november-workshop-now-available/>

²Arthur F. Holmes, *The Idea of a Christian College*, 2d ed. (Grand Rapids, MI: Eerdmans, 1987), 18.

³Reijer Hooykaas, "Teilhardism, Its Predecessors, Adherents, and Critics," *Free University Quarterly* 9 (1963): 59.

⁴Reijer Hooykaas, "Science, Materialism, and Christianity," *Free University Quarterly* 1 (1950): 60.

⁵Joseph L. Spradley, "How Have Christian Faith and Natural Science Interacted in History?" in Dorothy F. Chappell and E. David Cook, *Not Just Science* (Grand Rapids, MI: Zondervan, 2005), 28.

⁶Thomas Troeger, "View the Present Through the Promise," (Oxford: Oxford University Press, 1986) in *Sing! A New Creation* (Grand Rapids, MI: CRC Publications, 2001), #90.

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Advent 2009.



In This Issue

In brief, this March issue of *PSCF* has four main articles. In turn, James Rusthoven (McMaster University) presents a covenantal perspective on medical relationships, Mary VandenBerg (Calvin Theological Seminary) discusses different understandings of general revelation, Michael Keas (The College at Southwestern) offers a lengthy historical article on "Darwinism, Fundamentalism, and R. A. Torrey," and John Compton (Vanderbilt University) gives a personal account of the scientific career of his father, Arthur Holly Compton. A number of book reviews complete the issue.

As book review editors, Jim Peterson and I welcome Louise Freeman, a professor of psychology at Mary Baldwin College, as the newest member of our book review trio. She replaces Rebecca Flietstra (Point Loma Nazarene University) who served *PSCF* for the past two years. ☉

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James J. Rusthoven

Understanding Medical Relationships through a Covenantal Ethical Perspective

James J. Rusthoven

Relationships between different parties form the core of medical practice. Increasing attention has focused on the possible merits of understanding such relationships as covenantal in nature. Some advocates of a covenant ethic have focused on promise and fidelity as the defining features of this relationship. However, historical and/or metaphysical justification for prescribing a covenantal model varies, with some appealing to the ancient Greek medical tradition while others claim authority in the biblical revelation of covenant initially established by God with humankind.

In contemporary medicine, reliance on rational identification of a common morality without appeal to transcendent authority has become a dominant paradigm of medical ethics. The basis for envisioning a biblical covenant ethic for clinical relationships has a firm foundation in Reformed theology, which has developed the concept of covenant as a central theme. Such an ethic provides a transcendent grounding that is absent from a common morality based on reason alone that dominates much of bioethical thought. The patient-supporter relationship is presented as an integral part of medical practice that can be understood through a biblical covenant ethic as fidelity between a person or community and the vulnerable patient, grounded in the agape love of God for humankind.

Medical ethics has steadily broadened the boundaries of its field since its inception as a distinct discipline in the 1970s. However, one area that remains central to the concept and practice of medicine and that has been the subject of much attention from bioethicists from its earliest beginnings is the human relationships that make up the practice of medicine. Initially, ethical concerns focused on the historical predilection to paternalism that could be traced back to antiquity, and that threatened a contemporary cultural ethos which sought to provide greater empowerment to patients for making medical decisions concerning their care.

Over the past four decades, patient autonomy has gained a firm foothold, falling into line with the pervasive individualism of Western culture. However, the resulting power shift within the patient-caregiver relationship has not

CSCA member **Jim Rusthoven** is a part-time practicing medical oncologist who has developed a growing interest in medical bioethics in recent years. He has a master's degree in bioethics from the Joint Centre for Bioethics, University of Toronto, and is currently engaged in further graduate studies in the field. Jim also chairs the Biotechnology Reference Group of the Canadian Council of Churches, working to educate the churches and advise government on bioethical issues. He has taught both undergraduate courses in bioethics and the philosophy of science, and graduate seminars in ethics relating to research in developing countries. Jim is married to Thea who teaches French literature, and they have three sons. He particularly enjoys bird watching as a means of appreciating God's good creation; he keeps mind and body fresh through biking and jogging.

Article

Understanding Medical Relationships through a Covenantal Ethical Perspective

necessarily enriched our understanding of that relationship itself. Some bioethicists and caregivers have promoted a reexamination of medical relationships as a necessary corrective to this emphasis on individual autonomy. Covenantal relationships are often contrasted with contractual relationships, but the comparisons have varied, partially because of the lack of consistency in the use of the terms adopted by bioethicists, theologians, and philosophers.

In this article,¹ I provide the background for contemporary appeals to the application of a covenantal ethic to relationships in medicine, based on both Greek pagan and Christian traditions. I propose that a covenantal framework for engaging in medical relationships can more fully enrich our understanding of such relationships when grounded in the relationship between God and humankind, rather than in appeals to nontranscendent authority such as ancient Greek medical traditions and mythologies or to our rational capacity alone. Some of the merits of such a framework will be exemplified in its applicability to one of the least understood but very important relationships: that of the patient and supporting persons.

Background

Concepts of covenant that have been applied to medicine have drawn upon three main sources of authority to justify such a framework: Greek gods as revealed in Greek mythology, the Hebrew or Christian Scriptures, and abstract concepts such as human reason or trust. Appeal to gods of Greek mythology provides the religious grounding for the Hippocratic medical tradition, represented most widely by the Hippocratic Oath. Among the several gods to whom the taker of this oath appeals, the demi-god Asklepios is most prominently associated with the practice of medicine. The rod of Asklepios, a staff entwined by a serpent that symbolizes the blameless physician Asklepios, is the symbol most commonly associated with medical practice.²

Asklepios's persona evolved over nearly a millennium, such that he became the patron god of physicians and guardian of the art of medicine. Described by 700 BC as a demi-god who was born of Apollo and a human mother, he later became recognized as a man-god. In this form, he walked the earth and was considered sufficiently mortal to die and go to heaven, from where he would visit human-

kind as a *daimon* (spirit) in response to prayers for healing.³ His popularity grew among the lower and poorer classes of Greek and later Roman society, attributable in part to his apparent accessibility to supplicants through divine revelation and healing, condescending actions that apparently no other gods would consider.

Many Greek physicians, including Hippocrates, claimed descent from this hero-physician. Galen (AD c. 129–216) referred to Asklepios as his ancestral god, and he was trained in medicine at the Asklepieion at Pergamon. Asklepieions were temple complexes, the larger ones functioning as a cross between a sanatorium and a modern hospital.⁴ So much did Asklepios's qualities inspire the pagan world that some early church leaders compared Asklepios with Christ as Savior, Healer, and Advocate of the poor. Justin Martyr wrote,

and when we say also that ... Jesus Christ ... was crucified and died, and rose again, and ascended into heaven, we propound nothing new and different from what you believe regarding ... Asclepius, who though he was a great physician, was struck by a thunderbolt, and so ascended to heaven.⁵

Evolving Versions of the Hippocratic Oath

The Hippocratic Oath has been the most important and lasting link to the pagan Greek medical tradition and has been a reference point for ethical expectations in medicine. The Oath begins with the oath taker swearing before various gods to fulfill the oath. He then pledges fidelity to his mentor and the mentor's family for teaching him the art of medicine. After pledging to provide benefit to the sick through dietetic measures, he vows that he will refrain from inducing harm and injustice. Specifically, he will refrain from administering deadly drugs, abortive remedies or procedures, using the knife (surgery), engaging in sexual relations with those whom he calls on to heal, and will hold in confidence what he hears or sees in the course of his healing duties.⁶ Ludwig Edelstein has produced compelling evidence that the Oath was heavily influenced by Pythagorean ethics. He suggests that the Oath is not a reflection of common attitudes toward medicine during that time, but rather an ethical code of conduct that reflects the views of a small and relatively

isolated group that may have been trying to reform the profession.⁷

Christian versions of the Oath have been in circulation since the Middle Ages. Allen Verhey speculates that the earliest Christian variation may have originated as early as the sixth century, though the oldest existing manuscript dates back only to the tenth or eleventh century.⁸ As least two such versions were transcribed in the shape of a cross. A version entitled "The Oath According to Hippocrates Insofar as a Christian May Swear It"⁹ clearly retains some continuity with the classical text but differs from the original in two major ways. First, it replaces the invocation to the Greek gods with "Blessed be God the Father of our Lord Jesus Christ. Who is blessed for ever and ever; I lie not." This attempts to reassign the entire medical context and the relationships that it articulates into the story of creation and redemption as related through the Christian Scriptures. Rather than deriving the power of healing and identity from the Asklepiian family of gods, the oath taker seeks professional and personal nurturing, sustenance, and maturity as a follower of Jesus Christ. A second major change from the original text is the omission of the covenantal relationship of the physician to his mentor and the mentor's family. Verhey suggests that this was intended to avoid professional elitism in favor of refocusing the oath on service to the patient.¹⁰

Covenant and Code: Different Relationships within the Hippocratic Oath

The classical Oath itself alludes to several relationships. Nigel Cameron has stated that one of the essential elements of the Hippocratic tradition contained in the Oath is what he calls its triple covenant, involving deity, teacher, and patient.¹¹ William F. May, however, agrees with Edelstein that the specified relationship between the oath taker and the patient is not covenantal, but rather is restricted to a code of conduct. Its single covenantal relationship is that between the novice physician, his mentor, and the mentor's family.¹² This relationship is based on a student's promissory reciprocation for receiving the gift of knowledge of the medical art. As such, this relationship is reminiscent of a covenantal relationship if, at its core, it requires the *trust* that a *promise* will be fulfilled, includes an expectation

of supererogatory (heroic) efforts if needed, and involves a long-term if not lifelong relationship. May also suggests that the reference to transcendent powers in the form of the gods imparts a covenant meaning to the entire Oath. The power of the healing profession, specified in the duties to patients and the obligations to the mentor, is derived from an extra-temporal source with which the oath taker makes a promise to fulfill those duties and obligations.¹³

Is the Hippocratic Oath Relevant for Medicine Today?

The Hippocratic Oath has been used as a template for covenantal relationships in medicine. However, the relevance of the Oath to contemporary medical ethics has been questioned. For example, bioethicist Robert Veatch has rejected the Oath and its tradition as too physician empowering, too teleological, lacking any reference to social justice, and too short on deontological obligations to be applicable to medical ethics today.¹⁴ Indeed, there is recent evidence that the Oath is losing its popularity and, in some cases, has been replaced by other oaths.

Robert Orr et al. recently surveyed medical schools and associations regarding their use of the Oath.¹⁵ Among one hundred fifty medical schools surveyed in North America (157 surveys sent; response rate 96%), 98% of graduates took a professional oath in 1993. Twenty-two different versions of the Hippocratic Oath were used and only one school used the classical version of the Oath. Other oaths taken in various schools included the Declaration of Geneva (either 1948 or 1983 versions), an osteopathic oath, the Oath of Louis Lasagna, and the Prayer of Maimonides. While all of the oaths retained a pledge of commitment to patients, others deleted various content items that were in the classical Hippocratic Oath. Items most commonly deleted included the avoidance of sexual contact with patients, a covenantal relationship with a deity, refusing to perform abortions and euthanasia, and an agreement to be accountable for keeping the Oath.¹⁶ The nearly complete disappearance for reference to sexual contact with patients is particularly surprising given its recognition as a problem in contemporary practice.¹⁷

This study suggests that the Hippocratic Oath is becoming increasingly altered or replaced to reflect

Article

Understanding Medical Relationships through a Covenantal Ethical Perspective

more contemporary goals and values. Cameron observes that modern statements of ethical values retain the Hippocratic form. However, claims that those values stand in the great tradition of Greek medicine lack credibility, as its particular contents are changed to reflect today's values.¹⁸ While this is true with regard to specific sanctity of life issues such as abortion and euthanasia, some content items have been retained as more general features or principles of practice. In analyzing variations of the Oath, Orr et al. found consistencies that they have termed core values of medicine: general commitments to patients and teachers, defined boundaries for certain "ends" of medicine, the insistence on confidentiality, and the restriction of means to treatment. Any appeal to a transcendent Being is being increasingly altered or omitted. For example, the retention of a reference to deities dropped from 30% in oaths used in 1958 to only 11% in those used in 1993.¹⁹

Contemporary Appeals to Covenant as a Model of Medical Relationships

Against this background of pervasive Greek medical traditions and the intermittent synthesis of Christian ideas, the concept of covenant in medicine has been applied to various contemporary medical contexts to describe normative aspects of different relationships within medical practice and discourse. A recently published statement entitled *The Patient-Physician Covenant* professes that a covenant is at the center of medicine and is a moral enterprise grounded in trust.²⁰ At least one of its signatories believes that, in this covenant, the physician has a primary fiduciary responsibility to patients, the history of which is traced to the myth of Asklepios. The statement expresses a shared concern that today's physicians are allowing *materialistic self-interest, profit, and commercial interests* to erode what they see as a primary obligation to serve the good of those who seek their help and expect mutual trust.²¹

While the basis for that trust is not explicitly stated, its grounding in *common goodwill* is implied. There is no appeal to a transcendent ideal or power. The primacy of patient obligation is referenced against competing interests in profit-making ventures, particularly in managed care schemes, but the

statement does not address the potential *conflicts of obligations* regarding other covenant relationships with one's family, community, and other social groups.²² Such conflicts can be particularly problematic in a profession at the heart of which is the pursuit of the health of strangers.

Some contemporary bioethicists have tried to link the covenant concept with different relationships in medicine, including medical education. Canadian physician and bioethicist Jeff Nisker has written that a covenantal model captures the moral nature of medicine through the possession of certain *inherent* qualities such as trust, generosity, commitment, empathy, and creativity—qualities not considered part of a contractual model. Bemoaning the "demoralizing climate" that he perceives as a threat to health care and medical education, he suggests that such a model might improve the *esprit de corps* of both.²³ Nisker believes that the effectiveness of the *medical educator-student relationship* will likely be improved if developed covenantally and grounded in the moral nature of the profession. He appeals to *mutual trust* as the source of such grounding, but makes no claim for a transcendent source of authority on which to anchor the justification for his appeal to a covenant model.²⁴

In her focus group study of *patient-nurse relationships*, Susan Coffey argues that evidence supports the premise that a covenantal model incorporates well the nature and reality of the patient-nurse relationship.²⁵ Unlike other studies which have focused primarily on the *caregiver*, this study devotes at least equal time to the analysis of *the patient* and his or her role in the relationship. Coffey acknowledges the ancient roots of the covenant concept, explicitly mentioning Babylonian, Assyrian, Greek, and Mycenaean references and inferences to covenantal relationships. However, she makes no mention of covenant concepts in Jewish or Christian traditions. She seems to agree with May's conceptualization of covenant and its prescriptive potential in improving relationships involving health professionals. Again, however, she makes no mention of his claim that his concept is grounded in Christian belief and tradition.²⁶ Coffey concludes that a covenant model for the patient-nurse relationship offers a framework for both describing actual relationships and for developing better relationships, through the experiencing of those relationships.

James Li expresses concern that physicians are misplacing their priorities because of increasing demands on their allegiance to third parties.²⁷ To him, the problem can be distilled into contractual versus covenantal views of the *patient-physician relationship*. A contract is struck in a climate of inherent mutual mistrust and generally involves relatively equal parties that are primarily concerned about their own welfare. By contrast, a covenant is based on trust (what he calls a “last will and testament” type of relationship) and the partners are generally considered unequal in one or more respects. The welfare of the more vulnerable party is a primary concern of both parties.

Kyle Brothers has borrowed from the Judeo-Christian traditions in his appeal for a covenantal patient/physician relationship that accommodates the patient as the “vulnerable other.”²⁸ However, he seems to reduce this special covenant relationship to empowerment of the patient through dialogue, sensitivity to patient beliefs, and helping the patient to sort through options based on those beliefs. Once again, no appeal to a link with a relationship with a transcendent being is mentioned.

Grounding of Covenant Relationships in God’s Relationship with Humankind

From a Christian perspective, any valid relational covenant between humans can only be properly and completely fulfilled if recognized as necessarily reflecting the relationship with the transcendent God. Scripture teaches that the covenant theme runs throughout redemptive history, but its importance for a systematic theology varies within different Christian traditions. It is particularly within the Reformed traditions that the idea of covenant became a central theme in a biblically derived theology. Yet, even during the Reformation period, unanimity among the leading Reformers was illusive regarding a common view of the covenant within theological alternatives to that of the Roman Catholic Church. Indeed, within specific post-Reformation traditions today, there remain different interpretations of the position of covenant within the theologies of tradition founders.

From a Reformed Christian perspective, Scripture instructs that one should relate to others as

a reflection of the gracious gift of covenant that God established with humankind. As theologian Louis Berkhof put it, “... from the beginning” God “*condescended* to come down” to the creatures who bore his image and, “by positive enactment, *graciously* established a covenant relationship.”²⁹ The relationship between God and humans is thus covenantally qualified but administered in various ways throughout redemptive history. As John Stek has summarized, “... in [the Reformed] tradition, covenant became a theological *concept* utilized to *construe* the *nature* of the God-human relationship, and was necessitated by the ontic distance between Creator and creature.”³⁰

Many Reformed leaders during the Reformation and immediate post-Reformation period adhere to a *postlapsarian* or redemptive covenant of grace as the first covenant, necessitated by sin. That is, God did not strike a covenant relationship with humankind until after the Fall into disobedience. This covenant was generally considered to have been initiated in the Noahtic and Abrahamic covenants,³¹ the first of a series of covenants through which God attempted to maintain a relationship of trust with chosen remnants after sin entered the world. However, later followers and interpreters of these early leaders have suggested that some, including John Calvin, may have considered the *prelapsarian* (pre-Fall) relationship between God and Adam at creation to be also covenantal.

Peter Lillback has argued convincingly that, by its nature, God’s covenant is unconditional from God’s perspective but conditional from the human perspective.³² That is, God dispatches a purely gracious arrangement which he will not break, but for the individual human, obedience is a necessary response without which God’s gracious covenant could be jeopardized in divine judgment. According to Lillback, Calvin saw all humans accepted into a *common covenant* or adoption, which they could nullify through disobedience. That general or common covenant forms a *covenant community for all humankind*. Within that community are those who, by special election, will remain bound to God, though they will stumble and must be constantly on guard against disobedience. The non-elect, by contrast, will break the common covenant.³³

The idea of a *prelapsarian* covenant has come to be known as the *covenant of works*. Calvin alludes

Article

Understanding Medical Relationships through a Covenantal Ethical Perspective

to *conditionality* in the earliest relationship between God and Adam. Life for Adam and Eve was conditional on a continuing obedience to God, and such conditionality suggests a covenantal relationship.³⁴ Furthermore, suggests Lillback, Calvin sees the prohibition to eat of the tree of knowledge of good and evil as a test of obedience at a time when humankind had not been perfected. Adam needed to grow in wisdom through obedience to God. Lillback argues further that, for Calvin, the tree of life is a *sacrament*, a pledge of life, a seal, which then implies a covenant promise:

One [example of sacrament in the wider sense] is when he gave Adam and Eve the tree of life as a guarantee of immortality ... Another, when he set the rainbow for Noah and his descendants as a token that he would not destroy the earth with a flood. These Adam and Noah regarded as sacraments ... because they had a mark engraved upon them by God's Word, so that they were proofs and seals of his covenants.³⁵

Humankind's relationship with God determines its relationships *within* humankind. Humans should act with gracious authority toward those who depend on them (just as God does toward them), while acting in gratitude and obedience to those in authority over them, as they do to God. In contemporary bioethics, principles-based ethics dominates bioethical discourse and decision making. Its framework consists of the principles of autonomy, beneficence, non-maleficence, and justice reputedly derived from a common morality knowable by all through reason alone.³⁶ Principles-based ethics has been rightly criticized for lacking grounding outside of intuition and reason.

By contrast, a biblical concept of covenant, grounded in a common divine-human covenant at creation (i.e., a prelapsarian covenant or covenant of creation³⁷) as revealed in Scripture, could be helpful in providing a normative ethical framework and grounding for medical relationships. Perhaps most importantly, a biblical covenant ethic has a missional dimension; that is, it could also resonate with those who adhere to a common morality. A creation covenant between God and all of humankind that forms the moral grounding for covenant relationships in medicine may be persuasive as a more meaningful, normative alternative to principles-based ethics.

Christian Bioethicists' Views of Covenant in Bioethics

As reflected in their different confessional traditions, Christian bioethicists express quite variable Christian views of covenant in this context. I will review several different biblical covenant views held by Christian ethicists, beginning with a covenant view of Christian ethics that I have found very helpful and to which several prominent Christian writers in bioethics have referred. I will then address concepts of covenant formulated by various Christian bioethicists, as they apply to medical ethics.

Christian Covenant Relationships: Directed by Love and Reflections of the Covenant with God

Joseph Allen defines a covenant relationship as requiring several key elements. It must be constituted through willing acceptance of entrustment among the parties. As a result, the parties become part of a moral community with mutual obligations to each other that endures the test of time. He distinguishes entrustment from trusting (and trustworthiness) in that trusting connotes a disposition to commend ourselves to someone else, whereas entrustment goes further, by placing ourselves or something of value to us into the hands of another.³⁸

Allen distinguishes two types of covenants. The *inclusive covenant* is wholly creational in scope, involving all living creatures and all of humanity. The relationship does not require active and conscious reciprocation; the creatures need not be capable of covenanting with God. Rather, the covenant affirms their value as creatures of God's good creation, with human beings having a special responsibility for its care. This inclusive covenant was established at creation: "The Christian proclamation is that God has created all people to live in covenant with God and with one another."³⁹ By virtue of this covenantal arrangement, all persons are God's children, whether they agree to it or not. As in the relationship of a child to its parents, we preconsciously entrust ourselves to God's care through the creational covenant. Allen calls this the most fundamental human relationship. However, it is never fully realized in this world, even among those who wholly and faithfully keep their obligations. It is also maintained by an eschatological hope that "stands in judgment upon the brokenness of all human communities."⁴⁰

Allen also speaks of *special covenants* through which other moral responsibilities are shaped. They are distinguished from the inclusive covenant in their initiation by human beings with human beings, and in their special defining requirements, rights, and obligations. They also have common features, such as the need for faithfulness to the relationship, concerns for the needs of others, and respect for the worth of other participants. These types of covenants are inseparable to be fully meaningful. We are in relationship through both types at once. Our participation in the inclusive covenant is *concretely expressed* through our participation in our special covenants. Through the inclusive covenant, we are reminded that God is (or should be) the center of our moral life. This covenant forms a unifying meaning with the special loyalties of our special covenants.⁴¹

Allen also considers how the inclusive covenantal relationship with God provides the grounding for the moral life expressed through the special covenants by way of his steadfast love. He draws similarities between the Hebrew concept of godly love within covenant, as expressed in the Hebrew word *hesed*, and God's faithful love within the covenant expressed in the Greek word *agape* in the New Testament, confirming the unchanging nature of God's love within the covenant in redemptive history. Allen gives several characteristics of God's covenant love. In describing the binding nature of this love and its importance for each member of a covenant community, he stresses the individual worth that this love imparts to each member; we are worthy throughout our very being, at a deeper level than our moral worth. God loves us because he created us and covenanted with us from the beginning. Our worth is born out of the covenantal relationship.

Another characteristic of God's covenant love is its inclusiveness. Allen acknowledges the theological problem of interpreting Scripture's teaching regarding those who qualify as covenant participants. He makes the careful distinction between those to whom God's love is extended (i.e., those in the inclusive covenant), and the church as the community that responds positively and self-consciously to the new covenant in Jesus Christ. God will meet our individual needs but we must seek his kingdom and his righteousness. Accordingly, salvation is couched in communal terms as

the restoration of true participation in the faithful covenanting community.

Two particularly important characteristics of his covenant love are the steadfast and reconciling nature of God's love. God's enduring responsibility goes beyond the legally stipulated, time-limited criteria of a contract. Unlike the legal release from responsibility that contract breaking allows, covenant with God entails a unilateral promise to keep that covenant *no matter what*. However, with this commitment comes a righteous stipulation, to seek repentance from the covenant breaker and to accept forgiveness when repentance is heartfelt, so that covenantal integrity can be restored.⁴²

Allen describes special covenants involving human relationships in terms parallel to that of the inclusive covenant with God. While special inter-human covenantal relationships can be seen through the same characteristics that constitute the covenant with God, these characteristics are often distorted through sin by one or more parties within the covenant. Allen believes that the most neglected characteristic of covenant love in our time is the commitment to faithfulness to others. It is the commitment to take responsibility for the effects of our actions on others over time, and our commitment to care for others over the long term.

Covenant as a Framework for Bioethics: Christian Perspectives

Throughout his formative work from the early days of bioethics as a discipline, Paul Ramsey has tried to distill the covenant concept into *covenant-fidelity*. Expressed as Christian neighborly love with no requirement for reciprocation, he distinguishes this idea of a covenant relationship from a more secular idea of universal brotherhood or that of a cosmopolitan spirit.⁴³ Unfortunately, his covenant-fidelity theme is not systematically well developed. Robert Veatch, initially raised in the Methodist tradition and a firm believer in autonomous patient choice, proposes inventing a moral framework through a social contract by "rationally pursuing enlightened self-interest." For Veatch, a covenant is a *special contract* based on mutual loyalty and trust. He replaces covenant language with a Hobbsian interpretation of binding relationships, emphasizing public and legal aspects.⁴⁴ By contrast, Thomist bioethicists Edmund Pellegrino and David Thomasma favor the concept of a covenant of trust embodied

Article

Understanding Medical Relationships through a Covenantal Ethical Perspective

in an ethic of virtue, in which the physician pledges fidelity in a binding promise to help. They reject models of the physician/patient relationship that effectively reduce the relationship to a legal contract, a commodity transaction, or a purely biological healing relationship, in favor of one that they describe as a covenant of trust embodied in an ethic of virtue and trust.⁴⁵

William F. May has perhaps most fully articulated the covenantal relational types in a medical context. For May, covenantal relationships go beyond a material framework to encompass a different *spirit* that is internal. This spirit goes *beyond the temporal limitations* of a contract and thus prevents the expedient neglect of obligations and promises. Covenants have a “gratuitous, growing edge,” cutting deeper into personal identity and promoting fundamental change in a person’s being in the relation-building process. For patient-caregiver relationships, this enables the caregiver to *transformationally* go beyond expressed wants and become more attentive to patients’ deeper needs. Furthermore, it offsets the inherent power inequity in the relationship, allowing the more powerful caregiver to accept more responsibility for the more vulnerable partner, and reflecting back on God’s condescension for the sake of covenant.⁴⁶

From a Reformed perspective, Kenneth Vaux adds a *community dimension* by advocating an ethics of *koinonia* whereby covenanting communities of faith resist societal models of autonomous, self-ruling, and self-serving selves. Instead, we should exercise committed allegiance to God alone and, in his spirit of gracious acceptance and forgiveness, exist primarily for each other rather than ourselves. Hessel Bouma III and his colleagues have also written about covenantal ethics from their neo-Calvinist Reformed tradition. They agree with Allen on the distinction between an inclusive and special covenant. However, unlike Allen who seems to encompass *all living things* including humanity in this inclusive covenant with God, Bouma et al. seem to consider the inclusive covenant as Christians being in covenant relationship with God *and with all of creation*.⁴⁷ Thus, the temporal side of this covenant seems to be a post-Fall relationship between believers and God along with the rest of creation. This is a very different inclusiveness than that expressed by Allen, who includes all of humanity as well as

other living things on the temporal side. An inclusive covenant idea that encompasses all of humanity from the time of creation has appeal for Christians and perhaps also for non-Christians, in that it shows the primeval-creational, and thus inclusive, grounding of covenant rather than a more exclusive, salvific one. This may provide a better point of contact for bioethical discourse with non-Christians, for whom religious beliefs may be tied to exclusivity of certain participants.

Bouma et al. speak of covenant in much the same way as Allen and May, noting distinctions from contracts: endurance over time, a gift-giving nature, and a mutual shaping of the individual and their communities through covenanting relationships.⁴⁸ They also all speak of a kinship between deontological and covenantal ethics, in supporting some basic minimal rights and duties of individuals who are included in covenantal responsibilities. However, they acknowledge that such a moral minimalist view can also be characteristic of an individualism that prioritizes the individual over the community. They clearly distinguish the more demanding and expectant nature of covenant relations from the more limited and legalistic expectations of contractual ones.⁴⁹ They also see the rooted importance of the covenant with God toward all other covenant relationships.

In summary, the covenant theme plays a central role in the redemptive narrative that is taught in Scripture. It has its deepest roots in God the Creator, and points to lasting joy and peace through the sacrifice and resurrection of Jesus Christ. From these roots grow nurturing relationships between human beings, which hang on created relational structures, which in turn are given direction through the covenant relationship with God. It is from these roots that medical relationships can be most normatively fulfilled in a sphere of human endeavor defined by healing, relieving, and consoling. Without acknowledging and living out that relationship with God, all other relationships are incomplete, unfulfilled, and plagued by our sinful natures. As Spykman puts it,

Covenantal religion defines the fundamental structures undergirding all human relationships and every societal calling ... It embraces every earthly institution—marriage, schooling, labor, social service, science, art, even politics.⁵⁰

Relationship of Patients and Supporting Persons As Seen through a Covenant Ethic

Considerable literature exists concerning the need to maintain good communication and to avoid paternalism in caregiver-patient relationships. Application of a covenantal ethical approach for each type of relationship in medicine is beyond the scope of this article. However, one relationship that has been much less explored than the patient-caregiver relationship, and that can be richly understood and expressed through a covenantal framework, is the relationship of the *patient and supporting individuals*. Paul Ramsey was one of the first bioethicists to allude to the importance of empowering patients and those who support them to make moral judgments regarding the patient's care.⁵¹ This means patient participation and decision making with caregivers may be enriched by a meaningful covenantal relationship with supporting persons.

In a practice involving chronic progressive or life-threatening illness such as cancer and dementia, it is particularly important to strongly encourage patients to bring a trusted *Other* to clinic visits. This would preferably be the same person each time, to allow some relation building with that person and the caregivers, as well as to identify a point person who would communicate with others about the welfare of the patient. The support of this person reduces the patient's sense of vulnerability and provides an additional set of attentive ears and another interpretive mind that can help the patient comprehend and incorporate what is related by the physician. The relationship can also empower the patient to participate in better decision making at each decision node along his or her clinical course. It can give the patient strength to endure the sufferings associated with progressive disease. In certain situations, such as the donation of an organ from a relative or good friend, it is imperative that the caregiver ensure that the recipient and donor understand the implications, both the benefits and the risks, of the effects of the gesture on their ongoing relationship.

The relationship of the patient with such Others may be best developed through a biblical covenantal model. That person or persons will usually have an established pre-illness relationship with the patient based on trust at the onset of illness.

Such supporting Others will have to offer time and interpretive expertise, over and above other obligations or duties owed to individuals with whom they have distinct special covenantal relationships. Rearranging a schedule of family activities or taking time off work in order to accompany a patient to a clinic is one example. Providing daily care to change a wound dressing, or to ensure regular communication in order to keep a sick friend at home and out of the hospital, is another. As perceived through a biblical covenantal ethic, these relational bonds and obligations are grounded from creation in the grace offered by God to humankind, his special creation. Christians are directed by gracious love as the ordering principle, and this love justifies our thoughts and actions; just as Christ loved us, so we follow his way in our covenant love for others.⁵²

In many cultures, it is normal and expected that family and/or friends become intimately involved in the care of a loved one. In cultures with close-knit, extended families in particular, involvement in care and decision making is expected and can be very comforting for a terminally ill loved one. In certain cultures, however, it has been perceived as normal for family members to use their influence on vulnerable loved ones, to withhold information, or to deceive them, out of fear that the truth will not be in their best interest. In most western cultures, this is now perceived as coercive and paternalistic.⁵³

In his explorations of intergenerational relations in the context of illness in elderly family members, Drew Christiansen considers filial responsibility toward the elderly as a basic defense of the dignity of the elderly against the vulnerabilities created by failing health and reduced self-reliance.⁵⁴ In our society, this can create a tension between a societal-bred predilection toward autonomous freedom with its independence from Others, and a perceived risk to revert to paternalism with increasing dependence of elderly family members. In response, Christiansen rightly points out that caregiving always takes on another feature of covenantal relations: *sacrificial* character. In a family context, caregiving should normatively flow from an established covenantal relationship of promise and trust that lasts a lifetime. With illness comes another aspect or phase of that same relationship rather than the creation of a new relationship, as often occurs between patient and professional caregivers. Its core of promise, its inherently virtuous character in the domestic

Article

Understanding Medical Relationships through a Covenantal Ethical Perspective

sphere, and its long-term commitment qualify the relationship as covenantal even more deeply than that with their professional caregivers.

In a recent study of women with primarily breast and gynecologic cancers, 90% of subjects named a family member as their primary support, healthcare proxy, and/or emergency contact person. While over 80% named a first-degree relative to all three roles, only 57% of the time did a single person fill them all. Preexisting close family bonds formed the core of trust and comfort for the large majority of patients; yet, some members were perceived as better suited to provide specific manifestations of that support.⁵⁵

For those without families and who rely primarily on friends or neighbors, the support relationship can take on a more tentative character, depending on whether the relationship has functionally developed to replace lost or unknown family relations prior to the illness. However, the strength of the bond of fidelity and sacrificial potential may be as strong as, or stronger than, any familial relationship.

May advocates that whoever assumes a caregiver role, particularly for the dying, needs what he calls *the covenantal virtue of courage*. He describes courage in this context as “a matter of keeping one’s dislikes and fears under bridle for the sake of the good. It is firmness of soul in the face of adversity.” Thomas Aquinas distinguishes an active and a passive courage; the former connotes attack while the latter manifests endurance.⁵⁶ As deliverers of care, professional caregivers tend to advocate active courage, sometimes characterized in their pugilistic metaphors such as fighting the disease with active therapy, while the supporting Others must bring forward endurance, expressing the covenantal character of their role more passively, as in the tradition of Job’s friends.

As a pioneer of our contemporary care of the dying, Elizabeth Kubler-Ross urged that professional caregivers develop a kind of intimacy in their relationships with the dying, an almost mystical merging of the two. May, however, disagrees, acknowledging a distancing that occurs over time as health deteriorates, reflection about death intensifies, and the individual draws upon those with whom he or she has more closely shared life experiences, i.e., the faithful and supporting Other.⁵⁷ But

even such a covenantal faithfulness is marked by *strangeness*. The dying loved one is on a different path; or, rather, is hurrying faster down his or her path into strange territory. Like the friends of Job, sometimes the virtue of silent perseverance—just being there—is the passive courage that preserves the covenantal bond despite the strangeness.⁵⁸ Most assuringly, Scripture teaches that in our weakness the Spirit helps us. Even when we do not know what to pray for “... the Spirit himself intercedes for us with groans that words cannot express.”⁵⁹

Richard Zaner notes that spatial context may also give a distinctive character to patient/supporter relationships. A hospital room, for example, becomes the domain of the vulnerable. During a vigil of severe illness where death may not be far ahead, nursing staff come and go in shifts and physicians may make a daily visit for several minutes, but the closest covenanting ones often stay throughout the day and into the evening. Particularly when members of the same family take turns, there is a *covenantal continuity* of support. Indeed, the focus shifts so that the vulnerable one becomes dominant. Entry into the room feels intrusive. Those in a supportive role also increase their influence, bringing information and expressed needs to caregivers in other parts of the ward, or even outside the hospital.⁶⁰

The patient-supporter relationship is special in the medical encounter. In many ways, it is the most stressful, the most risky, the most self-sacrificing, indeed, perhaps the most covenantal of all medical relationships. While most often an extension of an established covenantal family relationship or one of true friends and companions, the patient-supporter relationship can test that covenant in its demand for courage and fortitude. Similarly, the larger supporting Christian community should also seek its covenanting role in such times, particularly when it professes Christ, and exists to forward reminders of the covenantal joys and expectations of the God-believer relationship among believers in times of health and in times of distress. As believers, we need to work hard in our own communities to muster the courage and fortitude to be covenantal helpers to our ailing church body members. In many of our faith communities, we pledge at infant baptism to help to raise a child in the faith. Should we develop a similar pledge to provide covenantal support for each other in times of illness? ☉

Notes

- ¹This paper was presented in part at the annual meeting of the American Scientific Affiliation, August 1–4, 2008, at George Fox University, Newberg, Oregon.
- ²This symbol has often been confused with the caduceus of Hermes, the symbol of a winged wand entwined by two serpents. However, some of Hermes's traditional roles, such as the patron god of thieves and the guide of souls to the underworld, might make this an ethically dubious symbol for the practice of medicine.
- ³James E. Bailey, "Asklepios: Ancient Hero of Medical Caring," *Annals of Internal Medicine* 124 (1996): 257–63.
- ⁴Robert A. Wilcox and Emma M. Whitham, "The Symbol of Modern Medicine: Why One Snake Is More Than Two," *Annals of Internal Medicine* 138 (2003): 673–7.
- ⁵Bailey, "Asklepios: Ancient Hero," 260–2. This is reminiscent of the tactic used by Paul to show the Athenians the connection between their unknown god and the living God. See Acts 17:22, 23.
- ⁶Ludwig Edelstein, "The Hippocratic Oath," in *On Moral Medicine: Theological Perspectives in Medical Ethics*, 2d ed., ed. Stephen E. Lammers and Allen Verhey (Grand Rapids, MI: Wm. B. Eerdmans Publishing, 1998), 107.
- ⁷Ludwig Edelstein, *Ancient Medicine: Selected Papers of Ludwig Edelstein*, ed. Owsei Temkin and C. Lilian Temkin (Baltimore, MD: The Johns Hopkins University Press, 1967), 6–39.
- ⁸Allen Verhey, *Reading the Bible in the Strange World of Bioethics* (Grand Rapids, MI: Wm. B. Eerdmans Publishing, 2003), 7, n. 20.
- ⁹W. H. S. Jones, *The Doctor's Oath: An Essay in the History of Medicine* (New York: Cambridge University Press, 1924), 23–5. Recently, another Christian Physician's Oath was approved by the Christian Medical and Dental Society's House of Delegates. See Kenneth A. Feucht and Byron Calhoun, "The Hippocratic and Other Oaths: Past and Present Proposal for an Oath for Christians," *Journal of Biblical Ethics in Medicine* 10, no. 1 (1994): 28, 29.
- ¹⁰Allen Verhey, "The Doctor's Oath and a Christian Swearing It," in *On Moral Medicine: Theological Perspectives in Medical Ethics*, 116, 117. Verhey believes that the Christian version of the Oath reflects an attempt to transform a rational and professional ethic through attention to the Christian story. He suggests that it does not disown a natural morality and piety, but rather reforms it. This has echoes of many Thomist moralists who suggest that Christianity provides the "motivation" for fulfilling universal moral commitments rather than a true re-forming of morality through Scripture. See Lisa S. Cahill, "On Richard McCormick: Reason and Faith in Post-Vatican II Catholic Ethics," in *Theological Voices in Medical Ethics*, ed. Allen Verhey and Stephen E. Lammers (Grand Rapids, MI: Wm. B. Eerdmans Publishing, 1993).
- ¹¹Nigel M. de S. Cameron, *Life and Death after Hippocrates: The New Medicine* (Wheaton, IL: Crossway Books, 1991), 23–45.
- ¹²William F. May, "Code, Covenant, Contract, or Philanthropy," *Hastings Center Report* 5 (December 1975).
- ¹³William F. May, *The Physician's Covenant* (Philadelphia, PA: Westminster Press, 1983), 111. Edelstein, on the other hand, believes that such references to deities were more related to appeals for fame and fortune than any acknowledgment of transcendental authority for their healing powers. See Edelstein, *Ancient Medicine*, 61.
- ¹⁴Robert M. Veatch, "The Hippocratic Ethic Is Dead," *New Physician* 48 (1984): 41–42, 48. Veatch reiterated this position in his 2008 Gifford Lecture, suggesting that claims by contemporary physicians that they follow the Hippocratic ethic are irrational if they are not members of the Greek cult. He goes further, to accuse patients of irrational behavior if they tolerate health professionals who claim to practice out of a professional code whose moral views are at odds with their own religious or secular tradition. In what seems to be a return to a more universalist approach to ethics, Veatch considers the possibility that religious and secular moral traditions can be harmonized, as a rational alternative to Hippocratic ethics.
- ¹⁵Robert D. Orr, Norman Pang, Edmund D. Pellegrino, and Mark Siegler, "Use of the Hippocratic Oath: A Review of Twentieth-Century Practice and a Content Analysis of Oaths Administered in Medical Schools in the U.S. and Canada in 1993," *The Journal of Clinical Ethics* 8, no. 4 (winter 1997).
- ¹⁶*Ibid.*, 380.
- ¹⁷For a review and commentary of sexual contact with patients, see American Medical Association, Council on Ethical and Judicial Affairs, "Sexual Misconduct in the Practice of Medicine," *Journal of the American Medical Association* 266 (1991): 2741–5; N. I. Gartrell et al., "Physician-Patient Sexual Contact: Prevalence and Problems," *Western Journal of Medicine* 157 (1992): 139–43.
- ¹⁸Cameron, *Life and Death after Hippocrates*, 58–9.
- ¹⁹Orr et al., "Use of the Hippocratic Oath," 385.
- ²⁰Christine K. Cassel, "The Patient-Physician Covenant: An Affirmation of Asklepios," *Annals of Internal Medicine* 124 (1996): 604–6.
- ²¹Recent studies suggest that such concerns are being addressed in various ways. The increase in women in the physician work force, for example, has been coincident with greater physician interest in making time for better healthy family relations through more part-time practices and taking leaves-of-absence. Evidence exists that these changes do not adversely affect patient outcomes. Training programs are putting greater emphasis on developing good relationships with patients through increased sensitivity to diverse backgrounds and beliefs. There is also greater attention among professional organizations to improving ethical behavior, to the avoidance of conflicting patient-care responsibilities, and to minimizing the influence of commercial interests and profits related to pharmaceutical companies on medical care. For further readings on these topics, see Reshma Jagsi, Nancy J. Tarbell, and Debra F. Weinstein, "Becoming a Doctor, Starting a Family—Leaves of Absence from Graduate Medical Education," *New England Journal of Medicine* 357 (2007): 1889–91; Patricia Parkerton, Edward H. Wagner, Dean G. Smith, and Hugh L. Straley, "Effect of Part-Time Practice on Patient Outcomes," *Journal of General Internal Medicine* 18 (2003): 717–24; Anthony L. Suchman, Kathryn Markakis, Howard B. Beckman, and Richard Frankel, "A Model of Empathic Communication in the Medical Interview," *Journal of the American Medical Association* 277, no. 8 (1997): 678–82; Chris MacDonald, "Will the 'Secular Priest' of Bioethics Work among the Sinners?" *The American Journal*

Article

Understanding Medical Relationships through a Covenantal Ethical Perspective

of *Bioethics* 3 (2003): 1–4 (InFocus); Robert Steinbrook, “Controlling Conflict of Interest—Proposals from the Institute of Medicine,” *New England Journal of Medicine* 360 (2009): 2160–3.

²²Joseph Allen distinguishes between an inclusive covenant involving God and human beings, and special covenants that involve interhuman relationships within distinctly different social structures. See Joseph Allen, *Love and Conflict: A Covenantal Model of Christian Ethics* (Nashville, TN: Abingdon Press, 1984). May also makes this distinction, but the inclusive covenant seems to differ from that of Allen in its scope. See William F. May, *Testing the Medical Covenant: Active Euthanasia and Health Care Reform* (Grand Rapids, MI: Wm. B. Eerdmans Publishing, 1996), 53.

²³Jeff Niskier, “A Covenant Model for the Medical Educator-Student Relationship: Lessons from the Covenant Model of the Physician-Patient Relationship,” *Medical Education* 40 (2006): 502–3.

²⁴Others have expressed concern that problems in medical education go beyond a lack of mutual trust, to include increasing demands on physicians’ time to be more administratively efficient and accountable, and a lack of time for students to reflect on their experiences, resulting in less time for teaching and less-effective learning, respectively. For further reading on these problems, and reflections on dealing with the emotional toll of patient care, see Ronald A. Arky, “The Family Business—To Educate,” *New England Journal of Medicine* 354 (2006): 1922–6; and David A. Landis, “Physician Distinguish Thyself: Conflict and Covenant in a Physician’s Moral Development,” *Perspectives in Biology and Medicine* 36, no. 4 (1993): 628–41.

²⁵Sue Coffey, “The Nurse-Patient Relationship in Cancer Care as a Shared Covenant: A Concept Analysis,” *Advances in Nursing Science* 29 (2006): 308–23.

²⁶*Ibid.*, 309.

²⁷James T. C. Li, “The Patient-Physician Relationship: Covenant or Contract?” *Mayo Clinic Proceedings* 71 (1996): 917–8.

²⁸Kyle Brothers, “Covenant and the Vulnerable Other,” *Journal of the American Medical Association* 288 (2002): 1133.

²⁹Louis Berkhof, *Systematic Theology* (Grand Rapids, MI: Wm. B. Eerdmans Publishing, 1949), 215.

³⁰John Stek, “‘Covenant’ Overload in Reformed Theology,” *Calvin Theological Journal* 29 (1994): 12–41.

³¹E. Clinton Gardner calls these “promissory covenants,” and distinguishes them from morally obliging covenants that involve commandments, through the obedience to which, faithfulness and responsibility toward the relationship is expressed. In either case, God’s covenants with Israel define their self-understanding as God’s people, expressed in how they live out their faith in Yahweh. See E. Clinton Gardner, *Justice and Christian Ethics* (Cambridge: Cambridge University Press, 1995).

³²Peter A. Lillback, “The Continuing Conundrum: Calvin and the Conditionality of the Covenant,” *Calvin Theological Journal* 29 (1994): 65.

³³Peter A. Lillback, *The Binding of God: Calvin’s Role in the Development of Covenant Theology* (Grand Rapids, MI: Baker Academic, 2001), 224, 225.

³⁴Peter A. Lillback, “The Continuing Conundrum,” 65. For God, however, the covenant had no conditions. That is, he vowed to keep his end of the covenant no matter what.

³⁵John Calvin, *Institutes of the Christian Religion*, ed. J. T. McNeill and trans. F. L. Battles, *Library of Christian Classics* 21 and 22 (Philadelphia, PA: The Westminster Press, 2006), IV.XIV.18, 1294. Bavinck also believes that the life of Adam and Eve bore the marks of a covenant before the Fall (Herman Bavinck, *Gereformeerde Dogmatiek II* [Kampen: Kok, 1928], 530). Furthermore, Spykman agrees with the link of sacrament and covenant before the Fall: “Already in the Garden [the covenant] was sacramentally sealed in the sign of that very special tree of life.” See Gordon J. Spykman, *Reformational Theology: A New Paradigm for Doing Dogmatics* (Grand Rapids, MI: Wm. B. Eerdmans Publishing, 1992), 265.

³⁶For a complete review of principles-based ethics and justification for its utility in bioethics, see Tom L. Beauchamp and James F. Childress, *Principles of Biomedical Ethics*, 5th ed. (Oxford: Oxford University Press, 2001), particularly pp. 397–408. As one point, the authors ask the reader whether the “heap of obligations and values unconnected by a first principle [that] comprises the common morality” can really be coherent (and thus justified) or is such coherence “more an article of faith than a demonstrable achievement?” (p. 407). Even the authors themselves sense the need for authority outside of common consensus about morality. A biblical covenant ethic can provide what they seek, and more.

³⁷Meredith Kline, quite rightly I think, suggests that the unity of covenant in Scripture be designated the Covenant of the Kingdom, while the Covenant of Creation be considered to refer to the covenant established at creation and maintained by the grace of God despite the Fall. The Covenant of Redemption refers to the new covenant in Christ, not as a replacement for, but rather as a fulfillment of, the Covenant of Creation as it was intended to be from the beginning. See Meredith Kline, *By Oath Consigned* (Grand Rapids, MI: Wm. B. Eerdmans Publishing, 1968), 36, 37.

³⁸Allen, *Love and Conflict*, 31–4.

³⁹*Ibid.*, 39, 40. Allen is not entirely internally consistent about the all-inclusiveness of this covenant. He speaks in another chapter about inclusive covenant as the whole of humanity created to live in covenant with God and one another. This suggests a less-inclusive covenant confined to human beings (see p. 132).

⁴⁰*Ibid.*, 40, 41. Spykman ties closely the covenant and the kingdom since God’s kingdom was covenanted into place at creation. Both covenant and kingdom reset the direction for childlike faithfulness and obedient servanthood, not only within the good orders of creation, but also within the structures of the fallen creature (see Spykman, *Reformational Theology*, 259).

⁴¹*Ibid.*, 44, 45.

⁴²*Ibid.*, 60–9, 71.

⁴³Ramsey was one of the most prolific and eclectic early Christian bioethicists. He borrowed extensively from several theological traditions, as his theme of covenant evolved into greater emphasis on community and law. See Paul Ramsey, *Basic Christian Ethics* (New York: Scribner’s, 1951), particularly p. 94 ff., and David H. Smith, “On Paul Ramsey: A Covenant-Centered Ethic for Medicine,” in *Theological Voices in Medical Ethics*, ed. Verhey and Lammers.

- ⁴⁴Robert M. Veatch, *A Theory of Medical Ethics* (New York: Basic Books, 1981), 125, 126.
- ⁴⁵Edmund D. Pellegrino and David C. Thomasma, *The Christian Virtues in Medical Practice* (Washington, DC: Georgetown University Press, 1996), 80, 105.
- ⁴⁶William F. May, *Testing the Medical Covenant*, 69, 70.
- ⁴⁷Hessel Bouma III, Douglas Diekema, Edward Langerak, Theodore Rottman, and Allen Verhey, *Christian Faith, Health, and Medical Practice* (Grand Rapids, MI: Wm. B. Eerdmans Publishing, 1989), 83–94. It should be mentioned that these authors seem to define “inclusive” differently from Allen and May. Bouma et al. speak of the inclusive covenant as Christians in covenant with God and with all of creation. Allen, in most of his writing, speaks of all living things within the inclusive covenant in that their value as God’s creatures is affirmed in such a concept (see Allen, *Love and Conflict*, 39). Like Bouma et al., May seems to refer to the mandate of the New Covenant to spread the message of Christ to all of humankind (see May, *Testing the Medical Covenant*, 53; May, *The Physician’s Covenant*, chap. 4).
- ⁴⁸Ibid, 84.
- ⁴⁹Ibid, 89–92.
- ⁵⁰Spykman, *Reformational Theology*, 359.
- ⁵¹Paul Ramsey, *The Patient as Person* (New Haven, CT: Yale University Press, 1970), xii, 2–7, 124.
- ⁵²Oliver O’Donovan speaks of the summary of the law in Matthew 22 as the ordering principle of Christian ethics in providing unifying order to the moral field and to the character of the moral subject. It provides interpretation of other principles and rules for moral actions. See his *Resurrection and the Moral Order* (Grand Rapids, MI: Wm. B. Eerdmans Publishing, 1994), 197–203; 226–44.
- ⁵³For more on these cultural differences and changes to these practices in recent years, see M. Costantini, G. Morasso, M. Montella et al., “Diagnosis and Prognosis Disclosure among Cancer Patients. Results from an Italian Mortality Follow-Back Survey,” *Annals of Oncology* 17 (2006): 853–9; James Hallenbeck and Robert Arnold, “A Request for Nondisclosure: Don’t Tell Mother,” *Journal of Clinical Oncology* 31 (2007): 5030–4; Kerry W. Bowman, “Cultural Pluralism in Health Care: A South African-Canadian Comparison,” *Annals of the Royal College of Physicians and Surgeons of Canada* 35 (2002): 114–6. It should also be noted, however, that some Christians believe that paternalism, withholding the full truth, and outright deceit may be justified in medical settings if motivated by a desire to help the afflicted achieve ultimate union with God. This position has been articulated by the Eastern Orthodox bioethicist H. Tristram Engelhardt Jr. in *The Foundations of Christian Bioethics* (Lisse: Swets and Zeitlinger, 2000).
- ⁵⁴Drew Christiansen, “Intergenerational Relations,” in *Duties to Others*, ed. Courtney S. Campbell and B. Andrew Lustig (Dordrecht: Kluwer Academic Publishers, 1994), 247–57.
- ⁵⁵Don S. Dizon, Jennifer S. Gass, Christina Bandera, Sherry Weitzen, and Melissa Clark, “Does One Person Provide It All? Primary Support and Advanced Care Planning for Women with Cancer,” *Journal of Clinical Oncology* 25 (2007): 1412–6.
- ⁵⁶May, *Testing the Medical Covenant*, 71.
- ⁵⁷Ibid, 72.
- ⁵⁸Job 2:11–13.
- ⁵⁹Romans 8:26b.
- ⁶⁰Richard M. Zaner, “Encountering the Other,” in *Duties to Others*, ed. Campbell and Lustig, 17–38, particularly 24, 25.

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Mary L. VandenBerg

Article

What General Revelation Does (and Does Not) Tell Us

Mary L. VandenBerg

The Reformed theological tradition tends to affirm scientific inquiry and often seeks to harmonize the discoveries of science with the biblical text. Much of what underlies the Reformed affirmation of science and the desire to harmonize the findings of science with the Bible is related to the theological understanding of the “two books” of revelation: nature and the Bible. Because God is the author of both books – the physical world and the Bible – so the argument goes, there can be no disagreement between them. Although one can appreciate the basic sentiment expressed by the assertion of agreement between the physical world and the Bible based on a common author, this assertion is fraught with problems. At a minimum, using the metaphor of the two books to advocate for a harmonization of the findings of science and the stories of the Bible with regard to the nature of the physical world represents a misunderstanding of the two-books metaphor as traditionally articulated and, therefore, a misappropriation of the theology of revelation to the task of harmonization.

Science and the Bible

For many people, the relationship between these two subjects is ambiguous at best, hostile at worst. Christians, especially those who affirm traditional notions about the reliability of the Bible, have waged war over this relationship. Battle lines are often drawn, fortresses built, and various forms of ammunition are lobbed back and forth. Since the Enlightenment, but especially since the publication of Charles Darwin’s *On the Origin of Species* (1859) and the explosion of scientific research and knowledge that has followed in its wake, Christians have increasingly moved in one of two directions.

On the one hand, there are Christians who reject the knowledge science pro-

vides, particularly in the areas of evolution and cosmology, and insist that the biblical accounts of creation and cosmology must be read in a woodenly literal fashion. They feel no need to harmonize the Bible and science because, for the most part, the scientific academy is wrong.¹ On the other hand, there are Christians who insist that what the Bible says about the origins of the universe does not, in fact, cannot, contradict what science has discovered.² In contrast to those in the first group, those in this group tend to affirm the discoveries of science while seeking to harmonize them in some way with the biblical text. The Reformed tradition, of which I am a part, tends to fall into line with the latter group, and it is this tradition I wish to examine.

Much of what underlies the Reformed affirmation of science and the desire to harmonize the findings of science with the Bible is related to the theological understanding of revelation.³ Reformed people are keen on speaking about

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revelation in terms of “two books.” General revelation, understood as the physical world or creation, is the first “book.” Special revelation, the Bible, is the second “book.” Because God is the author of both “books”—the physical world and the Bible—so the argument goes, there can be no disagreement between the two books. In other words, the findings of science *cannot* contradict the stories of the Bible.

Although one can appreciate the basic sentiment expressed by the assertion of agreement between the physical world and the Bible based on a common author, this assertion is fraught with problems. There are two main issues in this conversation, (1) how much concordance is there between what the Bible and science tell us about the nature of the physical world? and (2) how much concordance is there between what the Bible and science tell us about God?

This article will demonstrate that the theological concept of the two books of general and special revelation offers an answer to the second question but not to the first. Furthermore, using the metaphor of the two books to advocate for harmony between what the Bible and science tell us about the nature of the physical world represents a misunderstanding of the two books as traditionally articulated and, therefore, a misappropriation of the theology of revelation to the task of harmonization.

I will begin by giving some detail to the “two books” metaphor itself, including some historical perspective. I will then move to an explanation of the doctrine of revelation, especially as outlined in the Reformed tradition, paying special attention to John Calvin, from whom many derive the “two books” metaphor. Elucidating the doctrine of revelation as outlined by Calvin will demonstrate how the misunderstanding of this doctrine has led to its misappropriation with regard to resolving apparent conflicts between science and the Bible. I will conclude by offering some suggestions for moving forward in the ongoing discussions concerning the relationship between scientific findings and the Bible.

The Two Books and Science

As noted above, the “two books” metaphor for understanding the relationship between science and

the Bible has as its basic premise the idea that God has given human persons two sources of knowledge: nature and the Bible. These are sometimes referred to as “two books.” Furthermore, these two books cannot contradict one another.

Various scientists have grabbed hold of this metaphor as a way to defend a particular version of harmonizing the teachings of science with those of the Bible. Arthur McCalla offers a historical look at the notion of unified truth in the book of nature and in the book of the Bible. He traces the history of concordance between the two books to the tradition of natural theology.⁴ He offers Isaac Newton as an example of a seventeenth-century scientist whose belief in the fundamental unity of the two books drove his diverse research interests. For Newton, “whatever knowledge God has revealed in the (uncorrupted) Book of Scripture,” McCalla writes, “is harmonious with what he has inscribed in the Book of Nature.”⁵ McCalla also describes the work of seventeenth-century scientists Robert Hooke (perhaps best known for coining the term “cell” as the basic unit of life) and Dane Nicolaus Steno, regarding an explanation of the presence of fossils. McCalla notes that the explanation these men offered in no way upset their understanding of the Book of Nature as divinely inspired and in concordance with the other book, Scripture.⁶

Hooke ... read a providential intention into the function of fossils as signs of the history of the Earth. Steno similarly accepted that what we learn about nature both confirms and is confirmed by the Bible.⁷

The idea that the book of nature and the book of Scripture must agree with regard to what each teaches about the nature of the physical world was clearly present among certain prominent scientists well before the modern era.

The notion of agreement between the two books has continued into the more recent past. Creationists Henry J. Morris and John C. Whitcomb Jr. assert that the idea of two books is prevalent among Christians.⁸ They are adamant that the Bible leads people to accurate knowledge of the nature and operations of the physical world and that this knowledge cannot contradict the findings of science. They affirm that these two sources cannot be in conflict because both are modes of God’s revelation. They further suggest that when there is

Article

What General Revelation Does (and Does Not) Tell Us

an apparent contradiction between the two books, Scripture has the final answer. They write,

It has often been maintained that God has given us two revelations, one in nature and one in the Bible and that they cannot contradict each other. *This is certainly correct*; but when one subconsciously identifies with natural revelation his own interpretations of nature and then denounces theologians who are unwilling to mold Biblical revelation into conformity with his interpretation of nature, he is guilty of serious error. After all, special revelation supersedes natural revelation, for it is only by means of special revelation that we can interpret aright the world about us.⁹

For Morris and Whitcomb, it is clear that the findings of science and the teachings of Scripture must agree.

Perhaps the best contemporary assertion of the validity of the “two books” metaphor is in a recent popular book written by professors of astronomy and physics Deborah B. and Loren D. Haarsma. The Haarsmas are Christians who are keenly interested in helping their students understand and appreciate the relationship between sound scientific inquiry and the Christian faith. They clearly affirm the authority of Scripture while urging Christians to take the findings of science seriously. To that end, they offer the “two books” metaphor as a way to understand the intersection between the Bible and science.

The Haarsmas’ argument is linked with the Reformed doctrine of revelation. Appealing to the Belgic Confession, a sixteenth-century document subscribed to by many in the Reformed tradition, they explain that God has given people two “means” or “books” of revelation: nature and the Bible. Nature is known as God’s general revelation. The Bible is God’s special revelation. God is the author of both. They then explain, “Because God is the author of both revelations, we believe that nature and Scripture do not conflict with each other.”¹⁰ They continue, “God is not false or changeable, and we do not expect God to contradict himself by revealing something in nature that is contrary to Scripture.”¹¹

They admit that this “two books” metaphor is not perfect but is nonetheless useful for understanding the relationship between science and the Bible.¹²

They propose that the conflict people are confronted with lies not between nature and the Bible, for those two books cannot conflict as already explained. The conflict comes at the level of human interpretation. “Science,” they write, “is our human attempt to understand the natural world. Biblical interpretation is our human attempt to understand the Bible. Conflicts can arise, because our human understanding of one or both books may be in error.”¹³

It seems that there could be little dispute about human fallibility in attempting to interpret either of the books in question. Humans are finite. Our knowledge is always incomplete. The recognition that our knowledge is partial and our interpretations subject to error is, at least at some level, what drives our inquiry, scientific or biblical. Given this potential for error, it should be no surprise that our biblical interpretation of special revelation and our scientific interpretation of general revelation conflict at times. But is interpretation really the problem? The following section will offer an explanation of the theological term *revelation* and how the “two books” metaphor has functioned in the history of the church as a way to understand revelation.

The Two Books of Revelation

Revelation is the technical theological term that refers to how God makes himself known to humans. The Christian tradition has generally asserted that if finite humans are to have true knowledge of the infinite God, God must make himself known to them. In other words, God must reveal himself if humans are to know him and have fellowship with him.¹⁴

The metaphor of the two books, nature and the Bible, is directly tied to the doctrine of revelation, that is, the doctrine regarding how humans come to have knowledge of God. Article 2 of the Belgic Confession, which was quoted by the Haarsmas, is entitled “The Means by Which We Know God.” As already noted, the two means, according to Guido de Bres, the author of the Belgic Confession, are creation and the Bible. De Bres is probably following the thought of his teacher, sixteenth-century reformer John Calvin.¹⁵

Unlike de Bres, who speaks of two *means*, Calvin actually uses the language of two *books* in describing knowledge attained from nature and the Bible.

Calvin's writings are frequently referred to and quoted in support of this popular metaphor. What is often overlooked, however, is the fact that when Calvin is speaking about knowledge that we can gain from these two books, he, like de Bres, is specifically addressing the knowledge of God available in nature and in the Bible, not knowledge in general.

After a few preliminary observations, Calvin begins his discussion of knowledge of God by describing a general knowledge of God found in all people. He calls this general sense the "awareness of divinity."¹⁶ He writes, "God himself has implanted in all men a certain understanding of his divine majesty."¹⁷ In other words, all humans instinctually know that there is a higher being. However, apart from God's grace, he goes on to explain, humans will inevitably corrupt this natural awareness with the result that they will not end up with an accurate knowledge of God.¹⁸

Not only do all humans have this basic knowledge of God written on their hearts, but God has also revealed himself in the world in such a way that humans are without excuse for their ignorance of God. Calvin writes,

The final goal of the blessed life, moreover, rests in the knowledge of God. Lest anyone, then, be excluded from access to happiness, he not only sowed in men's minds that seed of religion of which we have spoken but revealed himself and daily discloses himself in the whole workmanship of the universe. As a consequence, men cannot open their eyes without being compelled to see him.¹⁹

Calvin is not doing something innovative here. He is simply following the teaching of Paul in Romans which states, "For since the creation of the world God's invisible qualities—his eternal power and divine nature—have been clearly seen, being understood from what has been made, so that people are without excuse" (Rom. 1:20, TNIV).²⁰ Commenting on Rom. 1:19, Calvin writes that when humans look at the visible world, they might, "by looking on so beautiful a picture, be led up to the Author himself."²¹ Calvin further describes the visible world as a kind of mirror in which humans can see God.²²

So where in the created order does Calvin think God reveals himself? Calvin explains that there are "innumerable proofs" in creation.²³ He points to the

"heavens and earth" generally, but also to the study of the creation as bearing witness to God. He writes,

There are innumerable evidences both in heaven and on earth that declare his wonderful wisdom; not only those more recondite matters for the closer observation of which astronomy, medicine, and all natural science are intended, but also those which thrust themselves upon the sight of even the most untutored and ignorant persons, so that they cannot open their eyes without being compelled to witness them.²⁴

For Calvin, the wonder of a baby nursing at its mother's breast is more eloquent than a preacher in declaring God's glory.²⁵ It is clear that Calvin thinks no one has any excuse for missing the evidence of God in creation. But it seems from his statement that he would think those engaged in the study of the physical world through the natural sciences have even more reason than "ignorant persons" to acknowledge the reality of "divine wisdom."

By "divine wisdom" Calvin does not mean divine revelation concerning the nature and properties of the physical world. Divine wisdom in creation refers to a recognition of the wisdom of God—his attributes—as displayed in the physical world. Despite human distortion of this display of wisdom, there is enough evidence of God that we should "break forth in admiration of the Artificer."²⁶ In other words, regardless of whether one is studying astronomy, medicine, physics, geology, or any other science, the knowledge one acquires about the physical world should lead to recognition of divine wisdom and praise for the Designer and his providential care of the world as observed in the intricacy, orderliness, and beauty of nature. The function or purpose of the book of nature—general revelation—is, therefore, to reveal knowledge of God.

There is a problem with the knowledge of God revealed in creation, however. Calvin asserts that although we have before us all this evidence of God, we are so blinded by sin that we do not read the evidence of God in creation accurately anymore. In fact, humans have in front of them, especially in their own bodies, the most eloquent witness to God. Nonetheless, they choose to suppress or distort this witness and blind themselves to it. Calvin explains,

How detestable, I ask you, is this madness: that man, finding God in his body and soul

Article

What General Revelation Does (and Does Not) Tell Us

a hundred times, on this very pretense of excellence denies that there is a God? ... They set God aside, while using "nature," which for them is the artificer of all things, as a cloak.²⁷

Once again, Calvin is merely following the teaching of Paul in Romans.

For although they knew God, they neither glorified him as God nor gave thanks to him, but their thinking became futile and their foolish hearts were darkened. Although they claimed to be wise, they became fools and exchanged the glory of the immortal God for images made to look like mortal human beings and birds and animals and reptiles. (Rom. 1:21–23, TNIV)

The problem with general revelation, therefore, is not that we interpret the data incorrectly with regard to any particular scientific subject we are studying, although that might be the case at times. The problem is that we miss or distort the author of the data, God.

In light of this problem, sometimes referred to as the noetic effect of the Fall, Calvin tells his readers that God has graciously given his people a way to "read" creation correctly: the Bible. Calvin even compares the Bible to spectacles:

Just as old or bleary-eyed men and those with weak vision, if you thrust before them a most beautiful volume, even if they recognize it to be some sort of writing, yet can scarcely construe two words, but with the aid of spectacles will begin to read distinctly; so Scripture, gathering up the otherwise confused knowledge of God in our minds, having dispersed our dullness, clearly shows us the true God.²⁸

In other words, once our vision has been corrected by the witness of the Bible, the second book, we will clearly see that the author of the beautiful book of nature is none other than God.

One must remember at this point that Calvin is not suggesting that what science discovers regarding the laws and processes of the physical world must, in some way, be read through the lens of Scripture in order to interpret the data of the physical world and its operation correctly. For example, Genesis 1 suggests to some that the world and everything in it came into being in six, twenty-four-hour days about 6,000 years ago. Geologic evidence, by contrast, suggests that the earth is billions of years old and the various life forms came into being

through a process of development and change. Calvin's teaching about the two books of revelation in no way suggests that the geologic evidence must somehow be pounded into the model presented in Genesis 1 in order to "read" it correctly.²⁹ Calvin is not concerned with knowledge of the physical world at all, except for how that knowledge points one to God. He makes this point in the preface to his commentary on Genesis, "The intention of Moses, in beginning his Book with the creation of the world, is, to render God, as it were, visible to us in his works."³⁰ In other words, the "two books" metaphor drawn from this section of the *Institutes* is not concerned in the least about the conflicts between scientific or naturalistic accounts of creation and biblical accounts of creation with regard to how those accounts explain processes of the physical world. The two books are simply two means by which humans come to know God, with Scripture providing the corrective lenses needed to see clearly the glory of God which is revealed in nature.

To summarize, Calvin's own description of the relationship between the two books is significantly different from how this metaphor has often been employed by those attempting to reconcile the findings of science with the Bible, whether a century later by Newton and Hooke, or in more contemporary debates by people like Morris and Whitcomb. Even the Haarsmas' scheme, which suggests harmony at the level of the two books themselves and conflict at the level of interpretation, misunderstands the basic premise of Calvin's argument, because the Haarsmas are addressing the problem of conflict between the interpretations of science and the Bible with regard to the physical properties and operations of the world.³¹ Errors of interpretation would only be a problem from Calvin's point of view insofar as those errors corrupt knowledge of God, not insofar as they lead to a lack of harmony between the Bible's description of the physical world and that of modern science.³² In other words, when we read the book of nature apart from the corrective lenses of Scripture, it is not that our scientific findings will necessarily go awry. Rather, the knowledge of God that can be obtained from the physical world will be corrupted. The harmony of the two books lies in the fact that both books will offer the reader knowledge of the author, God—enough knowledge, in fact, to leave one without excuse for turning away from God.

One scientist who recognizes this historical connection of the “two books” metaphor with the doctrine of revelation is geologist Davis Young. Like the Haarsmas, he begins by referencing Article 2 of the Belgic Confession, explaining that this article “expresses the view that there are two complementary sources of divine revelation: God’s written book, the Bible, and God’s unwritten book, Creation.”³³ He explains that those who hold this view think that since the Bible and creation both come from God, they “must be in perfect harmony.”³⁴ Interestingly, Young footnotes this statement with an explanation of the fact that the “two books” referred to in the Belgic Confession are concerned not with information about the created world, but have specific reference to revelation about God.³⁵ He writes,

Christians have typically understood “general revelation” as having to do with science. Again, however, the idea is not that *data* are divinely revealed but that *God* is revealed through the created order.³⁶

However, he ends this helpful footnote with the following statement:

Nonetheless, in spite of these qualifications, we are persuaded that both Creation and the Bible are from the same living God and that underlying them both is a fundamental unity that is grounded in God himself.³⁷

It is unclear to me exactly what Young is asserting here, but, at the very least, he seems to be saying that since both “books” are God’s books, we should expect some amount of harmonization between them with regard to the physical world, not just knowledge of God.

Young’s assertion, however, leaps from the category of “author” to the category of “content.” Certainly there is fundamental unity from the standpoint that God is the author of both books in the same way that Madeleine L’Engle is the author of *The Crosswicks Journal* and *A Wrinkle in Time*. In other words, one could ask, “What do the two books share in common?” The answer is, “The author.” The question is whether the same author entails the same or even similar content. That is much less clear.

While having the same author may imply identical or similar content, it does not entail it, and,

I think, that is nothing against the author. To employ the example of Madeleine L’Engle again, the two books mentioned share very little in common. One is a personal journal aimed at adult readers, recounting personal experiences and reflections on those experiences. The other is a fictional story aimed at young children. While there might be similarity between the two books as far as the style of writing, use of language, and so forth are concerned—features that might point one toward a single author—the genre and, presumably, even the purpose of the two books are different. In the case of the Bible and creation, there may be, as with L’Engle, similarity in content insofar as that content points one toward the author. In fact, that is what both Calvin and the bulk of the Christian tradition would assert through their use of the “two books” metaphor. Additionally, the doctrine of revelation suggests that there is also similarity in purpose between the Bible and creation: revealing knowledge of God. But there is no reason to believe that the similarity goes any further than that.

Perhaps Young is drawing on the established Christian tradition of *analogia entis*, the analogy of being. The *analogia entis* is, according to Richard Muller,

the assumption of an *analogia*, or likeness, between finite and infinite being which lies as the basis of the *a posteriori* proofs of the existence of God and at the heart of the discussion of the *attributa divina* [divine attributes].³⁸

Like the two books, however, the tradition of *analogia entis* is concerned with likeness between God and the world—in particular, human beings, although it may concern creation more generally. With respect to humans, the argument states that because human beings are made in the image and likeness of God, certain human attributes can be predicated of God, particularly what became known in many Reformed circles as the communicable attributes.³⁹ If one extends this to creation as a whole, the *analogia entis* would suggest that certain aspects of creation could also be predicated of God. For example, if creation is essentially characterized by order, one could suggest that God is a God of order, not chaos. *Analogia entis*, however, functions in the same way as the two books. It leads one to some sort of general knowledge of God, knowledge that would not contradict but will be enlightened by any knowledge gained

Article

What General Revelation Does (and Does Not) Tell Us

from the Bible. Thus, the unity of knowledge between creation and the Bible as explained via an understanding of the *analogia entis* is still a unity regarding knowledge of God, not a unity regarding knowledge of the physical operation and structure of the world.

Suggestions for Moving Forward

The critique of using the “two books” metaphor as justification for harmonizing the findings of science with the stories of Scripture leaves us with the question of where we should go from here. This article began by noting two main issues. The first issue mentioned was how much concordance there is between what the Bible and science tell us about the nature and operations of the physical world. The second issue, and the focus of this article, was how much concordance there might be between what the Bible and science tell us about God. With both questions, interpretation of the data or story has a role to play. This article has tried to explain that the “two books” metaphor relates to the second issue—that of revelation—and, that because in both books God is revealing himself to humans, we could expect a fairly high degree of harmony between how the Bible and the findings of science point us toward God.

The first issue, however, is considerably more complex and moves well beyond the scope of this article, except for the fact that the metaphor of the two books of revelation, as understood in the broad Christian tradition and explained by Calvin, offers no basis for advocating concordance between the findings of science and the information about creation found in the various types of literature of the Bible. Nonetheless, it seems that some level of reconciliation between the findings of science and Scripture would, at the very least, be existentially helpful.⁴⁰

For Christians who affirm a high view of the inspiration of Scripture, the findings of science can cause great angst when read alongside certain biblical accounts of the natural world.⁴¹ Rather than reading with interest the marvels of creation that science continues to uncover and praising the imaginative God who is behind all of this wonder, some Christians seem to prefer to ignore the findings of science, or even deny them, out of fear that these findings could, in some way, undermine the majesty of God.⁴² Helping people see that many of the

apparent conflicts between science and the Bible are simply *apparent* conflicts could help lower the anxiety of persons worried about offending God.⁴³

A helpful starting point for this project would be to recognize that the primary purpose of theology and the primary purpose of the physical sciences are not identical. Theology, as the word itself suggests, is the study of God. More specifically, the object of theological study is God as he has revealed himself.⁴⁴ Theologians should remember this primary purpose of theology as they exegete texts that seem to conflict with the findings of science. They should neither be too eager to reinterpret the Bible in order to make sense of the latest scientific data, nor too eager to disregard the findings of science in order to make sense of certain biblical texts. Rather, they should read with excitement the latest results of scientific inquiry. As Scott Hoezee writes, “Christians, of all people, can take proper, holy joy in such things, giving glory to God for a universe so wondrous and endlessly surprising.”⁴⁵

On the other side of the coin, astronomer Howard Van Til explains that nonphysical things are not the object of study for the natural sciences. Science, as Van Til points out, is the study of the physical world, “no more, no less.”⁴⁶ Scientists, therefore, should not be overly anxious to reinterpret various biblical texts, the purpose of which is to offer humans saving knowledge of God, in an effort to harmonize the Bible with the findings of science.⁴⁷ Rather, regardless of whether their findings regarding the nature of the physical world agree with the various accounts in the Bible, those findings, in addition to the obvious ways they enhance the world, should also have the theological purpose of pointing us to the Creator. The result of all our endeavors should be that we join with the ancient psalmist (maybe an amateur astronomer??) who gazed at the starry skies and with wonder declared, “O LORD, our Lord, how majestic is your name in all the earth!” (Ps. 8:1, 9). In that way, the work of the scientist, the work of the theologian, and the work of any other vocation is identical: to bring glory to God. ☉

Notes

¹Many in this camp, however, while rejecting secular science, have set up an alternative often referred to as “Creation Science.” Although I am referring specifically to how Christians deal with science and the Bible, many

secular scientists also fall into the category that rejects any harmonization but for a completely opposite reason: the Bible is wrong with regard to anything it has to say about operations of the physical world.

²¹I recognize that this two-fold division may not be entirely accurate. There may be those who do not fall into either camp on all issues in the debate between science and the Bible. Nonetheless, I believe that these two generalizations fairly characterize the debate as it tends to play out in Christian circles.

³It might be helpful at this point to define what is meant by *science*. In the most general sense, *science* simply means *knowledge*. Thus, theology is also a science. Aquinas even calls theology the “queen of the sciences” because it deals with things that “transcend human reason” (*Summa Theologica*, Prima pars, Q. 1, Art. 5). Nonetheless, for the sake of clarity, I am going to use the word *science* to refer specifically to those disciplines that specialize in study of the natural world.

⁴Arthur McCalla, *The Creationist Debate: The Encounter between the Bible and the Historical Mind* (London: T&T Clark, 2006), 2.

⁵*Ibid.*, 13.

⁶*Ibid.*, 20.

⁷*Ibid.*

⁸Henry M. Morris and John C. Whitcomb Jr., *The Genesis Flood: The Biblical Record and Its Scientific Implications* (Grand Rapids, MI: Baker Books, 1962), 458.

⁹Morris and Whitcomb, *The Genesis Flood*, emphasis mine, 458, n. 1.

¹⁰Deborah B. and Loren D. Haarsma, *Origins: A Reformed Look at Creation, Design, and Evolution* (Grand Rapids, MI: Faith Alive, 2007), 58.

¹¹*Ibid.*, 58.

¹²*Ibid.*, 59.

¹³*Ibid.*

¹⁴Millard Erickson, *Christian Theology* (Grand Rapids, MI: Baker Academic, 1983), 153.

¹⁵P. Y. DeJong, *The Church's Witness to the World* (Pella, IA: Pella Publishing, 1960), 26–8.

¹⁶John Calvin, *Institutes of the Christian Religion*, ed. John T. McNeill, trans. Ford Lewis Battles (Philadelphia, PA: Westminster Press, 1960), 1.3.1.

¹⁷*Ibid.*

¹⁸Calvin, *Institutes*, 1.4.1.

¹⁹Calvin, *Institutes*, 1.5.1.

²⁰It may also be helpful to note that Calvin is not innovative with regard to the general Christian tradition up to his time either. The metaphor of nature as a book goes back at least as far as Augustine. The general understanding in the western tradition is that the book of nature is a means of revealing God to humans. For a brief, but well-written history of the metaphor of nature as a book which reveals God, see Giuseppe Tanzella-Nitti, “The Two Books Prior to the Scientific Revolution,” *Perspectives on Science and the Christian Faith* 57, no. 3 (2005): 235–45. This in no way suggests that the work of science to discover more about the workings of the physical world is unimportant. Calvin himself in his comments on the human body writes with admiration about the skill of Galen in elucidating the genius of the Creator. I merely want to point out that the term “revelation” with which the so-called book of nature

in the tradition is concerned, refers to knowledge of God that is available in nature to all people. How adequate nature is for providing true knowledge of God is a debatable point within the tradition, even into the twentieth century.

²¹John Calvin, *Commentaries on the Epistle of Paul to the Romans*, trans. and ed. John Owen (Grand Rapids, MI: Eerdmans, 1948), 70.

²²Calvin, *Institutes*, 1.5.1; see also Calvin, *Commentaries on the Epistle of Paul to the Romans*, 70.

²³Calvin, *Institutes*, 1.5.2.

²⁴*Ibid.*

²⁵Calvin, *Institutes*, 1.5.3; Calvin, *Commentary on the Book of Psalms*, trans. James Anderson (Grand Rapids, MI: Eerdmans, 1948), 95–7.

²⁶Calvin, *Institutes*, 1.5.2.

²⁷*Ibid.*, 1.5.4.

²⁸*Ibid.*, 1.6.1.

²⁹It should likewise be noted that his teaching also does not suggest that the Bible’s account be hammered into that of science. Neither scenario is suggested by what Calvin is explaining.

³⁰John Calvin, *Commentaries on the First Book of Moses Called Genesis*, trans. John King (Grand Rapids, MI: Eerdmans, 1948), 58.

³¹Because the Haarsmas’ book is written for lay persons, it lacks a certain amount of detail that might be helpful for clarifying their argument. It was not entirely clear, e.g., that their statement regarding the lack of conflict between nature and the Bible was referring only to the nature and operations of the physical world. Perhaps they had knowledge of God in mind here, too (p. 58). Their general use of the term *revelation* throughout their book, however, seemed frequently to refer, not only to knowledge of God available in the natural world, but to knowledge of the operations of the physical world itself. For example, the age of the earth arguments presented in chapter 5 are discussing differences between interpretation of what God has *revealed* in the biblical text regarding the age of the earth, and what God has *revealed* via scientific data regarding the age of the earth. This is a category mistake, however. What God “reveals” in both the Bible and nature, even interpreted through the findings of science, is himself. See especially the introduction to chapter 5, pages 80–1.

³²This assumes that one can misinterpret the data of science and still recognize the sort of general knowledge of God one obtains from creation. If knowledge of God from general revelation depended on accurate scientific data, the knowledge provided during Calvin’s own time to which he refers would not have had the potential to point people to God. As with biblical exegesis, however, some errors can lead to a badly distorted view of God that in no way coincides with an orthodox understanding of God as defined by the Christian tradition. For example, those who suggest that God created the world with apparent age (i.e., the world only “appears” to be billions of years old), run the risk of making God look like a deceiver who is trying to fool the very people with whom he desires to be in relationship, a view that contradicts a good, loving, and just God affirmed by the Christian church. Perhaps this is where the “spectacles” of Scripture as a whole could offer some correction to this god of our own making.

Article

What General Revelation Does (and Does Not) Tell Us

³³Davis A. Young, "Where Are We? Perceived Tensions between Biblical and Scientific Cosmogonies," in *Portraits of Creation: Biblical and Scientific Perspectives on the World's Formation* (Grand Rapids, MI: Eerdmans, 1990), 4.

³⁴*Ibid.*, 4.

³⁵*Ibid.*, 4, n.6.

³⁶*Ibid.*, 5, n.6.

³⁷*Ibid.*

³⁸Richard Muller, *Dictionary of Latin and Greek Theological Terms* (Grand Rapids, MI: Baker Books, 1985), 32–3.

³⁹Herman Bavinck, *God and Creation*, vol. 2 of *Reformed Dogmatics*, ed. John Bolt, trans. John Vriend (Grand Rapids, MI: Baker Academic, 2004), 131.

⁴⁰I say "at the very least" because I do not mean in any way to suggest that there are not other, very compelling reasons one might want to engage in this project. I merely want to offer one very basic reason why this project might be important.

⁴¹The issues that seem to raise the most difficulty are those dealing with cosmology and the origins of the earth, and much of this is the result of insisting the Bible be read as a science text, rather than as a text that, first and foremost, tells us about God and his salvific work for all of creation. In fact, it is interesting that sometimes the same people who have difficulty with issues concerning the age of the earth seem to have little difficulty with biblical statements regarding the movement of heavenly bodies, such as those that refer to the sun rising and setting.

⁴²This could, in part, be the fault of scientists who too often present their findings in a way that is either inaccessible to those who are untrained, or boring, or both. Christian scientists may want to take up the challenge of presenting

their findings in a way that could inspire awe, not of science, but of the God to whom all scientific endeavors should point.

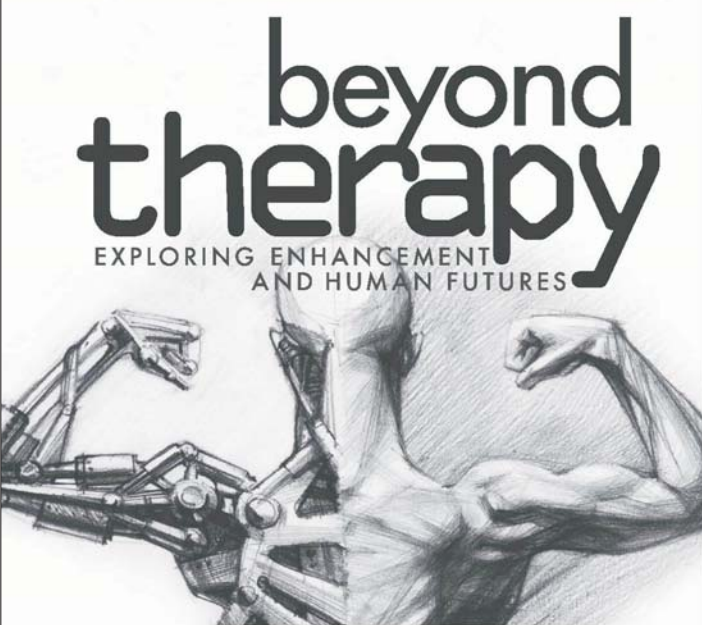
⁴³The Haarsmas' book, aside from my critique of their use of the two books metaphor, makes great strides in this direction. They also offer excellent insights for helping Christians understand the part that worldview plays in shaping how Christians approach science. This Reformed perspective has great potential for better dialog and less conflict between the broad Christian community and the scientific community.

⁴⁴Herman Bavinck, *Prolegomena*, vol. 1 of *Reformed Dogmatics*, ed. John Bolt, trans. John Vriend (Grand Rapids, MI: Baker Academic, 2003), 34–8; Erickson, *Christian Theology*, 21–2; Louis Berkhof, *Systematic Theology* (Grand Rapids, MI: Eerdmans, 1938), 39–44; Donald G. Bloesch, *God the Almighty: Power, Wisdom, Holiness, Love* (Downer's Grove, IL: InterVarsity Press, 1995), 27–30.

⁴⁵Scott E. Hoezee, *Proclaim the Wonder: Engaging Science on Sunday* (Grand Rapids, MI: Baker, 2003), 69.

⁴⁶Howard J. Van Til, "The Character of Contemporary Natural Science," in *Portraits of Creation*, 127.

⁴⁷Even if everyone could agree on a particular exegetical method, the difficulty involved in dealing with ancient texts, including identification of genre, context, pericope, audience, and so forth, would likely still lead to some disagreement with regard to the conclusion of any given text under consideration. Genesis 1 is a good example. Regardless of everything else involved in interpreting this particular text, there is continued disagreement about the seemingly simple issue of the genre of this important text.



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Michael N. Keas

Darwinism, Fundamentalism, and R. A. Torrey

Michael N. Keas

R. A. Torrey (1856–1928), a leading world evangelist at the turn of the twentieth century, played a prominent role in the emergence of fundamentalism, which aimed to defend Christianity against liberalism. The writers of The Fundamentals (1910–1915), including Torrey, proposed harmony between science and Christianity by accepting the standard geological ages and by offering some criticisms of Darwinism. Torrey advanced the work of The Fundamentals beyond 1915 through the monthly periodical of the Bible Institute of Los Angeles, The King's Business (1910–1970). Although Torrey offered occasional criticism of Darwinism in The King's Business and his other publications, he urged evangelicals and fundamentalists to focus on biblical inerrancy and a repudiation of naturalism more broadly. There is much to be emulated from early fundamentalism before it flung itself into the humiliation of the 1925 Scopes trial – a disastrous move that Torrey did not support. R. A. Torrey is worth remembering in 2010, the centennial year of The Fundamentals.

Historical and philosophical analysis of science and religion can improve our understanding of how science and religion *have* related and how they *should* relate. On the last page of his insightful book about American fundamentalism, historian George Marsden wrote,

Since God's work appears to us in historical circumstances where imperfect humans are major agents, the actions of the Holy Spirit in the church are always intertwined with culturally conditioned factors.¹

Following Marsden, I shall analyze some of the “culturally conditioned factors” of science and fundamentalism in the early twentieth century (how science and religion *have* related), largely leaving the matter of how they *should* relate to another study. Even so, historical knowledge can inform philosophical inquiry.

The Bible Institute of Los Angeles (hereafter, Biola) played a prominent role in the emergence of fundamentalism in the early twentieth century, particularly through the work of R. A. Torrey – Biola's dean from 1912 to 1924. If the twenty-first-century reader can look beyond the harmful connotations of the term fundamentalism today and recognize its beneficial features before the 1925 Scopes trial, such reflection might inspire a better relationship between science and Christianity. Presbyterian

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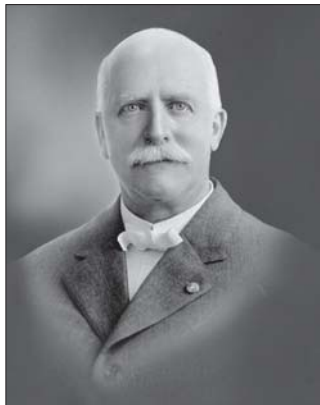
Article

Darwinism, Fundamentalism, and R. A. Torrey

millionaire Lyman Stewart (1840–1923) funded some important early steps of the fundamentalist renewal of evangelical Christianity, including founding Biola (1908)² and its monthly periodical *The King's Business* (1910), financing a series of pamphlets called *The Fundamentals* (1910–1915), and hiring Torrey to take up the editorial torch of these publications while serving as Biola's dean. To better understand early fundamentalism and its relationship to Darwinism, we will focus on the life of Torrey.³

Evangelicalism's Scholarly Revivalist: Reuben Archer Torrey (1856–1928)

R. A. Torrey embodied the scholar-evangelist ideal of evangelical Christianity, though to a lesser degree than the principal American founding father of evangelicalism, Jonathan Edwards (1703–1758).⁴



Reuben Archer Torrey (1856–1928). Courtesy of Biola University Archives.

Torrey's first two years at Yale College (where Edwards had also attended) were devoted to the classical liberal arts. Yale juniors studied physics, astronomy, German or French, in addition to continuing their earlier work in mathematics, rhetoric, logic, Greek, and Latin. The eighteen or so required courses of Torrey's senior year included chemistry, geology, anatomy, and physiology (four brief courses), as well as courses with Yale's conservative evangelical president Noah Porter (1811–1892). The studies under Porter consisted of Christian apologetics, natural theology, and three philosophy courses.⁵ Torrey graduated in 1875 with a general BA degree.

Around the time Torrey began his studies at Yale in 1871, the daily chapel services were reportedly dreary and disliked by students. Compulsory chapel attendance at the Sunday afternoon service was lifted in 1872. "The intent was not to undermine the chapel, but to aid in its appeal. For the next seven years, the College President [Noah Porter] and various tutors filled the pulpit."⁶ An Englishman visiting Yale in 1869 reported,

All the students are compelled to attend the daily morning service, which takes place at eight AM. The chapel is a frightful building fitted up in the coldest and meanest meeting-house style ... But cold and mean as is the chapel, the service is colder and meaner still. Any more heart-chilling and profane performance could scarcely be imagined. The students, on entering, either commenced a conversation with their friends, or applied themselves, with great diligence, to the subject-matter of the lectures which were to follow after the service. In no instance did any one engage in private prayer ... The air of utter carelessness and irreverence, which was universal, was chilling to witness. If the congregation had disbelieved in the existence of God, it could not have been worse. Such being the spiritual food which Puritanism has to offer to her sons in her own chosen home, who can wonder at the unbelief and unbounded immorality which is making New England a byword even in the United States?⁷

Although Porter worked hard to bolster Christianity at Yale after he became president in 1871, some of this depressing report probably describes what Torrey experienced in his years as a rowdy Yale undergraduate (1871–1875). In one of his published sermons, Torrey describes his Yale undergraduate experience, beginning "as a boy of fifteen," as a descent "into dissipation and sin," until

... one awful night [in the senior year], a mere boy still, with all hope gone, with life desolate and bare, life so barren that there was just one step between me and hell, in fact, that very night I started to take that awful step, to take my life by my own hand. I sprang out of bed and drew open a drawer to take out the instrument that would end my life. For some reason or other I could not find it. God did not let me find it, and I dropped upon my knees, and said, "Oh God, if you will take this awful burden from my heart, I will preach the Gospel"; and God not only removed the burden, I found a joy I had never dreamed of in this world, and all the years since it has gone on increasing, with the exception of a short time when I fell under the blighting power of scepticism and agnosticism; all the rest of the time all these years the joy has grown brighter, brighter, brighter every year.⁸

Porter, a pivotal figure in the history of American higher education,⁹ played an important role in the formation of Torrey's worldview. Torrey likely heard President Porter's inaugural address, which he delivered in the fall of 1871, when Torrey was a freshman. In this address, the new college president argued that Christians do not need to fear modern science, which, at its best, is committed to an open inquiry that leads to truth.¹⁰ Porter on other occasions warned of the "atheistic tendencies of much of modern science, literature, and culture." He included here a caution about the "ill-disguised materialism of Huxley" and the "evolutionism of Herbert Spencer, with its demonstrated impossibility of a positive theism."¹¹ Indeed, George Marsden tells a compelling story of *The Soul of the American University: From Protestant Establishment to Established Nonbelief* (Oxford University Press, 1994), in which Porter is one of the most important characters—attempting to protect American education from the universal acid of materialism. We hear echoes of President Porter in Torrey's work.

Torrey returned to Yale in 1875 for three years of seminary education. During his final year at Yale, Torrey attended D. L. Moody's (1837–1899) campus and New Haven community revival meetings. He also volunteered for six weeks in Moody's "inquiry room," leading many people to Jesus.¹² Moody, the most influential revivalist of the late nineteenth century, had become one of Porter's strongest allies in the cause of distinctively Christian education in the face of attacks from liberal theology and scientific materialism. This was an about-face for Porter, who mid-century had uncritically assumed that higher education would inevitably advance Christianity, and who had downplayed the importance of campus-sponsored revivals.¹³

Porter's most controversial decision as a college president, which took place shortly after Torrey had graduated with his seminary degree in 1878, was to forbid Yale professor William Graham Sumner to adopt Herbert Spencer's textbook *The Study of Sociology*, especially because of this assessment of Spencer's book by Porter:

And so he ends this long discussion with the assumption with which he begins, that in social phenomena we can only recognize natural causation, because forsooth, if Sociology is a science it cannot admit any other agencies.¹⁴

Porter recognized that such methodological naturalism would distort the findings of sociology, because it would preclude the detection of divine agency in human affairs. Torrey demonstrated similar insight in his later work.

After four years of pastoral work in Ohio punctuated by occasional revivals, Torrey (accompanied by his wife Clara and infant daughter Edith) studied theology in Leipzig and Erlangen. Most of Torrey's German professors believed that the original manuscripts of the Bible contained errors—a view Torrey rejected at the end of his year in Germany.¹⁵

Torrey, whose sermons reflected a substantial Yale education and the influence of Moody, became one of the most influential evangelicals near the turn of the twentieth century. After returning from Germany and serving as pastor at several churches in Minneapolis, Torrey, in 1889, accepted Moody's invitation to become the first superintendent of the new Bible Institute of Chicago (later named Moody Bible Institute, hereafter, MBI). George Marsden has identified MBI as the leading Bible institute among the nearly dozen that had originated by 1910, particularly because of the leadership of Moody and Torrey.¹⁶ Torrey worked under the uneducated (but gifted) Moody to create an exemplary Bible institute curriculum for common people to achieve biblical literacy and lay ministry skills—much of which Torrey later adapted for Biola. Marsden has concluded that early twentieth-century Bible institutes like MBI and Biola were at the leading edge of



The Bible Institute of Los Angeles (BIOLA) was housed in Los Angeles' tallest building when it was complete enough for students to occupy it in 1914.¹⁷ This historic building was demolished in 1988.¹⁸ Courtesy of Biola University Archives.

Article

Darwinism, Fundamentalism, and R. A. Torrey

a middle position among evangelicals in regard to the relationship between Christianity and culture. They advocated both revivalism centered on the message of the cross and social reform through urban ministry. "They should see in the cities not only their sin, but also their suffering, and attempt to eliminate both," according to Marsden's distillation of their rallying cry.¹⁹ Although such a balanced perspective represented the typical evangelical orientation in the nineteenth century,²⁰ it had become increasingly rare after 1910. Liberals turned to the social gospel (including eugenics and its forced sterilization of the "feeble-minded")²¹ and conservative evangelicals paid little attention to the material needs of the poor.

As a leader within the balanced, historic evangelical tradition, Torrey spent most of his time at MBI developing and delivering curriculum for lay people to receive theological training, sometimes with attention to the methodological similarities between theology and science. He published his notes for a MBI (and later Biola) doctrine class in the 1898 textbook *What the Bible Teaches*. The preface explains that, in this book, "the methods of modern science are applied to Bible study—thorough analysis followed by careful synthesis." His textbook was "an attempt at a careful, unbiased, systematic, thorough-going, *inductive* study and statement of Bible truth."²² Such a vision of the methodological similarities of theology and science, with an emphasis on a shared Baconian ideal of inductive inquiry, has been common among evangelicals over the past few centuries.²³

Torrey's characterization of the scientific method was similar to what Nobel Prize winner Robert Millikan (1868–1953) would write in 1923: "The purpose of science is to develop without prejudice or preconception of any kind a knowledge of the facts, the laws, and the processes of nature."²⁴ Nevertheless, Torrey and Millikan saw religion quite differently. In the next sentence of the same pamphlet published by the University of Chicago Divinity School, Millikan wrote: "The even more important task of religion, on the other hand, is to develop the consciences, the ideals, and the aspirations of mankind." Torrey was a critical realist in religious²⁵ (and scientific) matters, while Millikan—following the spirit of modernism—reduced religion to the culturally constructed yearnings of humanity. Historian Edward Davis has investigated this liberal

American way of reconciling science and religion in the 1920s. He has focused on the widely circulated series of Chicago pamphlets, including Millikan's, which abandoned historic Christianity in the name of modernization.²⁶ Torrey, while defending Christianity, recognized common methodological ground between science and theology—provided that one rejects the naturalistic philosophy (miracle prohibition) assumed by many scientists and theological practitioners of higher criticism.²⁷

While actual scientific practice contains more diverse methodological practices than either Torrey or Millikan articulated, they both recognized the ideal of objectivity that has inspired many scientists. Philosophers and historians of science since the 1950s have made it implausible to believe in a unique "scientific method" that almost always leads us closer to the truth. But, there is still reason to believe that we know much more about nature now than in the past. Most scientists are critical realists like Millikan (and Torrey), and actual scientific work reflects a variety of methodological orientations—most notably hypothetico-deductive approaches and the inductive procedure of "inference to the best explanation" (comparative explanatory and predictive power).²⁸

Fundamentalist statements about scientific method were not that much different from what leading scientists like Millikan were expressing. Thus, we must rethink George Marsden's often-repeated argument that twentieth-century fundamentalists were methodologically inferior relative to the scientists of their day, in that they invoked a naive Baconian-inductivist characterization of science.²⁹ A scientific argument should be evaluated evidentially, regardless of the methodological characterization offered by the argument's proponent. Even so, a brief survey of prominent early twentieth-century statements about scientific methodology is instructive.

F. R. Moulton, known for coauthoring with geologist Thomas C. Chamberlin a "planetesimal" mechanism for the origin of our solar system that temporarily replaced Laplace's nebular hypothesis, declared that astronomy "is a science" because "the facts which have been acquired by observations and experiments are classified on the basis of their essential relations to each other and to the facts and principles of other sciences."³⁰ This resembles

Torrey's factual "analysis" followed by "synthesis." Moulton offered this characterization of scientific procedure in his 1906 astronomy textbook, which passed through several editions in the first quarter of the twentieth century. Moulton later summarized the triumph and methods of science in his lead essay of the general science textbook of 1926, which he coauthored with fifteen other University of Chicago science faculty. Moulton stated,

Within a few decades the world has been revolutionized by science and its applications. The successes of science invite attention to its methods. That science depends upon observations and experiments is known to everyone, but those who have not been engaged in its pursuit cannot fully realize the scrupulous care with which observations and experiments are made, the faithfulness with which they are recorded, the variety of conditions under which they are repeated, and the caution with which conclusions are drawn from them. Science does not bow down before precedent nor custom nor dogma; it exalts the truth and honestly seeks it. The fact that scientific theories have often been altered justifies no reproach to science, for they are simply the most coherent organizations of its data that are possible at a given time. The fact that changes are necessary means that knowledge has been increased. New discoveries do not contradict earlier truth, but include it as a special case, or as an imperfect statement of some larger truth.³¹

What were leading philosophers saying about the methods of science in the time of Torrey? The English economist and logician William Stanley Jevons (1835–1882) authored an influential assessment of scientific method that appeared in two editions and numerous reprints from 1874 (when Torrey was an undergraduate at Yale) to 1920. He wrote,

In a certain sense all knowledge is inductive. We can only learn the laws and relations of things in nature by observing those things. But the knowledge gained from the senses is knowledge only of particular facts, and we require some process of reasoning by which we may collect out of the facts the laws obeyed by them. Experience gives us the materials of knowledge: induction digests those materials, and yields us general knowledge.³²

Philosopher Bertrand Russell (1872–1970) voiced an amusingly simplistic depiction of induction as the essence of scientific method in 1931:

The conflict between Galileo and the Inquisition is not merely the conflict between free thought and bigotry or between science and religion; it is a conflict between the spirit of induction and the spirit of deduction. Those who believe in deduction as the method of arriving at knowledge are compelled to find their premises somewhere, usually in a sacred book. Deduction from inspired books is the method of arriving at truth employed by jurists, Christians, Mohammedans, and Communists.³³

Russell's viewpoint—including his faulty warfare view of science and religion—has influenced more recent science education. For example, Eric Rogers approvingly quotes Russell's naive methodological pronouncement in *Physics for the Inquiring Mind*, which was a physics textbook that emerged from a 1950s course at Princeton University.³⁴ Roger's work as a science educator was celebrated soon after his death in 1990, in a memorial publication.³⁵

R. A. Torrey: The Harmony of Science and Christianity in the Tradition of James Dwight Dana

If Torrey's characterization of scientific method shared much in common with the pronouncements of leading scientists, what about his opinion of biological evolution? "Whatever truth there may be in the doctrine of evolution as applied within limits to the animal world, it breaks down when applied to man," Torrey asserted in *What the Bible Teaches*.³⁶ Like many other evangelical leaders, he advocated what was later called progressive creationism—the view that God miraculously created new types of organisms at different times (interspersed with limited evolution and mass extinction) throughout millions of years in earth history.³⁷ Torrey probably acquired progressive creationism from his favorite Yale professor, geologist James Dwight Dana (1813–1895), who had advocated this view in various forms throughout his career as one of America's leading scientists.³⁸

The Dana-Torrey alliance proved to be an important venue for promoting the harmony between science and Christianity near the turn of the twentieth century. Dana had the relevant scientific credentials

Article

Darwinism, Fundamentalism, and R. A. Torrey

and Torrey, a recognized theologian-evangelist, conveyed some of Dana's ideas to millions through revival sermons and related publications. A detailed look at Dana's subtle views about evolution and divine action will help us to understand Torrey's assessment of these issues. By the time Torrey studied under Dana in 1874, Dana had just announced, in print, that he had accepted a more evolutionary version of progressive creationism which he considered "most likely to be sustained by further research." He tentatively concluded that the "evolution of the system of life went forward through the derivation of species from species, according to natural methods not yet clearly understood, and with few occasions for supernatural intervention."³⁹

From 1871 to 1890, Dana delivered a series of lectures on evolution at Yale College in which he concluded (in the lecture versions that he began to deliver in the late 1870s and early 1880s)⁴⁰ that Darwinian natural selection had only succeeded in explaining the *survival* of the fittest species, not the *origin* of species.⁴¹ Dana recognized the explanatory power of natural selection in making sense of the geographical distribution of species in past and present floras and faunas—roughly what we now call biogeography and ecological succession. In his eighth and final lecture in this unpublished series, Dana wrote concerning Darwin's theory, "I see nothing here to sustain the view that *the survival of the fittest* satisfies our inquiry as to *the origin of the fittest*."⁴² However, natural selection acting on variations might help explain some of the smaller "divergences like that of the horse and giraffe from other species," Dana granted. He continued his assessment of the limited efficacy of natural selection in the next paragraph:

But it explains only in part. The [sic] most of the higher subdivisions of animals were already developed very nearly as we now have them in Paleozoic time; all the grand subdivisions of Radiates & Mollusks and nearly all of Insects and Vertebrates; and many of these were out in complete display in the Cambrian [period of the Paleozoic era]; thus showing that in this development of the Kingdoms of Life there was some more profound cause at work than superficial natural selection.⁴³

Dana reaffirmed this conclusion in the last edition of his *Manual of Geology* (1895) shortly before his death,

while also observing that "the *origin* of variation is not considered" in Darwin's theory and that it is "for the most part throughout the Kingdoms of life," a phenomenon "without explanation."⁴⁴ In both his 1895 *Manual of Geology* and his earlier unpublished lectures, Dana maintained that "natural variations" originated by mechanisms that science had not yet adequately determined. He nevertheless considered such variation to be "natural," rather than miraculous "creative acts" of God, which Dana (correctly) recalled had been the view of Louis Agassiz (1807–1873)—America's leading zoologist, and friend of Dana.⁴⁵ Dana accepted an account of life's history that he called "*evolution by natural variation*."⁴⁶

Before we examine this viewpoint, it is important to note Dana's advocacy of a few exceptions to this general story. He excluded human origins and a few other crucial points in life's history from "evolution by natural variation" because he thought such were instances of detectable intelligent causation of the sort advocated by Louis Agassiz ("intervention of an intellectual power," was Agassiz's expression).⁴⁷ In 1890, Dana published a lengthy Yale lecture (different from his eight-lecture evolution series) that surveyed evolution and related interpretive issues in Genesis. Here he specified two of the points of divine intervention in natural history prior to God's creation of humans:

There is, hence, reason for believing that the power which so controls and exalts chemical forces, raising them to the level required by the functions of a plant, cannot come from unaided chemical forces; and much less that which carries them to a still higher level, that of the living, sentient animal.⁴⁸

Dana appears to refer to a power that is beyond the inherent capacities of unaided material nature. This is made somewhat clear by the context of the above passage. The origin of plants (a category that included microbes in Dana's terminology) represented the origin of first life, of which "science, as is universally admitted, has no explanation; for no experiments have resulted in making dead matter a living species."⁴⁹ So Dana argued that a special organizing power was needed to account for the origin of "plant" life, and yet again for the origin of "sentient animal" life.

This continued insistence upon at least some interventionist acts of God in prehuman natural

history, a view that Dana apparently held throughout his life, would itself be sufficient to regard him as a progressive creationist rather than a theistic evolutionist. However, there are additional reasons for this assessment. As for the bulk of life's history beyond such rare interventionist exceptions, Dana distinguished his own view—*evolution by natural variation*—from Darwinism in two respects. First, he rejected the suggestion that chance variation (coupled with natural selection) constitutes the engine of evolutionary change: "It is of no avail to speak of *chance* variations. The use of the word *chance* indicates personal ignorance. Chance has no place in nature's laws, and can have none in nature-science."⁵⁰ Dana's last assertion about the nature of nature in his 1895 *Manual of Geology* further illuminates what he meant by *natural* (but not random) variations, which he thought fueled evolutionary progress: "the whole Universe is not merely dependent on, but actually is, the Will of one Supreme Intelligence."⁵¹ Put otherwise, Dana believed that God guided (usually in a noninterventionist manner) the production of the variations among organisms that constituted most of biological evolution. Second, Dana distinguished his understanding of evolution from Darwin's by arguing that natural variations make their initial appearance within the majority of a population, not the minority as Darwin had suggested. The few population members lacking such new beneficial variations would be eliminated by natural selection.⁵² Natural selection is a conservative, not innovative, process in Dana's view of life's history.⁵³

Dana considered the progressive appearance of increasingly complex life over millions of years to be "a fact, whether carried forward by Natural Causes under Divine power & guidance, or by Divine Intervention."⁵⁴ This is how he expressed it in the first of his eight Yale lectures on evolution, which he delivered to students episodically from 1871 to 1890. Dana's distinction here is between those cases in which God works through natural processes (without a role for "chance") to achieve his goals in nature, and those cases in which God's interventionist acts cause new entities to come into existence by momentarily suspending natural law, as in the case of the first appearance of plants, animals, and humans.⁵⁵

Dana's subtle views on biological origins have not been captured adequately by recent secondary

sources,⁵⁶ which is a point worth emphasizing before we return to Torrey's acceptance of Dana's views. Here is how historian Ronald Numbers summarizes Dana's viewpoint:

Came to accept theistic evolution in the 1870s but continued to insist that "a creative act" was necessary for the origin of humans; leaned more toward neo-Lamarckian than Darwinian mechanisms.⁵⁷

Contrary to this assessment, Dana also insisted upon at least two interventionist acts of God in prehuman history, and he considered the origin of variation to be largely "without explanation," at least more so than Lamarckian or Darwinian in character. Historian David Livingstone even claims (with only minor qualification) that by 1883 "Dana had clearly accepted the Darwinian cornerstone of evolution—namely, natural selection."⁵⁸

We have seen that Dana considered natural selection to be more helpful in explaining biogeography and ecological succession, rather than in explaining the origin of radically new life forms (which alone would give it "cornerstone" status in the Darwinian sense). Although Dana sometimes appeared to be one of "Darwin's forgotten defenders" (the title of Livingstone's book), Dana more often proclaimed the congruence of his views with those of progressive creationists like Louis Agassiz (1807–1873) and Arnold Guyot (1807–1884).⁵⁹ Although Dana believed in fewer interventionist acts of God in natural history than either Agassiz or Guyot, he agreed with them that God guided the progressive appearance of fundamentally new types of organisms. The origin of the major groups of species had nothing to do with chance and almost nothing to do with natural selection, Dana concluded. Dana was not a theistic evolutionist, at least not in the most common and recent senses of this term.⁶⁰

Torrey's assessment of Darwinism was strikingly similar to Dana's. Recall what Torrey wrote in 1898: "Whatever truth there may be in the doctrine of evolution as applied within limits to the animal world, it breaks down when applied to man." In fact, Torrey's diary suggests vaguely *how* Darwin's theory "breaks down when applied to man."⁶¹ In a dozen diary entries dated July through September of 1882, Torrey reports reading Darwin's *Descent of Man* (which first appeared in 1871—the year Torrey began his Yale studies and the year Dana began his

Article

Darwinism, Fundamentalism, and R. A. Torrey

Yale evolution lectures). On July 17, he remarks, "Darwin's argument on the development of the moral faculty seems extremely weak." The next day he writes,

Read in Darwin's "Descent of Man" & Mivart's criticism of Darwin on Language, Duty & Pleasure in "Lesson from Nature." Mivart points out [two illegible words] facts in Darwin's theory, which Darwin did not sufficiently notice or seem to apprehend in his later editions. This portion of Darwin's work lacks the acuteness and discrimination of other parts.⁶²

Torrey appears to have recognized the force of St. George Jackson Mivart's argument against Darwin's theory of the origin of morality by means of natural selection. "Perceptions of right and wrong, and of our power of choice, and consequently responsibility, are universally diffused amongst mankind, and constitute an absolute character separating man from all other animals," declared Mivart in his thesis statement placed at the head of his chapter on "Duty and Pleasure,"⁶³—a chapter Torrey apparently finished reading on July 18, 1882. Although Mivart, a prominent Catholic theistic evolutionist, acknowledged "altruistic habits can be explained by 'natural selection,'" he maintained that this is beside the main point at issue, namely,

No amount of benevolent habits tend even in the remotest degree to account for the intellectual perception of "right" and "duty." Such habits may make the doing of beneficial acts pleasant, and their omission painful; but such feelings have essentially nothing whatever to do with the perception of "right" and "wrong," nor will the faintest incipient state of the perception be accounted for by the strongest development of such sympathetic feelings. Liking to do acts which happened to be good is one thing; seeing that actions are good, whether we or others like them or not, is quite another.

Mr. Darwin's account of the moral sense is very different from the above. It may be expressed most briefly by saying that it is the prevalence of more enduring instincts over less persistent ones—the former being social instincts, the latter personal ones. ...

Mr. Darwin then means by "the moral sense" an instinct, and adds, truly enough, that

"the very essence of an instinct is, that it is followed independently of reason" ([*Descent of Man*,] vol. i, p. 100). But the very essence of moral action is that it is not followed independently of reason.⁶⁴

Torrey's evaluation of Darwin's *Descent of Man* and Mivart's *Lessons from Nature* appears to have been cut short by the appearance of what later became known as "The Great September Comet of 1882." Torrey reports in his diary that he viewed a comet in early October after having read (on September 14, 21, and 28) a book on observational astronomy by H. W. Warren.⁶⁵ Soon after viewing the comet, the Torrey family spent a year in Germany—apparently leaving Darwin's and Mivart's books behind. Torrey's enjoyment of scientific literature spurred him to even read aloud to his wife Clara from R. A. Proctor's *Light Science for Leisure Hours*.⁶⁶

Torrey, who read widely on evolution, was somewhat ambivalent about evolutionary theory and its relation to Christianity. In a sermon used during his 1902–1905 revival tour, Torrey presented scientific arguments against universal common descent, but then presented a backup greater-God evolutionary design argument (in case universal common descent were ever proven).⁶⁷ In October 1925 (shortly after the Scopes trial), Torrey recalled in a letter to his friend James Gray, editor of the *Moody Bible Institute Monthly*,

Even after I came to believe thoroughly in the Bible, and in its exact interpretation, I was, to a certain extent, an evolutionist. I later, with more thorough study, was led to give up the evolutionary hypothesis for purely scientific reasons.⁶⁸

In that same published letter, Torrey indicated that a fundamentalist could be an evolutionist in at least some sense of the term:

While I am not an evolutionist in any sense, I have known men intimately who were as sound on the Scriptures and on all fundamental doctrines of our faith as I am who were at the same time evolutionists. I think they are mistaken, but I can see how a man can believe thoroughly in the absolute infallibility of the Bible and still be an evolutionist of a certain type.⁶⁹

The Moody editors inserted a footnote at this point that read:

The “evolutionist” in mind evidently, is not he who denies the supernatural, but who employs the term in the simple sense of growth, progress, development from the lower to the higher in the history of the universe of man.⁷⁰

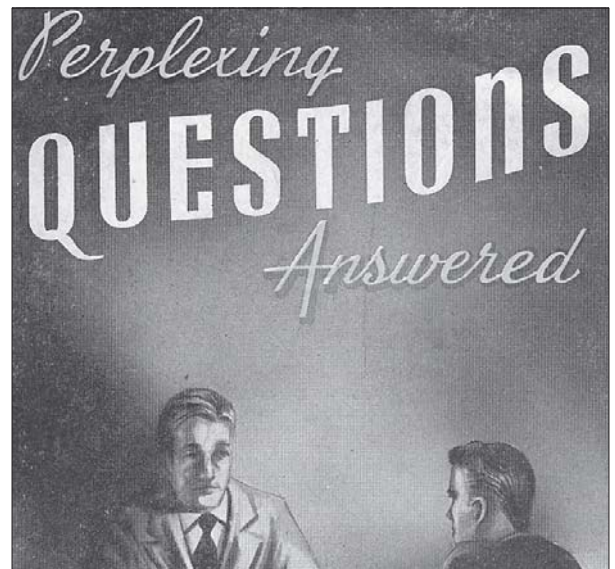
During the period in which Torrey collaborated with *The Fundamentals* publication project (1910–1915), he promoted a book by the British criminal law practitioner and amateur theologian Sir Robert Anderson (1841–1918), *A Doubter’s Doubts about Science and Religion*.⁷¹ Torrey included this book within the “Montrose Library,” which was a collection of recommended books routinely promoted in Biola’s organizational monthly, *The King’s Business*.⁷² Anderson’s book thus gives us additional insight into Torrey’s own views about science and religion.

After discussing the meager evidence in favor of Darwin’s theory of the origin of species, Anderson suggested that “the first and greatest question relates, not to the phenomena of life, but to its origin.”⁷³ Interacting with some of the published remarks of Charles Darwin, T. H. Huxley, and Herbert Spencer, Anderson argued that no theory of the origin of life enjoyed significant support at that time. Even so, Huxley is quoted as saying that “at some time or other abiogenesis must have taken place. If the hypothesis of evolution be true, living matter must have arisen from non-living matter.”⁷⁴ Such a conclusion, however, merely assumes the very naturalistic philosophy in question. Anderson aptly characterizes Huxley’s abiogenesis assertion as “boundless credulity.”⁷⁵

Returning to Darwin’s theory proper, which pertains to the origin of species, not the origin of life, Anderson comments that “it claims a hearing on its merits. And viewed in this light, no one need denounce it as necessarily irreligious.” He then argues that intelligently guided human evolution would be “a far more amazing act of creative power than the Mosaic account of the genesis of man supposes.”⁷⁶ But “base materialism” is powerless to explain the origin of human religious consciousness.⁷⁷ In the end, Anderson concludes that the available evidence does not substantially support Darwinian evolution. It is “merely a philosophical theory” that is “unnecessary, except of course with those scientists who cling to any plank that will save them from having to acknowledge God.”⁷⁸ Anderson’s analysis of Darwinism and naturalistic

philosophy is reflected in Torrey’s occasional remarks on the subject, including his earlier diary entries analyzed above.

Despite his partial uncertainty about evolution, Torrey consistently advocated the design argument in his sermons and publications. His clearest exposition of the basic structure of the design inference surfaced in his book *Practical and Perplexing Questions Answered*.⁷⁹ Here he describes a conversation with an “inquirer” that he would redirect by pulling out his watch. A series of questions would help the inquirer recognize his own ability to make the design inference without having seen either the act of design or the designing intelligence. The first peak of this conversation comes in this sentence: “The watch shows the marks of intelligent design, thus proving it had an intelligent maker.” Torrey would then inquire, “What about your own eye? Is it not as wonderful a piece of mechanism as a watch? Did it not then have a Maker?” He would apply this insight to other features of the universe that display “symmetry, order, beauty, law, [and] adaptation of means to an end,” which “prove the existence of an intelligent Creator and Designer.” This is the classic teleological argument for God’s existence. Evolution, “even if true, would not take away any of the force of the argument from design in nature,” because of the need for a “power of development” imposed on nature by a designer. Here is an echo of Dana, Torrey’s geology professor, whose Yale lectures contained similar perspectives.

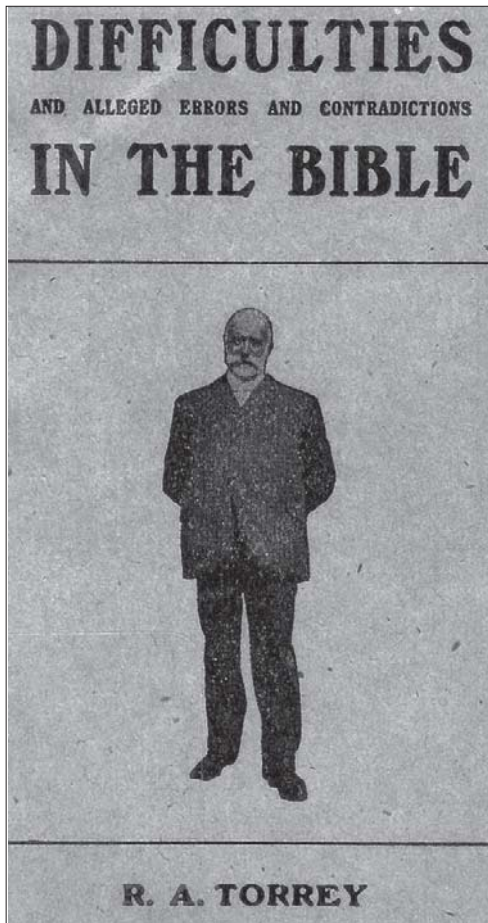


A portion of the cover of R. A. Torrey, *Practical and Perplexing Questions Answered* (Chicago: Moody Press, 1908).

Article

Darwinism, Fundamentalism, and R. A. Torrey

Prepared by a Yale and German theological and liberal arts education, by several decades of pastoral and Bible institute leadership, and by a number of prayer-bathed revivals in America, Torrey was eager for revival on a larger scale. From 1902 to 1905, Torrey and singer Charles Alexander (1867–1920) saw nearly 100,000 conversions in meetings held in Japan, China, Australia, India, and Great Britain.⁸⁰ Upon returning to America, Torrey turned increasingly to full-time evangelistic work (leaving MBI in 1908), until he accepted the call to Biola's deanship in 1912, having preached to a total of about 15 million people on four continents.⁸¹ Within three years after the completion of his unprecedented evangelistic crusades in 1905, Torrey had published his main apologetic works,⁸² which included many of his musings on evolution and intelligent design. Beginning in 1909, he joined forces with other evangelicals in a joint publication project, *The Fundamentals*, which helped identify a new breed of evangelicals: the fundamentalists.



The cover of R. A. Torrey, *Difficulties and Alleged Errors and Contradictions in the Bible* (Chicago, IL: The Bible Institute Colportage Association, 1907).

Evangelicalism, Fundamentalism, and Christian Worldview Thinking: 1889–1915

Besides his role as a leading turn-of-the-century evangelical revivalist, Torrey was one of the editors and authors of *The Fundamentals* (1910–1915). This publication series not only helped define fundamentalism, but it also disseminated James Orr's explicit articulation of Christianity as a "worldview"—a project Orr had begun in about 1889 (the same year Torrey began writing Bible institute curricula).⁸³ We will focus on how Torrey and Orr contributed to the sort of Christian worldview analysis that informed early fundamentalism in regard to science and Christianity.

What are evangelicalism, fundamentalism, and Christian "worldview" thinking? Evangelicals are best defined as Christians affected by the eighteenth-century revivals led by people such as Jonathan Edwards and John and Charles Wesley, who were committed to biblical authority, Christ's substitutionary atonement (and a few other major doctrines), a conversion experience, and transformation of the world through evangelism and social action.⁸⁴ Christian fundamentalism has been a movement within evangelicalism since the early twentieth century. It opposed liberalism and defended the truths of Christianity more actively than many evangelicals had done previously. Christian worldview thinking (explicitly using the term "worldview" or *Weltanschauung*) has been a project, within both evangelicalism and the Reformed tradition since the late nineteenth-century, to develop a comprehensive account of reality that is rooted in the Bible and clearly distinguished from non-Christian views of the world. This project was largely initiated in about 1889 by the Scottish Presbyterian theologian James Orr (1844–1913)—who was also a leading author of *The Fundamentals*—and (in the mid-1890s) by the Dutch Reformed polymath Abraham Kuyper (1837–1920).⁸⁵

When Moody died in 1899, Torrey succeeded him as a leading world evangelist. Torrey later became a central figure in the fundamentalist movement. Moody himself had been a proto-fundamentalist, according to Marsden.⁸⁶ The main fundamentalist ingredient that Moody lacked—the passion and educational background to fight liberalism—Torrey possessed in abundance. In fact, Torrey's chief

disagreement with Moody was precisely concerning this issue of fighting the intellectual idols of the age. "Christ and His ... disciples ... attacked error," Torrey wrote. It is not enough to "simply teach the truth," he argued in 1899, delineating his position in contrast to that of Moody.⁸⁷ Although the term "fundamentalist" did not appear in print until 1920,⁸⁸ fundamentalism had been in the works for at least a few decades prior. The worldwide dispersal of the pamphlets called *The Fundamentals* provided the root of the name and some of the momentum that gave fundamentalism its public face.

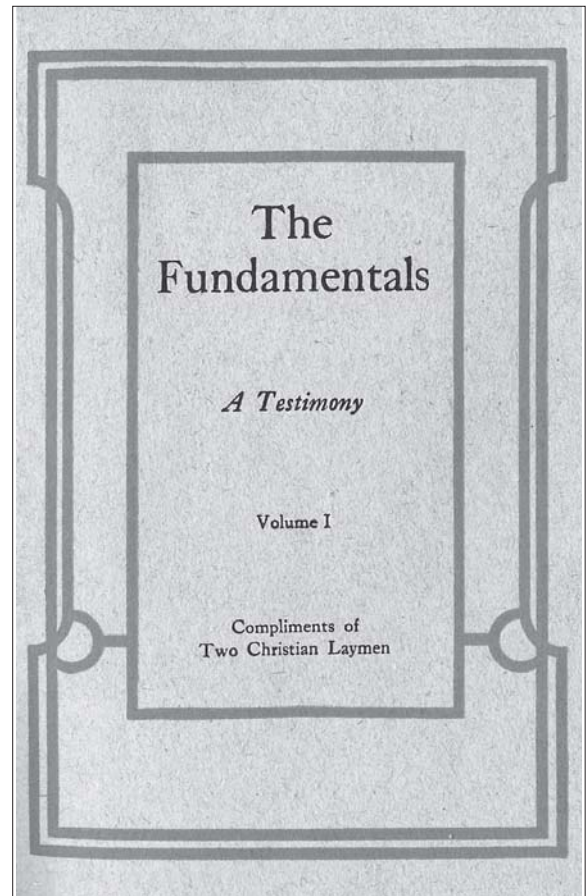
What initiated *The Fundamentals* project in 1909? Oil prospector Lyman Stewart had long dreamed of funding the wide circulation of a scholarly defense of mere evangelical Christianity with a minimum of sectarian content.⁸⁹ Soon after his Union Oil Company of California had multiplied its worth five times between 1900 and 1908,⁹⁰ Lyman and his brother Milton decided to advance God's kingdom anonymously with a proclamation of basic Christianity. They were the "two Christian laymen" on the title page of each of the undated twelve volumes of *The Fundamentals* that appeared from 1910 to 1915. The preface to the last volume states that "over 2,500,000 copies of the twelve volumes have been published and circulated,"⁹¹ leading some to believe that this referred to the number of copies of *each* volume. The *total* copies of *all* twelve volumes is what the preface actually intended to report, a number that grew to nearly three million according to the next sentence of the preface (this included reprints of back copies).

Orr was one of the most influential essayists in *The Fundamentals*, particularly because he had already established his reputation as a founding father of Christian "worldview" thinking.⁹² In his magnum opus, *The Christian View of God and the World as Centering in the Incarnation* (1897), he had declared,

The opposition which Christianity has to encounter is no longer confined to special doctrines or to points of supposed conflict with the natural sciences—for example, the relations of Genesis and geology—but extends to the whole manner of conceiving of the world, and of man's place in it, the manner of conceiving of the entire system of things, natural and moral, of which we form a part. It is no longer

an opposition of detail, but of principle. The circumstance necessitates an equal extension of the line of defense. It is the Christian view of things in general which is attacked, and it is by an exposition and vindication of the Christian view of things as a whole that the attack can most successfully be met.⁹³

Orr's participation in *The Fundamentals* promoted this sort of Christian worldview analysis on a massive scale (owing to the large distribution of those volumes). Orr expresses his views about science and Christian worldview thinking in his essay "Science and Christian Faith" (vol. 4). He declares that natural law "in the Bible is never regarded as having an independent existence. It is always regarded as an expression of the power or wisdom of God." This clarification undercuts a class of arguments later known as "god of the gaps," according to which God is implicated in nature only when we fail to explain something by means of natural laws and natural events. Orr also argued that when someone



The Fundamentals (1910–1915) were issued as twelve separate volumes (about two per year). Nearly three million of these volumes (about 250,000 of *each* volume) were mailed around the world.

Article

Darwinism, Fundamentalism, and R. A. Torrey

lifts their arm, they do not “abolish the law of gravitation but counteract or overrule its purely natural action by the introduction of a new spiritual [non-material] force.”⁹⁴ What scientific materialists would need to justify in their approach, Orr suggests, is “not simply that natural causes operate uniformly, but that no other than natural causes exist ...”

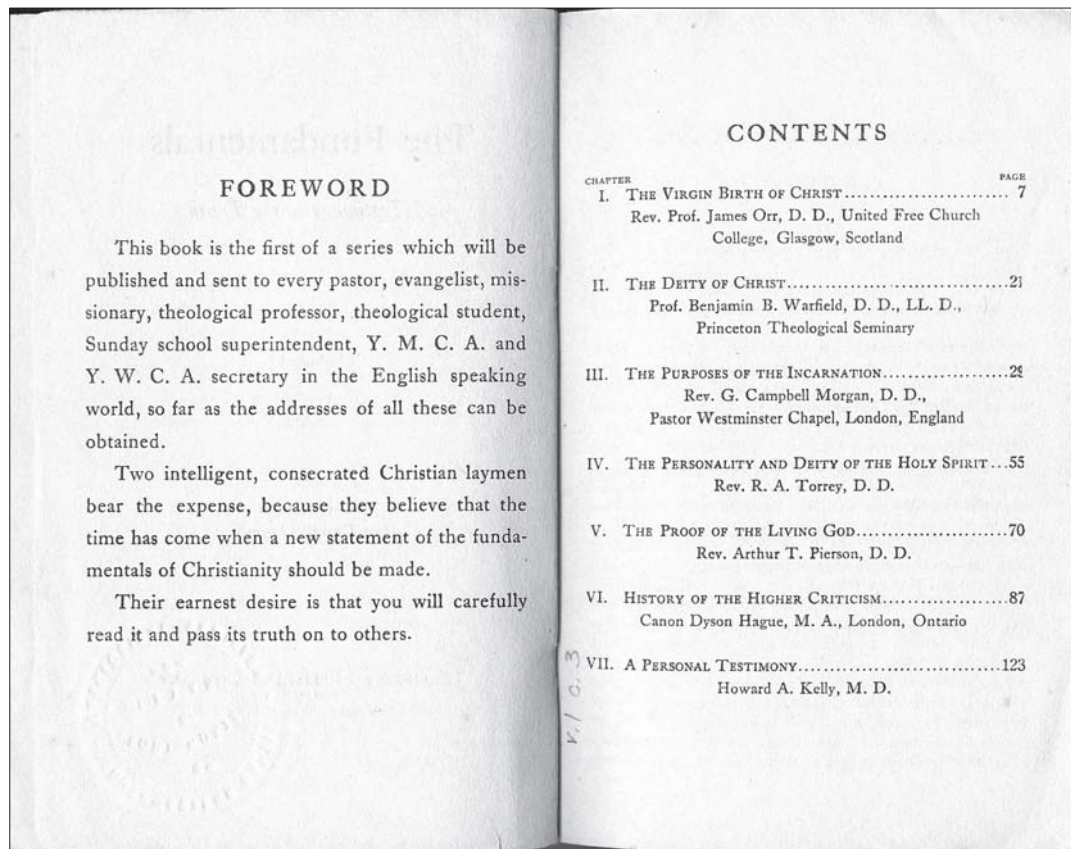
Digging yet deeper into the worldview level of analysis, Orr concluded,

The real question at issue in miracle is not natural law, but *Theism*. It is to be recognized at once that miracle can only profitably be discussed on the basis of a theistic view of the universe. It is not disputed that there are views of the universe which exclude miracle.⁹⁵

He mentions atheism, pantheism, and deism as examples of worldviews that preclude miracles. But then he “marvels” at those theists (especially theistic evolutionists) who presume that “for the highest and holiest ends in His personal relations with His creatures, God can work only within the limits which nature imposes; that He cannot act without and above nature’s order if it pleases Him to do so.”

He concludes, “Miracles stand or fall by their evidence, but the attempt to rule them out by any a priori dictum as to the uniformity of natural law must inevitably fail.”⁹⁶ Orr skillfully avoids both extreme presuppositionalism and exclusive evidentialism in his articulation of a Christian worldview as compared with rival worldviews.

In this same essay, Orr dismantled the Draper-White⁹⁷ warfare thesis of science and Christianity by means of the overall harmony that is evident in the history of science and Christianity. Historians of science, particularly since World War II, have resoundingly discredited the warfare thesis along similar lines (but to little effect as the warfare image still has popular currency). Furthermore, Orr displays a remarkably accurate grasp of the limited extent to which conflict *has* appeared in the history of science and Christianity, namely when either nature or Scripture was misinterpreted. For example, Orr—echoing Augustine, Calvin, Galileo, and many others—observes that the Bible is not a scientific textbook, but is written using the common language of how things appear from earth.⁹⁸ Admittedly, “Galileo was imprisoned by the church,” but “truth



The Fundamentals, volume 1 (1910). R. A. Torrey served as a writer and one of the editors of the project.

prevailed, and it was soon perceived that the Bible, using the language of appearances, was no more committed to the literal moving of the sun round the earth than are our modern almanacs, which employ the same forms of speech [e.g., 'sunrise']." Similarly, Orr argues that the "great divine 'week' of work" is itself part of the "symbolic setting of the picture" in Genesis 1, and not intended to teach creation in six solar days.⁹⁹ In fact, none of the essays in *The Fundamentals* advocated a young earth. Orr also concluded that Noah's flood was anthropologically universal, but geographically local.¹⁰⁰ Many of the errors of fundamentalism became pervasive only later in the history of the movement, after the influence of giants like Orr had faded.

After the demise of fundamentalism among most evangelicals in the generation after the Scopes trial, some aspects of its earlier strengths were later revived. For example, Carl F. H. Henry (who was born in 1913, the year Orr died) read Orr's *The Christian View of God and the World* in a Wheaton College senior course on theism, which (Henry later recalled) "did the most to give me a cogently comprehensive view of reality and life in a Christian context."¹⁰¹ Henry revived careful Christian worldview analysis in the tradition of Orr, but he and his Wheaton classmate Billy Graham also shed the tainted "fundamentalist" label in their intellectual and revivalist renewal of evangelicalism during the second half of the twentieth century.

In his "Science and Christian Faith" essay, Orr also proposed a resolution to the apparent conflict between biological evolution and the Bible. Significant evidence points to "some form of evolutionary origin of species—that is some genetic connection of higher with lower forms," but he thought that this change was limited (without specifying *how* limited).¹⁰² He also argued that God directs the mechanisms of evolution toward purposeful ends. "Evolution," he concludes, "is coming to be recognized as but a new name for 'creation' ..." Orr also asserts that the origin of life is inexplicable by "purely mechanical and chemical agencies" and that the origin of traits such as consciousness and morality similarly require the operation of "spiritual powers" or a "special act of the Creator."¹⁰³ Orr's views here are in line with the Dana-Torrey trajectory analyzed earlier.

The Fundamentals (1910–1915) displayed a range of opinion on evolution that did not become focused

political resistance among fundamentalists until the 1920s. Although some essayists in *The Fundamentals* clearly rejected universal common ancestry, others accepted it (with the exclusion of the special case of humans). The most qualified author on evolution among the essayists was theologian (and amateur geologist) George Frederick Wright (1838–1921), who was professor of the "Harmony of Science and Revelation" at Oberlin College in Ohio. Wright argued that "modern evolutionary speculations have not made much real progress over those of the ancients." He especially noted the lack of success of Darwin's proposed mechanism of natural selection acting on random variations, which, indeed, historians of late have shown to have been temporarily eclipsed by neo-Lamarckian and other goal-directed mechanisms around the turn of the twentieth century.¹⁰⁴ Wright concluded that "design" is still detectable in evolutionary change, but he was vague about how much common ancestry he deemed to be well documented (he also changed his mind about this subject a few times during his career).¹⁰⁵

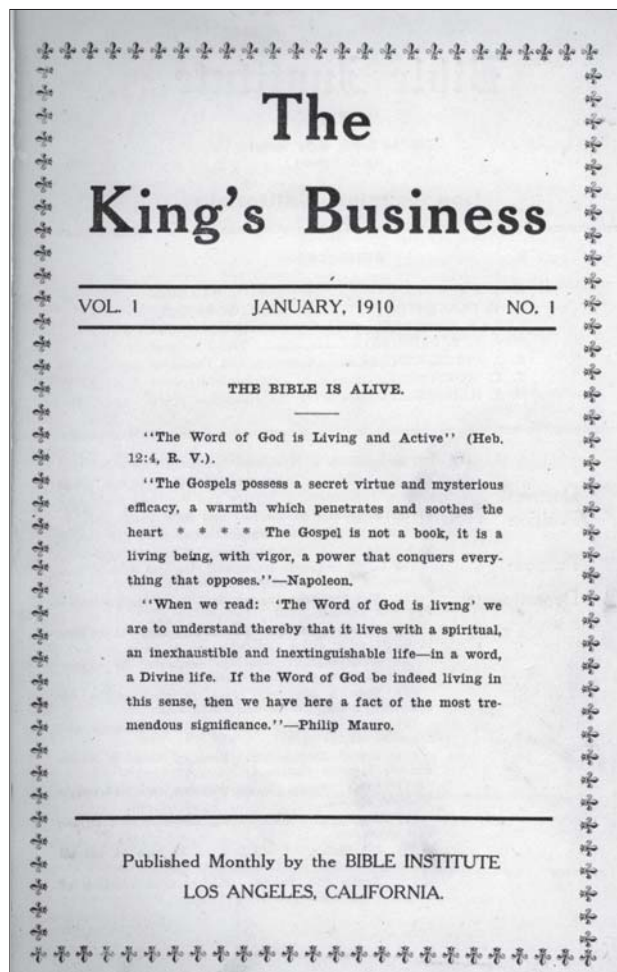
Furthermore, Wright made the case (like Orr and design theorists today) that humans are known to act routinely as intelligent agents in breeding animals and fashioning technology—or even in just moving their arm, as Orr had illustrated. Thus, "we cannot banish God from the universe without stultifying ourselves and reducing man's free will to the level of a mere mechanical force. But man is more than that; and this everyone knows." Even though Wright was correct about the strong human intuition that validates our status as volitional beings who retain personal identity through time (unlike material objects), he might be surprised by the degree to which materialists subsequently have attempted to reduce humans to material entities.

In the preface to the last volume of *The Fundamentals*, which appeared in 1915, under Torrey's editorial oversight, readers were urged to subscribe to *The King's Business* published by Biola (also edited by Torrey), which was offered as a continuation of *The Fundamentals*. The first eleven volumes of *The Fundamentals* had spurred 200,000 letters to the publisher, half of which had requested more.¹⁰⁶ Torrey was happy to comply by sending a complimentary issue of *The King's Business* to each reader in the hope that many would continue by subscription.¹⁰⁷ The oil money of the Stewart brothers was behind all these projects: *The Fundamentals*,

Article

Darwinism, Fundamentalism, and R. A. Torrey

The King's Business, and Biola itself.¹⁰⁸ *The King's Business* focused on "fundamental Christianity" and Sunday school lessons, including background reading and editorial comments about current events. Other than a high profile presence of mail-order offers from the Biola Book Room, Biola's self-promotion was kept to a minimum. This monthly connection with an instant international constituency helped put Biola on the religious world map, particularly as the periodical was also known for its editor, the renowned world evangelist R. A. Torrey. *The King's Business* (1910–1970) was one of the most influential fundamentalist periodicals of the first half of the twentieth century.¹⁰⁹ *Christianity Today* (1956–), the brainchild of Billy Graham and Carl F. H. Henry, became the leading evangelical journal (and chief defender of orthodoxy in the wake of fundamentalism's decline) of the second half of the twentieth century.¹¹⁰



Courtesy of Biola University Archives.

Science, Religion, and the Great War: 1914–1918

While Orr had argued against the alleged war between science and Christianity in *The Fundamentals* (as had Torrey in his revival messages and Bible school curriculum), Torrey's monthly editorials in *The King's Business* often addressed the war in Europe that soon drew America into overseas combat. Torrey maintained a pacifist position through the first half of World War I, which had begun in August 1914. But in his April 1917 editorial (written February 15, two weeks after Germany had begun unrestricted submarine warfare), Torrey made an about face. "Ought Christians to go to war?" he asked. "They certainly should," he answered. "But what war should they go to?" First, he gave the spiritual answer: "The war against Satan (Eph. 6:12, 13); the war against sin and unbelief and error in all its countless forms." Then Torrey suggested the necessity of physical warfare:

There seems to be no possibility of America's being kept out of this most appalling war in all the world's history. The course being pursued by Germany has no shadow of excuse in international law or humanity. In their desperation that nation and its rules seem to have gone mad. It looks as if there was nothing left to be done but to utterly crush the nation, to bring it to its senses.¹¹¹

Indeed, the USA entered the war on April 6, 1917. In the same April 1917 issue of *The King's Business*, Torrey penned another article about the spiritual war over the authority of Scripture. He suggested that the "most dangerous enemies of the Bible today are college professors and principals of high schools, and even theological professors, who ... are ... attempting to show that the Bible is full of errors and not in accord with the assured results of modern science and history."¹¹² Later in this article, however, Torrey proclaimed,

The greatest scientist that America produced in the nineteenth century, my own friend and beloved instructor in geology, Prof. Dana, said, "The grand old book of God still stands, and this old earth the more its leaves are turned and pondered, the more will it sustain and illustrate the sacred word."¹¹³

In the February 1918 issue of *The King's Business*, Torrey addressed the spiritual and Darwinian

dimensions of the Great War. First, he celebrated the “taking of Jerusalem by the English forces” as a fulfillment of prophecy.¹¹⁴ Then he launched five pages that blamed Darwinian evolution for the war.

There can be no question that the present war and some of the most horrible features of German ‘frightfulness’ are the direct outcome of the evolutionary hypothesis, which has had so great a sway in German universities and in German scientific thought.¹¹⁵

Torrey documented how numerous German intellectuals and military leaders had justified German military aggression based on Darwinian principles in early twentieth-century publications.¹¹⁶ Although recent scholarship has shown that authors like Torrey and William Jennings Bryan (of the Scopes trial) overestimated the direct line of influence from Darwinism to the outbreak of World War I,¹¹⁷ there remains a substantial case for social Darwinism as one of the significant factors that led to the war. Torrey did not recognize one glaring counterexample to his thesis: some Darwinists were pacifists. But, ironically, the reason for such pacifism usually hinged upon the objection that, in modern wars, the wrong people were being killed—Europeans rather than allegedly inferior non-European races.¹¹⁸

Though Darwin himself opposed militarism as a deliberate policy,¹¹⁹ he judged the “war of nature” to be the source out of which morality itself originated. A tribe with more altruistic behavior would out-compete (in the “battle for life”) those lacking such selfless behavior, he reasoned.¹²⁰ Those superior in battle were also those on the high moral ground (as an alleged consequence of natural history). Torrey, making many of these same points about Darwinism and military aggression, quipped, “This may sound like Darwinian evolution gone mad, but it is really the evolutionary hypothesis carried to its logical issue.”¹²¹ Historian Richard Weikart has recently documented a more nuanced version of Torrey’s assessment (and connected it to both World Wars) in his book *From Darwin to Hitler* (2004).¹²²

In the same editorial analyzed above, Torrey shows how some of the leading German scholars of biblical higher criticism tarnished their reputations by publicly voicing support for German militarism. For example, he profiles statements from Gustav Adolf Deissmann, professor of New Testament

exegesis at Berlin. Deissmann proclaimed the Great War to be “our holy war,” which has strengthened religion: “I say it [i.e., the present war] has steeled [i.e., strengthened] it [i.e., religion] ... This is not relapse to a lower level, but a *mounting up to God himself*.” Torrey, perhaps recalling his own experience studying theology in Germany, responded, “Who will desire to study New Testament theology under a man who is capable of such an infamous and Satanic utterance as this[?]”¹²³ Torrey concludes his editorial with these words, “It makes for the progress of true thought that they and their theories are necessarily discredited by these recent utterances.”

Some evangelical leaders had defended theistic evolution up to World War I,¹²⁴ but this support dwindled among evangelicals and fundamentalists after the Great War. Although evangelicals had long argued that higher criticism in the hands of liberal theologians (those assuming naturalism in varying degrees) had corrupted our understanding of the book of God’s words (the Bible), now there was a growing concern that scientific naturalism had degraded our knowledge of the book of God’s works (nature). There was also increasing evidence that the domain of the two books significantly overlapped, particularly in disputes about the value (or repudiation) of war and of the sanctity of each individual human life.

Torrey not only opposed America entering the war (until it appeared necessary), but he also helped advertise a pamphlet in *The King’s Business* that opposed the war against “inferior” Americans by eugenicists who were campaigning to create a master race through human breeding.¹²⁵ Beginning in December 1912, *The King’s Business* advertised this fourteen-page “small book” by Philip Mauro (1859–1952)¹²⁶ entitled “*Eugenics*” A New “Movement” (of which no copies are known to exist today).¹²⁷ The advertisement for Mauro’s five-cent treatise announced that it “tells of another new movement instigated by Satan.” Mauro, the New York lawyer who contributed several essays to *The Fundamentals*, and who later wrote the brief that William Jennings Bryan used in the Scopes trial, was a popular Christian apologist. Mauro opposed eugenics, which was the attempt to guide human evolution by regulating human procreation. Although Darwin himself provided some of the rationale for improving humanity through breeding in his *Descent of Man* (1871),¹²⁸

Article

Darwinism, Fundamentalism, and R. A. Torrey

eugenics did not become a popular social movement until about the time of Mauro's conversion to Christianity near the turn of the century.

As a lawyer, Mauro might have been familiar with some of the eugenics-based compulsory sterilization laws that were passed beginning in 1907.¹²⁹ By the early 1930s, thirty states had enacted such laws and over 12,000 Americans had been sterilized under their guidance (a total of over 60,000 compulsory sterilizations had taken place by 1958).¹³⁰ Most of those sterilized were deemed insane or "feeble-minded." With hindsight, the "feeble-minded" designation was often quite dubious, including, in many cases, merely financially underprivileged people. Although conservative evangelicals and fundamentalists typically opposed eugenics, liberal preachers typically supported the movement.¹³¹

R. A. Torrey and the Organization of Fundamentalism before the Scopes Trial: 1918–1925

The Baptist minister Harry Emerson Fosdick—a theistic evolutionist and ambivalent supporter of eugenics¹³²—became the best known "liberal" critic of fundamentalism through his widely distributed sermon "Shall the Fundamentalists Win?"¹³³ In this sermon delivered in May of 1922, Fosdick affirmed "genuine liberals" within Christianity who combine "new knowledge and the old faith," and who might "say that the virgin birth is not to be accepted as a historic fact." He warned that fundamentalists "have actually endeavored to put on the statute books of a whole state binding laws against teaching modern [evolutionary] biology," referring to the first such attempts in 1921.¹³⁴ "If they had their way, within the church, they would set up in Protestantism a doctrinal tribunal more rigid than the pope's," he predicted concerning his increasingly mobilized fundamentalist opponents. Given that eugenics was routinely taught as part of evolutionary biology at this time¹³⁵ (including in the textbook at issue in the 1925 Scopes trial),¹³⁶ Fosdick probably felt compelled to support eugenics despite his doubts about some of its aims. Indeed, he was one of three Christian ministers who were charter members of the American Eugenics Society Advisory Council, which formed in 1923 (the year following his sermon against fundamentalism).¹³⁷

How did the fundamentalists get organized before the 1920s, the decade in which their movement became a national sensation? Much of the answer comes from a look at a flurry of activity centered on Torrey, whom emerging fundamentalists recognized as the leading evangelical revivalist. Although Torrey was theologically open to certain forms of evolution, he had argued extensively in the February 1918 issue of *The King's Business* that Darwinism was the main cause of World War I. Fundamentalists took note of this. The pillars of Christian civilization seemed to be crumbling under the influence of Darwinism and higher criticism (see cartoon below). Defenders of Christendom needed to get organized.

At the fourth annual meeting of the World's Christian Fundamentals Association (WCFA), which was held in the 4,564-seat auditorium of the Bible Institute of Los Angeles in 1922, Minneapolis pastor William B. Riley began the convention by telling the story of the birth of the WCFA and its aim of combating the two main components of modernism: evolution and higher criticism. He explained how the WCFA was conceived in the summer home¹³⁸



The King's Business 13 (July 1922): 642.
Courtesy of Biola University Archives.

of Torrey, Biola's dean, at a meeting in 1918, called by Riley and the editor of the first five volumes of *The Fundamentals*, A. C. Dixon.¹³⁹ Riley encouraged fundamentalists to fight modernism in colleges and seminaries. To document this need, he summarized the results of the survey published by James Leuba in *Belief in God and Immortality* (1916): "... more than half of those teaching biology, geology and history have discarded a belief in a personal God and a personal immortality."¹⁴⁰ Riley then turned to the "fruit" of this unbelief in American academic leadership, noting that a higher percentage of freshman students in colleges believe in the Christian faith than do upperclassmen. Leuba's study indicated to Riley that the "camouflage of Christianity, so long worked by modernist instructors, is now removed, and for the first time since the conflict began the army of Modernism is in the open and under direct fire."¹⁴¹ Historian Edward Larson has recognized the WCFA as a leading organization behind the political activation of fundamentalism.¹⁴² However, Torrey's biographer, Roger Martin, concludes that Torrey withdrew from the WCFA soon after the Los Angeles meeting for two reasons: its over-emphasis on fighting evolution and its "subsequent divisiveness and improper spirit."¹⁴³ Martin suggests that Torrey thought the inerrancy of Scripture should be the primary focus of organized attempts to renew Christianity.

Indeed, Torrey's emphasis on biblical inerrancy spans the chronological range of his publications.¹⁴⁴ In 1899, he compared acceptance of inerrancy in the face of apparent errors in the Bible to the acceptance of Copernican astronomy before Galileo's discovery of the phases of Venus. "So we see," he concluded,

that according to the common-sense logic recognized in every department of science (with the exception of Biblical criticism, if that be a science), if the positive proof of a theory is conclusive it is believed by rational men, in spite of any number of difficulties in minor details. He is a shallow thinker who gives up a well-attested truth because of some facts which he cannot reconcile with that truth. And he is a very shallow Bible scholar who gives up the divine origin and inerrancy of the Bible because there are some supposed facts that he cannot reconcile with that doctrine. Unfortunately we have many shallow thinkers of that kind, even in our pulpits.¹⁴⁵

Biblical inerrancy, set within science and religion methodological dialogue, makes a prominent appearance in Torrey's 1907 book that answers the most frequent questions asked during his 1902-1905 world evangelism tours, which resulted in about 100,000 conversions. Torrey opens his book with "a general statement" about alleged biblical errors in which he notes that there is "scarcely a doctrine in science generally believed today that has not had some great difficulty in the way of its acceptance." Appealing to the early years of Copernican astronomy, he writes,

When the Copernican theory, now so universally accepted, was first proclaimed, it encountered a very grave difficulty. If this theory were true, the planet Venus should have phases as the moon has, but no phases could be discovered by the best glass then in existence. But the positive argument for the theory was so strong that it was accepted in spite of this apparently unanswerable objection. When a more powerful glass was made, it was found that Venus had phases after all. The whole difficulty arose, as most all of those in the Bible arise, from man's ignorance of some of the facts in the case.¹⁴⁶

Torrey reinforced the same point by reviewing the acceptance of the nebular hypothesis (of the solar system's origin) despite anomalous data.

The nebular hypothesis is commonly accepted in the scientific world today. But when this theory was first announced, and for a long time afterward, the movements of the planet Uranus could not be reconciled with the theory. Uranus seemed to move in just the opposite direction from that in which it was thought it ought to move in accordance with the demands of the theory. But the positive arguments for the theory were so strong that it was accepted in spite of the inexplicable movements of Uranus.¹⁴⁷

In 1922, six years before his death, he identified inerrancy and Jesus' bodily resurrection as the two most pressing issues of the day, despite the recent flurry of talk about evolution, which he deemed comparatively "not so fundamental and vital." Debate about evolution was marked by

great confusion of thought both upon the part of the Conservatives and on the part of the Liberals. Neither side define [sic] with accuracy just what they mean by "Evolution," and the ardent advocates of Evolution, having given

Article

Darwinism, Fundamentalism, and R. A. Torrey

what they consider conclusive proof of the fact of an Evolution of a certain character, at once assert that they have proved the doctrine of Evolution in an entirely different sense. There is a similar confusion, though not so frequent or so gross, on the part of those contending against Evolution. No one should write either for or against Evolution without a careful definition of just what he means by Evolution.¹⁴⁸

Torrey offered this assessment of evolution on the eve of the 1925 Scopes trial with the observation that an adequate book on the topic had yet to be written. He had the “hope” that “a man” he had in mind would do the job. This man’s identity remains a mystery.

Conclusion: R. A. Torrey and Issues in Science and Christianity before 1925

Fundamentalist leader R. A. Torrey offered evangelical Christians insightful approaches for dealing with Darwinism and naturalism before his death in 1928. These insights, some of which Torrey derived from Yale’s president Noah Porter and Yale’s geologist J. D. Dana, might inspire a better relationship between science and Christianity today. How important was Dana to a nineteenth-century assessment of Darwinian evolution? Darwin himself wrote Dana a letter a few years before the *Origin of Species* appeared in 1859, in which he confided, “but when I shall publish, Heaven only knows, not I fear for a couple of years, but when I do the first copy shall be sent to you.”¹⁴⁹ Indeed, in a letter from Darwin to Dana dated November 11, 1859—subsequently found inserted into Dana’s copy of the *Origin of Species*—Darwin announced the fulfillment of his promise and challenged Dana with these words: “I know too well that the conclusion, at which I have arrived, will horrify you, but you will, I believe & hope, give me credit for at least an honest search after the truth. I hope that you will read my Book.”¹⁵⁰ Dana apparently read it, honestly evaluated it, and then rejected the cornerstone of Darwinism: the claim that natural selection acting on random variations has the creative power to make all life from simple beginnings. Torrey followed a similar course.

In 1889, two important evangelical projects were initiated: Torrey began creating a model Bible curriculum for ordinary Christian workers as the

superintendent of Moody’s new Bible Institute in Chicago, and Orr began writing his Kerr lectures that embodied the first explicit articulation of Christianity as a “worldview.” These two projects reinforced each other and became part of the larger fundamentalist movement to defend Christianity against modernism, as argued in *The Fundamentals* (1910–1915). The writers of *The Fundamentals*, including Orr and Torrey, proposed harmony between science and Christianity by accepting the standard geological ages and by offering at least some critique of Darwinism. Biola advanced the work of *The Fundamentals* through its monthly periodical, *The King’s Business* (1910–1970), which Torrey designated as the successor to *The Fundamentals* in the final volume of that series. Torrey could do this because he was editor of both publications, and the funding for both came from the same millionaire brothers—Lyman and Milton Stewart. Although Torrey offered occasional critiques of Darwinism in *The King’s Business* and in his books and sermons, he urged evangelicals and fundamentalists to focus more on biblical inerrancy and a critique of naturalism in all academic fields, rather than on the details of how God’s creative acts unfold in time. While Biola University and most other evangelical institutions today no longer accept the tainted “fundamentalist” label, there is much to be emulated from early fundamentalism before it flung itself into the humiliation of the 1925 Scopes trial—a disastrous move that Torrey did not support.¹⁵¹

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Notes

¹George M. Marsden, *Fundamentalism and American Culture*, 2d ed. (Oxford: Oxford University Press, 2006), 260. The second edition leaves the original edition of 1980 unchanged, other than an additional chapter about recent fundamentalism. Marsden is both a leading historian of evangelicalism and fundamentalism, as well as an influential advocate of Christian worldview thinking in academia today—particularly since the publication of his book *The Outrageous Idea of Christian Scholarship* (Oxford: Oxford University Press, 1997). After declaring the Society of Christian Philosophers the premier role model of Christian thought, Marsden also favorably mentions the American Scientific Affiliation in *Outrageous Idea*, 102.

²As president of Biola and its primary donor, Lyman Stewart built Los Angeles’ tallest building (thirteen floors), which was mostly completed in 1914 to house the young interdenominational evangelical Bible Institute. See www.talbot.edu/about/history.cfm (accessed July 28, 2009).

³Torrey’s family burned his letters and diaries after his death in 1928, according to Kermit L. Staggers, “Reuben A.

Torrey: American Fundamentalist, 1856–1928” (PhD diss., Claremont Graduate School, 1986), i. However, some of Torrey’s diaries and other unpublished materials have surfaced in various archives. For a review of these materials, see www.wheaton.edu/bgc/archives/Papers/Torrey/papers.html (accessed July 28, 2009). Many of Torrey’s published works are available at www.freewebs.com/ratorrey/index.htm (accessed July 28, 2009).

⁴Perry Miller, the grand expositor of the New England mind and founder of the Yale edition of *The Works of Jonathan Edwards*, described Edwards as the first and greatest homegrown American philosopher,” according to the Yale Divinity School’s Jonathan Edwards Center, “Jonathan Edwards: Biography,” <http://edwards.yale.edu/about-edwards/biography> Yale University, 2006 (accessed December 18, 2007). While Edwards contributed substantially to theological and philosophical reflection on natural philosophy (science), Torrey commented sparsely on the science of his day. Edwards helped define early evangelicalism by defending the rationality and authenticity of the recent revivals. Similarly, Torrey fortified the foundations of evangelicalism by modeling and defending the legitimacy of intellectually responsible revivals.

⁵George W. Pierson, *Yale College: An Educational History, 1871–1921*, vol. 1 (New Haven, CT: Yale University Press, 1952), 69–71. Many of these courses in the senior year were only a few weeks long.

⁶www.yale.edu/chaplain/yalehistory.html (accessed July 30, 2009).

⁷*Ibid.*

⁸R. A. Torrey, *Revival Addresses* (Chicago, IL: Fleming H. Revell, 1903), 149–50.

⁹George M. Marsden, *The Soul of the American University: From Protestant Establishment to Established Nonbelief* (Oxford: Oxford University Press, 1994).

¹⁰*Ibid.*, 126.

¹¹Noah Porter, “The American Colleges and the American Public, Part IV,” *New Englander* 28 (October 1869): 753–60, as quoted in Marsden, *The Soul of the American University*, 126–7.

¹²Staggers, “Reuben A. Torrey,” 45.

¹³Marsden, *The Soul of the American University*, 22–3.

¹⁴Noah Porter, “Herbert Spencer’s Theory of Sociology,” *Princeton Review*, ser. 4, no. 6 (September 1880): 295, as cited in Marsden, *The Soul of the American University*, 131.

¹⁵Staggers, “Reuben A. Torrey,” 51–7.

¹⁶Marsden, *Fundamentalism*, 129.

¹⁷See Biola’s centennial timeline at <http://100.biola.edu/timeline/index.html> for dates and photographs.

¹⁸Cecilia Rasmussen, “Oilman Leaves a Lasting L. A. Legacy,” *Los Angeles Times*, March 2, 2008; <http://articles.latimes.com/2008/mar/02/local/me-then2?pg=2> (accessed July 28, 2009).

¹⁹*Ibid.*, 128.

²⁰Marvin N. Olasky, *The Tragedy of American Compassion* (Wheaton, IL: Crossway Books, 1992).

²¹Christine Rosen, *Preaching Eugenics: Religious Leaders and the American Eugenics Movement* (Oxford: Oxford University Press, 2004).

²²R. A. Torrey, *What the Bible Teaches* (Chicago, IL: Fleming H. Revell, 1898), 1. Emphasis is in the original. In a later Bible study curriculum, Torrey offered the same approach:

“It is the method of modern science; first a discovery of the facts, and then a classification of the teachings,” R. A. Torrey, *Studies in the Life and Teaching of Our Lord* (Los Angeles, CA: Biola Book Room, 1909), i, available at www.freewebs.com/ratorrey/StudiesInTheLife1-140.htm (accessed July 28, 2009).

²³Marsden, *Fundamentalism*, 55–62, 214–6.

²⁴Robert Millikan, *A Scientist Confesses His Faith* (Chicago, IL: American Institute of Sacred Literature, 1923), as cited in Edward B. Davis, “Science and Religious Fundamentalism in the 1920s,” *American Scientist* 93 (May–June 2005): 258. Millikan won the Nobel Prize in physics in 1923, for isolating the electron and measuring its charge. In 1923 and 1924, Millikan used two prestigious award acceptance speeches to communicate to a wider scientifically literate audience a description of the nature of science that is consistent with the one quoted above. In October 1923, he expressed his appreciation to the American Institute of Electrical Engineers for awarding him the Edison Medal, despite the lack of immediate technological significance of his pioneering work with the electron. He remarked:

in behalf of all workers in what is called the field of pure science, all those who are spending their lives in trying merely to ferret out nature’s secrets and to better man’s understanding of her laws, I wish not only to express my appreciation to the Institute for the award, but also to compliment it upon the breadth of its own vision and the service to science which it has done in recognizing before the public the value of this other field. For, in the final analysis, the thing in this world which is of most supreme importance, indeed the thing which is of most *practical* value to the race, is not, after all, useful discovery or invention, but that which lies far back of them, namely, “the way men think” — the kind of conceptions which they have about the world in which they live and their own relations to it. It is this expanding of the mind of man, this clarifying of his conceptions through the discovery of truth which is the immediate object of all studies in the field of pure science. (Robert A. Millikan, *Science and Life* [Boston, MA: The Pilgrim Press, 1924], 2–3)

On page 86 of this 1924 book, Millikan republished the 1923 statement on science and religion that also appeared in his pamphlet *A Scientist Confesses His Faith*, which includes this declaration: “The purpose of science is to develop without prejudice or preconception of any kind a knowledge of the facts, the laws, and the processes of nature.” He indicates that the larger 1923 statement was “published widely in the press of the United States in June 1923,” under the title of “A Joint Statement upon the Relations of Science and Religion by a Group of Scientists, Religious Leaders and Men of Affairs.” This 1923 statement reappeared in *Popular Astronomy: A Review of Astronomy and Allied Sciences* 48 (1940): 425–6, at the end of the article “Astronomy and Religion” by Louise E. Ballhausen — with the journal editor’s explanatory note that its ethos had become “generally accepted by educated, thoughtful persons” — which suggests that many early twentieth-century scientists accepted this characterization of science. The 1923 statement also appeared as appendix A in *The Autobiography of Robert A. Millikan* (New York: Prentice Hall, 1950). Although Millikan’s Nobel Lecture presents

Article

Darwinism, Fundamentalism, and R. A. Torrey

a more nuanced description of the nature of science, it does not conflict with the assessment of science voiced above. Millikan writes,

The fact that Science walks forward on two feet, namely theory and experiment, is nowhere better illustrated than in the two fields for slight contributions to which you have done me the great honour of awarding me the Nobel Prize in Physics for the year 1923. Sometimes it is one foot which is put forward first, sometimes the other, but continuous progress is only made by the use of both—by theorizing and then testing, or by finding new relations in the process of experimenting and then bringing the theoretical foot up and pushing it on beyond, and so on in unending alternations. (Robert A. Millikan, “The Electron and the Light-Quant from the Experimental Point of View,” Nobel Lecture, May 23, 1924, p. 1), www.huwu.org/nobel_prizes/physics/laureates/1923/millikan-lecture.html (accessed December 26, 2009)

In Millikan’s most significant scientific monograph, he offers a similar description of science:

A science, like a planet, grows in the main by a process of infinitesimal accretion. Each research is usually a modification of a preceding [sic] one; each new theory is built like a cathedral through the addition by many builders of many different elements. This is preeminently true of the electron theory. (Robert A. Millikan, *The Electron, Its Isolation and Measurement and the Determination of Some of Its Properties* [Chicago, IL: The University of Chicago Press, 1917], 5)

Curiously, Millikan’s numerous science textbooks are largely devoid of general characterizations of the nature of science.

²⁵Torrey’s critical realism is seen in his characterization of his systematic theology as an “an attempt” at unbiased inductive Bible study (he recognized human fallibility in the interpretive process). Torrey, *What the Bible Teaches*, 1. Another example of his critical realism is found in one of Torrey’s revival addresses from his worldwide tour at the turn of the twentieth century. He presented the basic argument of what C. S. Lewis would later popularize as the trilemma:

There is no question that Jesus Christ claimed to be divine; no competent student will deny that He claimed to be divine. Well, then, He was one of three things; He was either divine, as He claimed to be, or else He was the most audacious impostor the world has ever seen, or else He was the most helpless lunatic the world has ever seen. He must have been one of these three. (Torrey, *Revival Addresses*, 176–7)

This is a historical argument for the reality of Jesus’ divinity. Although Lewis coined the term “trilemma,” the argument itself appears to go back to the patristic period.

²⁶Davis, “Science and Religious Fundamentalism,” 255–9. See also Edward B. Davis, “Robert Andrews Millikan (1868–1953): His Religious Life and Thought,” in Nicolaas A. Rupke, *Eminent Lives in Twentieth-Century Science and Religion*, 2d ed. (Frankfurt am Main: Peter Lang, 2009), 253–74. Davis estimates that Millikan was the second most famous scientist in the United States (after Einstein) in the mid-1920s.

²⁷Higher criticism often aimed to “demythologize” the Bible, which was the attempt to reconstruct Christianity with little or no acceptance of the supernatural actions of God in human history.

²⁸See the classic book on this topic: Peter Lipton, *Inference to the Best Explanation*, 2d ed. (London: Routledge, 2004). For an application of Lipton’s characterization of scientific methodology to contemporary origins issues, see Stephen C. Meyer, *Signature in the Cell: DNA and the Evidence for Intelligent Design* (New York: HarperOne, 2009), 155–9, 343–4.

²⁹Marsden, *Fundamentalism*, 55–62, 214–6.

³⁰Forest Ray Moulton, *An Introduction to Astronomy* (London: Macmillan, 1906), 2. For an account of how the Chamberlin-Moulton “planetesimal hypothesis” temporarily eclipsed the Laplacian “nebular hypothesis” in the early twentieth century, see Ronald L. Numbers, *Creation by Natural Law: Laplace’s Nebular Hypothesis in American Thought* (Seattle, WA: University of Washington Press, 1977), 75–6. Moulton was a prominent astronomer at the University of Chicago and later served as secretary of the American Association for the Advancement of Science, according to the Moulton obituary by F. C. Leonard, *Journal of the Royal Astronomical Society of Canada* 47 (1953): 84.

³¹Forest Ray Moulton, “Astronomy,” in H. H. Newman, ed., *The Nature of the World and of Man* (Chicago, IL: University of Chicago Press, 1933), 3–4. The first edition of this comprehensive science textbook was published in 1926, the second edition appeared in 1927, and the third (and last) “star” edition in 1933. Its preface indicates that the textbook contains the lectures for a “survey course,” offered annually at the University of Chicago, “to a group of selected first-year students of superior intelligence.” The preface also reports that the sixteen authors met as a group over sixteen weeks to review each author’s contribution.

³²William Stanley Jevons, *The Principles of Science: A Treatise on Logic and Scientific Method* (London: Macmillan, 1900), 11–2.

³³Bertrand Russell, *The Scientific Outlook* (London: George Allen and Unwin, 1931), 33.

³⁴Eric M. Rogers, *Physics for the Inquiring Mind: The Methods, Nature, and Philosophy of Physical Science* (Princeton, NJ: Princeton University Press, 1960), 285.

³⁵Eric M. Rogers, Brenda Jennison, and Jon Ogborn, *Wonder and Delight: Essays in Science Education in Honour of the Life and Work of Eric Rogers 1902–1990* (Bristol: Institute of Physics, 1994).

³⁶Torrey, *What the Bible Teaches*, 294–5.

³⁷The term “progressive creationism” was most influentially promoted in Bernard Ramm’s *The Christian View of Science and Scripture* (Grand Rapids, MI: Eerdmans, 1954), a book based upon lectures in Ramm’s 1946–1951 Biola apologetics class.

³⁸For an assessment of Dana’s prominent role in American science, see Numbers, *Creation By Natural Law*, 94–100. For example, Dana was the principal editor of the leading American scientific periodical of the time, *The American Journal of Science and Arts*. Torrey referred to Dana often in his sermons and publications as a friend and as an authority on the harmony of science and theology. For example, in his book that answers the questions most frequently asked

during his revivals around the globe, he cites Dana (and Lord Kelvin) to substantiate the harmony between the order of creation in Genesis and the order established by geology. He also advocated the gap theory (a gap of time between Gen. 1:1 and 1:2) as a way of accepting an old earth, and suggested that the nebular hypothesis gives us scientific reasons to believe in the origin of “light” before the origin of our sun—thus reconciling days one and four of the creation “week” with modern science. R. A. Torrey, *Difficulties and Alleged Errors and Contradictions in the Bible* (Chicago, IL: The Bible Institute Colportage Association, 1907), 29–32.

³⁹James D. Dana, *Manual of Geology*, 2d ed. (1874; reprint, New York: Ivison, Blakeman, Taylor, 1876), 603–4. The identical language appears in the third edition (1880) of this book on the same pages. The final (1895) edition of this book, which was copyrighted in 1894, was Dana’s last major work before his death in 1895. Here he revised and enlarged this section, as we shall see below.

⁴⁰James Dwight Dana, “Lectures on Evolution,” Dana Family Papers, Yale University Library. Dana’s lecture manuscripts are located in box 4, folders 119–26, which are on reel 4 of the microfilm collection of Dana’s papers. On a page just prior to the first lecture, Dana indicated the years he delivered each of his lectures and when he expanded an older lecture into two new ones. Each lecture lasted about sixty minutes according to his notations. When lecture material expanded much beyond this limit, he would split that ancestor lecture into two descendant lectures. Thus, Dana expanded his initial three lectures of 1871 into a total of eight lectures by 1879 (or 1880; there is some ambiguity in his chronological notation). The entire series of eight lectures is continuously paginated, often with letter suffixes appended to page numbers to signify inserted pages in the growing lecture series. In 1883 and 1885, he printed outlines (not complete transcripts) of his eight-lecture sequence. These two outlines are virtually identical, thus indicating the mature and stable nature of their content in the 1880s. He records having delivered these lectures at Yale up through 1890.

⁴¹Dana, “Lectures on Evolution,” lecture seven, p. 74, assesses the state of evolutionary theory in the late 1870s:

The causes appealed to will be found to be insufficient—even including that which has been accepted as so potent—Darwin’s natural selection. But if convinced that natural causes have acted, the review of them will help the open mind to understand how they have acted. This thought is repeated in slightly different language in his 1895 *Manual of Geology*, p. 1034. In lecture seven, p. 85 (the last page of that lecture), Dana writes (my italics are underlined words in Dana’s manuscript both here and in the other citations below):

Natural selection is the survival at least of those that survive, if not of always the fittest; and hence action under this principle has determined through all time, in connection with physiological law, the kind of plants and animals that have survived and that thus have come to live together and make up the various associations of species in this land & over the globe; that is it has determined the faunas and floras of the present and past time. This result, not the *Origin* of species, is the chief result under the Darwinian Principle.

In lecture eight, p. 99, he writes,

But the preeminent importance of the principle of Natural Selection, otherwise called the Survival of the Fittest, in species-making I have questioned. A favorable variation is likely to be perpetuated; and those individuals that cannot adapt themselves to changing conditions or new emergencies are likely to succumb, so that the fittest is most sure to survive and perpetuate its kind. This far the principle cannot be questioned. But this *survival* of the fittest and the *origin* of the fittest are very different subjects.

⁴²Dana, “Lectures on Evolution,” lecture eight, on an unpaginated sheet located between p. 100 and 100A.

⁴³*Ibid.*, p. 100A. Dana was impressed by the non-Darwinian implications of the numerous sudden appearances of biological novelty on the higher taxonomic levels (he refers in this quotation to levels in the vicinity of what we now would call phyla), especially as in the case of what is now called the Cambrian explosion. See also Dana, “Lectures on Evolution,” lecture one, p. 2, in which he considers the possibility of a polyphyletic view of origins in which common ancestry is far from universal, but rather a scenario in which there are separate origins for each of “the seemingly distinct tribes or families of species.” For a recent review of this trajectory of paleontological interpretation, see Stephen C. Meyer, Scott Minnich, Jonathan Moneymaker, Paul A. Nelson, and Ralph Seelke, *Explore Evolution: The Arguments for and against Neo-Darwinism* (London: Hill House, 2007). To visualize this kind of argument, view Illustra Media’s film “Darwin’s Dilemma” (2009).

⁴⁴Dana, *Manual of Geology* (1895), 1032–5, emphasis is in the original. Dana also advocated, as did Darwin, a limited role for neo-Lamarckian evolutionary mechanisms, but concluded that, for the most part, the origin of variation was “without explanation.”

⁴⁵*Ibid.*, 1029–30. See also Dana, “Lectures on Evolution,” lecture one, p. 24A, in which Dana writes,

Agassiz, in view of the evidence, always spoke of the system of progress—which he illustrated in his lectures with great force and enthusiasm—as a development of God’s plan, an expression of the thoughts of God. And yet Agassiz held until his death that species came into existence through special creative acts. All the new facts about the succession of species that geology brought to light in the later years of his life only enhanced to his mind the beauty & wisdom of the divine plan.

Although Dana first delivered this initial lecture of his series in 1871, at least this portion of the lecture must post-date Agassiz’s death in 1873. All of his lectures display numerous revisions and expansions from 1871 to 1890, as he crossed out material, inserted phrases, and added many new paragraphs and whole pages to previous lectures.

⁴⁶*Ibid.*, 1030, emphasis is in the original.

⁴⁷The difference between Agassiz and Dana hinged on the *number* of instances of detectable intelligent causation in nature’s history. See Louis Agassiz, “Evolution and Permanence of Type,” *Atlantic Monthly* (1874), 92–101. Here Agassiz writes,

The most advanced Darwinians seem reluctant to acknowledge the intervention of an intellectual power in the diversity which obtains in nature, under the plea

Article

Darwinism, Fundamentalism, and R. A. Torrey

that such an admission implies distinct creative acts for every species. What of it, if it were true? Have those who object to repeated acts of creation ever considered that no progress can be made in knowledge without repeated acts of thinking? And what are thoughts but specific acts of the mind? Why should it then be unscientific to infer that the facts of nature are the result of a similar process, since there is no evidence of any other cause? The world has arisen in some way or other. How it originated is the great question, and Darwin's theory, like all other attempts to explain the origin of life, is thus far merely conjectural. I believe he has not even made the best conjecture possible in the present state of our knowledge.

⁴⁸James D. Dana, *The Genesis of the Heavens and the Earth and All the Host of Them* (Hartford, CT: Student Publishing, 1890), 46–7. Unlike Agassiz, Dana thought that all non-human species-level differences arose by means of God's general providence over natural variations, rather than by "special divine acts" (p. 18). In this thin monograph, Dana mostly restates what he wrote in his essay "Creation; or, the Biblical Cosmogony in the Light of Modern Science," *Bibliotheca Sacra*, 42 (1885): 201–24, especially on p. 212. Dana did not revoke his assertion of multiple divine interventions in life's history in his 1895 *Manual of Geology*, and so remained what we might call a progressive creationist for this reason and others given in my analysis of Dana.

⁴⁹Dana, *The Genesis of the Heavens*, 45.

⁵⁰Dana, *Manual of Geology* (1895), 1036.

⁵¹*Ibid.* Dana also ends his Yale evolution lectures with this same paraphrase of A. R. Wallace, the co-discoverer of natural selection: Dana, "Lectures on Evolution," lecture eight, p. 125. The actual words of Wallace read, it does not seem an improbable conclusion that all force may be will-force; and thus, that the whole universe is not merely dependent on, but actually *is*, the WILL of higher intelligences or of one Supreme Intelligence.

Alfred Russel Wallace, *Contributions to the Theory of Natural Selection: A Series of Essays* (London: Macmillan, 1870), 368. For a recent treatment of Wallace in regard to his invocation of intelligent causation in biology, see Michael A. Flannery, *Alfred Russel Wallace's Theory of Intelligent Evolution* (Reisel, TX: Erasmus Press, 2009).

⁵²Dana, *Manual of Geology* (1895), 1033–4.

⁵³A quite different argument for the conservative effect of natural selection is well supported today. See Meyer et al., *Explore Evolution*, 90–6.

⁵⁴Dana, "Lectures on Evolution," lecture one, p. 1.

⁵⁵*Ibid.*, p. 10A (there are several pages marked "10A"; this one is two pages prior to p. 11). Dana writes here in his first (1871) lecture in the eight-lecture series,

... the progress of life which geology has brought to our knowledge was essentially a development, I do not say by natural causes, but, somehow a development or evolution, either by natural causes, or by supernatural alone, that is divine, or by the two in conjunction. Which of these three methods is or appears to be sustained by Science will be later discussed.

Judging from his later lectures and published remarks, Dana decided that science supports the third method of evolution (God acting through natural causes and by

special intervention). Dana goes on to say in the next paragraph,

The development, however carried forward, was development *according to a divine plan*. In such a plan there would be order; and a degree of parallelism even with development from the egg should be looked for in view of the comprehensive unity of purpose or law which pervades all nature, and which must pervade the work of an Infinite Creator.

The closing sentence of lecture one, p. 24A, reads,

The question beyond this which we have before us is: Whether progress under this system of development or evolution demanded a divine act in order to pass in each case, the limits of species, or Whether God's Power wrought out the great system through natural law as the expression of His Will.

⁵⁶Initially, based on secondary sources, I had thought that in the 1870s Dana had shifted to an almost completely theistic evolutionary perspective. After examining the primary sources, I was surprised to discover otherwise. I thank Ted Davis for suggesting that I dig deeper into Dana's views on evolution in response to hearing my paper on Torrey at the Baylor University ASA meeting in August 2009. For an overview of Dana's role in promoting the harmony of science and Christianity, see Edward B. Davis, "The Word and the Works: Concordism and American Evangelicals," in *Perspectives on an Evolving Creation*, ed. Keith B. Miller (Grand Rapids, MI: Eerdmans, 2003), 34–58, especially 47–8.

⁵⁷Ronald L. Numbers, *Darwinism Comes to America* (Cambridge, MA: Harvard University Press, 1998), 142.

⁵⁸David N. Livingstone, *Darwin's Forgotten Defenders: The Encounter between Evangelical Theology and Evolutionary Thought* (Grand Rapids, MI: Eerdmans, 1987), 75. Livingstone apparently got this idea, at least in part, from William F. Sanford, "Dana and Darwinism," *Journal of the History of Ideas* 26 (1965): 540–6, which is an article Livingstone cites for other facts. On p. 538, Sanford writes, "It is clear that Dana accepted the cornerstone of Darwinism, natural selection." But on p. 540, Sanford agrees with my analysis of Dana when he writes,

One of the leading objections was the failure of Darwin's theory to explain what it had set out to demonstrate, namely the origin of species. The doctrine of survival of the fittest Dana admitted to be a fact. However, Natural Selection, true to its title, could not satisfy him as to the *origin* of the fittest. If species became fit because they could better adapt themselves to the circumstances in which they were placed, what then determined their greater adaptability? Dana believed that there had to be an inner agent guiding a species through its mutations to the present result.

Stanford cites Dana, "Lectures on Evolution," lecture seven and lecture eight, to substantiate this point.

⁵⁹Dana, *The Genesis of the Heavens* (1890), 56–8.

To the minds of Agassiz and Guyot, thus taught by nature, the hand of God did not appear to be lifted from His works by such truths. They held that the development was carried forward by the Creator, and looked upon each successive species as existing by His creating act. God was not only at the head as the

source of power, but also in every movement, and creatively in each new step of progress.

Dana, a few years prior to giving this *Genesis of the Heavens* lecture at Yale, claimed that Guyot “was led to accept, though with some reservation, the doctrine of evolution through natural causes.” See “Biographical Memoir of Arnold Guyot,” in the *Annual Report of the Board of Regents of the Smithsonian Institution for 1887* (Washington, DC: Government Printing Office, 1889), 712, as cited in Livingstone, *Darwin’s Forgotten Defenders*, 77–8. Livingstone argues here that Dana “was stretching the term ‘evolution’ way beyond its customary limits,” given that Guyot was much more of a progressive creationist than a theistic evolutionist. According to my analysis of Dana’s own use of the phrase “doctrine of evolution through natural causes,” he had in mind something quite different from what we would call theistic evolution. Such evolution had nothing to do with random variations and almost nothing to do with natural selection. Instead, it was a process guided by divine design.

⁶⁰Recent definitions and descriptions of theistic evolution and related views (and snapshots of their history) may be found at www.faithandevolution.org/questions.php and <http://biologos.org/questions> (accessed October 8, 2009). Most commonly today, theistic evolution refers to the belief that God created life through natural selection acting on what scientists detect as “random variations.” Some insist that such variations are only apparently random (as far as science is capable of determining), and that God actually directs the process of evolution. Other theistic evolutionists maintain that God’s sovereign guidance of the course of evolution is minimal or virtually nonexistent (e.g., open theists). Dana held views fundamentally at odds with both of these versions of theistic evolution, while maintaining his position as one of America’s leading advocates of the harmony of science and Christianity during the late nineteenth century. The terms “evolutionary creationism” and “BioLogos” are more recent alternative labels for theistic evolution.

⁶¹Torrey, *What the Bible Teaches* (1898), 294–5.

⁶²Diary of R. A. Torrey, Ephemera of Reuben Archer Torrey Senior, collection 107, box 3, Billy Graham Center Archives, Wheaton College. Torrey notes on July 19, “Finished today the first part of the ‘Descent of Man.’” Darwin’s book is divided into three parts, the first part of which includes up through chapter 7. Chapter 5, “On the development of the intellectual and moral faculties during primeval and civilized times,” is the focus of Torrey’s comments on July 17, 1882. “In chapter 5 of Darwin’s book, we find such jolting statements as: ‘... excepting in the case of man himself, hardly any one is so ignorant as to allow his worst animals to breed.’” The July 18, 1882 diary entry refers to Torrey’s reading of St. George Jackson Mivart, *Lessons from Nature, as Manifested in Mind and Matter* (London: J. Murray, 1876), 82–127.

⁶³Mivart, *Lessons from Nature*, p. 95.

⁶⁴*Ibid.*, 108–9.

⁶⁵Henry White Warren, *Recreations in Astronomy, with Directions for Practical Experiments and Telescopic Work* (New York: Harper and Bros., 1879).

⁶⁶Torrey’s diary entry of Tuesday, July 18, 1882. Richard A. Proctor, *Light Science for Leisure Hours: A Series of Familiar*

Essays on Scientific Subjects, Natural Phenomena (New York: Appleton, 1871).

⁶⁷The greater-God argument attempts to present the God of theistic evolution as greater (compared to the traditional view of the creator) in that he designed things to design themselves. While Torrey occasionally argued against Darwinism in his sermons and books, he considered universal common descent (despite what he took to be its very weak evidential support) consistent with the design argument:

But suppose the doctrine of evolution were true, it would not for a moment militate against the argument from design. If there were originally some unorganized protoplasm that developed into all the forms of life and beauty as we see them today, it would be a still more remarkable illustration, in one way, of the wisdom and power of the Creator, for the question would arise, Who put into the primordial protoplasm the power of developing into the universe [of life] as we see it today.

(Torrey, *Revival Addresses*, 8)

⁶⁸“Dr. R. A. Torrey Replies to Dr. O. E. Brown,” a letter from R. A. Torrey [to the editor, James Gray], October 2, 1925, sent from his South Pasadena home, published in the *Moody Bible Institute Monthly* 26 (December 1925): 161–2. About a year prior to writing this letter, Torrey had resigned from the Biola deanship (effective July 1, 1924) in order to engage in full-time evangelistic work. Torrey repeated this sort of commentary on evolution in his sermon “God is” in R. A. Torrey, *Soul-Winning Sermons* (New York: Fleming H. Revell, 1925), 13:

I gave it up not for religious reasons; I do not know any conclusive religious reasons against it: I gave it up for purely scientific reasons. I gave it up because it was absolutely unproven, and all really scientifically discovered and proven facts were against it instead of for it.

Torrey then also repeats his greater-God escape hatch on p. 14: “If it [evolution] were true it would be in a way a more striking proof of the existence and wisdom and power of God, than if the universe were created outright as we see it today.” He drove the point home by analogy: “Which would be more wonderful, for a man to make a watch today, or for a man to make a second hand with an inherent capacity for developing into a watch?”

⁶⁹“Dr. R. A. Torrey Replies to Dr. O. E. Brown,” 161–2.

⁷⁰*Ibid.* The awkward sentence structure is in the original. James Gray, the chief Moody editor, had published this article three months earlier: “Why a Christian Cannot Be an Evolutionist,” *Moody Bible Institute Monthly* 25 (August 1925): 538–40. On p. 538, Gray defines evolution as “a theory which undertakes to account for, or to explain, the origin and course of the universe independently of God.”

⁷¹Robert Anderson, *A Doubter’s Doubts about Science and Religion* (New York: Gospel Publishing House, 1909).

⁷²The back cover of *The King’s Business* often recommended Anderson’s book in the first two years of this journal’s existence (1910–1911). Beginning with the back cover of the August–September 1911 issue, *The King’s Business* announced the arrival of the “Montrose Library,” a collection of books named after the Montrose Bible Conference facility that Torrey founded in 1908—located in Montrose, Pennsylvania (where Torrey was later buried). Beginning with the July 1913 issue of *The King’s Business*, the

Article

Darwinism, Fundamentalism, and R. A. Torrey

"Montrose Library" was explicitly identified as a collection of resources that "Doctor Torrey says every Christian should own." Torrey had recently taken up the editorial command of *The King's Business*.

⁷³Anderson, *A Doubter's Doubts*, 4.

⁷⁴*Ibid.*, 7.

⁷⁵*Ibid.*, 11.

⁷⁶*Ibid.*, 17–8.

⁷⁷*Ibid.*, 21.

⁷⁸*Ibid.*, 27.

⁷⁹R. A. Torrey, *Practical and Perplexing Questions Answered* (Chicago, IL: Moody Press, 1908), 68–9. This material is a later version of some of the arguments found in his revival sermons, which he published in 1903 midway through his evangelistic crusades on four continents: Torrey, *Revival Addresses*, 5–8. Torrey revised this sermon in Torrey, *Soul-Winning Sermons*.

⁸⁰George T. B. Davis, *Torrey and Alexander: The Story of a World-Wide Revival* (New York: Fleming H. Revell, 1905), 10.

⁸¹Staggers, "Reuben A. Torrey," 197. Staggers cites "A Souvenir of Reuben Archer Torrey Day at the Billy Graham Center," Wheaton College (n.d.), p. 2.

⁸²Torrey, *Difficulties and Alleged Errors and Contradictions in the Bible* and Torrey, *Practical and Perplexing Questions Answered*.

⁸³Orr worked on his Kerr lectures for three years before delivering them in 1891. David K. Naugle, *Worldview: The History of a Concept* (Grand Rapids, MI: Eerdmans, 2002), 7.

⁸⁴Mark A. Noll, *The Rise of Evangelicalism: The Age of Edwards, Whitefield, and the Wesleys*, vol. 1 of "The History of Evangelicalism" (Downers Grove, IL: InterVarsity Press, 2003), 19. See a critique of Noll (specifically, David Bebbington, upon whom Noll leans for a definition of "evangelical") in Richard Turnbull, *Anglican and Evangelical?* (London: Continuum, 2007), 55–89. My definition of "evangelical" takes into account the work of all these scholars.

⁸⁵Naugle, *Worldview*, 17. Kuyper presented a Christian "worldview" in his 1898 Stone Lectures at Princeton University.

⁸⁶Marsden, *Fundamentalism*, 46–7.

⁸⁷"What was Christ's Attitude Toward Error? A Symposium," *Record of Christian Work* 18 (November 1899): 600.

⁸⁸Marsden, *Fundamentalism*, 107.

⁸⁹According to Louis Meyer, the idea of the fundamentals first came to Lyman Stewart in the early 1890s, in a meeting held during the Niagara Bible Conference. Meyer was the executive secretary of the Fundamentals project at this time. Louis Meyer, "The Fundamentals," *The King's Business* 3 (December 1912): 333–4.

⁹⁰Union's capital grew from \$10 million to \$50 million according to "Lyman Stewart," in "Twentieth-Century Great American Business Leaders," Harvard Business School, 2004, webpage: www.hbs.edu/leadership/database/leaders/868 (accessed December 18, 2007). The Union Oil Company of California, later Unocal, was purchased by Chevron in 2005. See "Company Profile: Providing Energy for Human Progress," www.chevron.com/about/leadership (accessed December 18, 2007) and "Unocal Corporation," in "Reference for Business: Company Histories," www.referenceforbusiness.com/history/UI-Vi/Unocal-Corporation.html (accessed December 18, 2007).

⁹¹"A Statement by the Two Laymen," preface to *The Fundamentals: A Testimony to the Truth* 12 (Chicago: Testimony Publishing Company, [1915]), 4.

⁹²Naugle, *Worldview*, 6–13.

⁹³James Orr, *The Christian View of God and the World As Centring in the Incarnation*, Kerr lectures for 1890–1891, 4th ed. (New York: Randolph, 1897), 4.

⁹⁴James Orr, "Science and Christian Faith," in *The Fundamentals* 4, 95.

⁹⁵*Ibid.*, 96.

⁹⁶*Ibid.*, 95–6.

⁹⁷John William Draper, *History of the Conflict between Religion and Science* (London: Henry S. King, 1875) and Andrew Dickson White, *A History of the Warfare of Science with Theology in Christendom* (London: Macmillan, 1896).

⁹⁸Orr cites John Calvin's commentary on Genesis as an example in Orr, "Science and Christian Faith," 97.

⁹⁹*Ibid.*, 101. For a recent, and more sophisticated, exegetical treatment of Genesis 1 that is similar to Orr's, see C. John Collins, *Genesis 1–4: A Linguistic, Literary, and Theological Commentary* (Phillipsburg, NJ: P & R Publishers, 2006).

¹⁰⁰James Orr, "The Early Narratives of Genesis," in *The Fundamentals* 6, 97.

¹⁰¹Naugle, *Worldview*, 15.

¹⁰²Orr did regard evolution limited enough to preclude human evolution:

Certainly there would be contradiction if Darwinian theory had its way and we had to conceive of man as a slow, gradual ascent from the bestial stage, but I am convinced, and have elsewhere sought to show, that genuine science teaches no such doctrine. (Orr, "The Early Narratives," 96)

¹⁰³*Ibid.*, 103.

¹⁰⁴See the chapter "The Eclipse of Darwinism" in Peter J. Bowler, *Evolution: The History of an Idea*, 3d ed. (Berkeley, CA: University of California Press, 2003).

¹⁰⁵Ronald L. Numbers, *The Creationists: From Scientific Creationism to Intelligent Design*, 2d ed. (Cambridge, MA: Harvard University Press, 2006), 33–50.

¹⁰⁶"A Statement by the Two Laymen," preface to *The Fundamentals* 12, 4.

¹⁰⁷Around 1915 *The King's Business* had a circulation of nearly 200,000. See <http://100.biola.edu/timeline/index.html> (accessed July 29, 2009).

¹⁰⁸Stewart to Dr. R. A. Torrey, Montrose, Pennsylvania, August 8, 1912, Lyman Stewart Correspondence, Biola University Archives. Stewart writes,

We trust also that you have been sufficiently impressed with the importance of the work here to be willing to make Los Angeles the center of your work for the balance of your life. We hope, therefore, that you will not feel limited or hampered by reason of the five year clause in the Bible Institute's contract with you.

Later he says,

The facts of our magnificent climate, our fertile soil, our rich mines, our cheap fuel, the superior intelligence of our citizenship, the near opening of the Panama Canal, and the proximity of our Coast to the Orient, insure, we believe, in the comparatively near future, if conditions continue normal, a commercial industrial empire on this coast such as the world has not even dreamed of.

- ¹⁰⁹See www2.biola.edu/kingsbusiness (accessed July 29, 2009) regarding the influence of *The King's Business*. See also Ronald Lora and William Henry Longton, *The Conservative Press in Twentieth-Century America* (Santa Barbara, CA: Greenwood Press, 1999).
- ¹¹⁰Beth Spring and Christianity Today Staff, "Carl F. H. Henry, Theologian and First Editor of Christianity Today, Dies at 90," www.christianitytoday.com/ct/2003/decemberweb-only/12-8-14.0.html (accessed January 14, 2008). See also Kenneth W. Shipps, "Christianity Today (1956–)" in Lora and Longton, *The Conservative Press*, 171–80, which notes that a 1979 Gallup poll found *Christianity Today* to be "the most widely read religious periodical among clergy in the United States." In 1981, the journal had a circulation of nearly 200,000. It fluctuated below this figure through the 1980s and 1990s. For circulation statistics, Shipps refers the reader to the *Christianity Today* Collection, box 4, folder 1, Billy Graham Center Archives, Wheaton College. As of September 2009, *Christianity Today* had a circulation of 140,000 and an online readership of 265,000 unique persons per month (this number exceeds 443,000 if one includes blogs and other domains of the *Christianity Today* website, according to a *Christianity Today* employee with whom I spoke in September 2009).
- ¹¹¹R. A. Torrey, editorial, *The King's Business* 8 (April 1917): 292–3.
- ¹¹²R. A. Torrey, "Is the Bible in Danger," *The King's Business* 8 (April 1917): 297.
- ¹¹³*Ibid.*, 299.
- ¹¹⁴R. A. Torrey, editorial, *The King's Business* 9 (February 1918): 92.
- ¹¹⁵*Ibid.*, 95.
- ¹¹⁶Torrey makes the same points in his 16-page tract, R. A. Torrey, *What the War Teaches or The Greatest Lessons of 1917* (Los Angeles, CA: Biola Book Room, 1918), 9–11.
- ¹¹⁷Stephen Jay Gould, "William Jennings Bryan's Last Campaign," in *Bully for Brontosaurus: Reflections in Natural History* (New York: Norton, 1991), 416–31.
- ¹¹⁸Richard Weikart, *From Darwin to Hitler: Evolutionary Ethics, Eugenics, and Racism in Germany* (New York: Palgrave Macmillan, 2004), 163–5.
- ¹¹⁹Peter J. Bowler, *Charles Darwin: The Man and His Influence* (Cambridge: Cambridge University Press, 1996), 219.
- ¹²⁰Weikart, *From Darwin to Hitler*, 166.
- ¹²¹R. A. Torrey, editorial, *The King's Business* 9 (February 1918): 96.
- ¹²²Weikart's work has sparked historiographic debates that are usefully introduced at www.faithandevolution.org/debates, which includes critical reviews by Jeff Schloss and Sander Gliboff.
- ¹²³Torrey, editorial, *The King's Business* 9 (February 1918): 100. The original is missing the required question mark.
- ¹²⁴Livingstone, *Darwin's Forgotten Defenders*.
- ¹²⁵See, for example, the bestseller, Edwin Black, *War against the Weak: Eugenics and America's Campaign to Create a Master Race* (New York: Four Walls Eight Windows, 2003).
- ¹²⁶Some of Mauro's writings and his only biography are at www.preteristarchive.com/StudyArchive/m/mauro-philip.html (accessed January 11, 2008). Mauro is also remembered for authoring two pamphlets about his experience on the ship *Carpathia* during the Titanic rescue of April 1912.
- ¹²⁷Philip Mauro, "Eugenics" *A New "Movement,"* 2d ed. (London: Samuel E. Roberts, [1912]). The second edition is the only one recorded in *WorldCat* as presently existing – the only copy of which was reportedly located in the library of Reformed Theological Seminary in Jackson, Mississippi. Because this library lost Mauro's anti-eugenics pamphlet, we must infer its message from advertisements in the unpaginated rear sections of *The King's Business* from 1912 to at least September 1914. Mauro later wrote a legal apologetic, *Evolution at the Bar* (Boston, MA: Hamilton, 1922), that *The King's Business* also promoted. As a leading New York lawyer, Mauro might have had exposure to the eugenics movement by 1912 through a Broadway play on the subject that was in the works, and through the many new eugenics publications that were appearing. Also, in 1912, the first international Eugenics Congress was held in London (where Mauro's pamphlet was published), at which American eugenicists played a prominent role. See John G. West, *Darwin Day in America: How Our Politics and Culture Have Been Dehumanized in the Name of Science* (Wilmington, DE: ISI Books, 2007), 125–6.
- ¹²⁸Darwin wrote,
With savages, the weak in body or mind are soon eliminated; and those that survive commonly exhibit a vigorous state of health. We civilised men, on the other hand, do our utmost to check the process of elimination; we build asylums for the imbecile, the maimed, and the sick; we institute poor-laws; and our medical men exert their utmost skill to save the life of every one to the last moment. There is reason to believe that vaccination has preserved thousands, who from a weak constitution would formerly have succumbed to small-pox. Thus the weak members of civilised societies propagate their kind. No one who has attended to the breeding of domestic animals will doubt that this must be highly injurious to the race of man. It is surprising how soon a want of care, or care wrongly directed, leads to the degeneration of a domestic race; but excepting in the case of man himself, hardly anyone is so ignorant as to allow his worst animals to breed. (Charles Darwin, *The Descent of Man* [Akron, OH: The Werner Company, (1874)], 136 of this version of the 2d edition [1874], which is identical to p. 168 of the 1st edition [1871])
The quoted passage is near the beginning of the section of chapter 5 that is entitled "Natural Selection as Affecting Civilised Nations."
- ¹²⁹Indiana passed the first compulsory sterilization law in 1907, which was also the first legislation of this sort in the world. West, *Darwin Day in America*, 87.
- ¹³⁰Mark H. Haller, *Eugenics: Hereditarian Attitudes in American Thought* (New Brunswick, NJ: Rutgers University Press, 1984), 141. On p. 49, Haller also says that by the 1890s, both salpingectomy (cutting and tying of the fallopian tubes) and vasectomy (cutting and tying of the *vas deferens*) were available. These operations sterilized humans without significantly affecting their gender.
- ¹³¹Christine Rosen, *Preaching Eugenics: Religious Leaders and the American Eugenics Movement* (Oxford: Oxford University Press, 2004).
- ¹³²*Ibid.*, 131–2. Rosen cites Fosdick's December 1928 sermon "The Importance of the Ordinary Man," in which he

Article

Darwinism, Fundamentalism, and R. A. Torrey

asserted that people of average capabilities are important to the progress of humanity—a belief repudiated by some eugenicists. On p. 116, Rosen suggests that Fosdick's motivations for joining the AES [American Eugenics Society] are difficult to assess. He made few public statements about eugenics, and those he did were cautious. "Few matters are more pressingly important than the application to our social problems of such well-established information in the realm of eugenics as we actually possess," was a typically restrained encomium. "The failure to do this is almost certainly going to put us in the position of endeavoring to cure symptoms while basic causes of social degeneration and disorder go untouched."

Here Rosen quotes Fosdick in the pamphlet *Eugenics at Work*, 1931, AES Papers, American Philosophical Society Library. Rosen tells us that

Rev. Fosdick's papers, which he deposited in the library of Union Theological Seminary in New York, yield no trace of his participation in the eugenics movement. Fosdick himself prepared the papers for the archives, and as he lived long enough to see eugenics thoroughly discredited, it is possible that he withheld those documents that revealed his participation in the movement. AES papers reveal his participation, however.

¹³³Marsden, *Fundamentalism*, 171. Harry Emerson Fosdick, "Shall the Fundamentalists Win?" *Christian Work* 102 (June 10, 1922): 716–22 is available at *History Matters*, "'Shall the Fundamentalists Win?' Defending Liberal Protestantism in the 1920s," <http://historymatters.gmu.edu/d/5070> (accessed January 11, 2008).

¹³⁴Regarding anti-evolution legislative attempts beginning in 1921, see Edward J. Larson, *Trial and Error: The American Controversy over Creation and Evolution*, 3d ed. (Oxford: Oxford University Press, 2003), 39–49.

¹³⁵See Ronald Ladouceur's "Biology Textbooks before Scopes," www.faultymemories.com/wordpress/?p=552 (accessed October 20, 2009), which cites Ronald P. Ladouceur, "Ella Thea Smith and the Lost History of American High School Biology Textbooks," *Journal of the History of Biology* 41 (2008): 435–71. Leading eugenicists were also among the most active defenders of Darwinism in schools. As John West notes,

In the anti-evolution controversies of the 1920s ... the American Association for the Advancement of Science (AAAS) appointed a special committee to publicly defend evolutionary theory. Its membership consisted of three scholars who were also leaders of the eugenics movement: Charles Davenport, Henry Fairfield Osborn, and Edwin Conklin (West, *Darwin Day in America*, 130).

¹³⁶George W. Hunter, *A Civic Biology: Presented in Problems* (New York: American Book Company, 1914), 261–5. On p. 261, Hunter lists various diseases that are allegedly inherited, including tuberculosis, epilepsy, and feeble-mindedness, "which it is not only unfair but criminal to hand down to posterity." On p. 263, he argues that such people are "true parasites" because they "take from society, but they give nothing in return." Most of those labeled "feeble-minded" at this time would not be considered mentally ill today. See West, *Darwin Day in America*, 123–62, which includes a review of the so-called Kallikak family who are also cited in Hunter's textbook as a feeble-minded lineage on p. 262.

¹³⁷Rosen, *Preaching Eugenics*, 116. See also John M. Bozeman, "Eugenics and the Clergy in the Early Twentieth-Century United States," *The Journal of American Culture* 27 (December 2004), 422–31. Bozeman claims on p. 427 that Fosdick did not contribute anything substantial to the AES's journal and concludes that Fosdick "appears to have lent his name primarily out of his interests in overpopulation and birth control." Consistent with Bozeman's analysis, Rosen, p. 156, reminds us that Fosdick "declared himself an 'ardent advocate' of birth control, and in 1928, preached to an audience of more than thirteen hundred about its benefits."

¹³⁸Ernest R. Sandeen, *The Roots of Fundamentalism* (Chicago, IL: University of Chicago Press, 2008), 243. Torrey retained his Montrose, Pennsylvania, home (at a fundamentalist conference center) as a summer residence when he took the Biola deanship—a position that included summers off so Torrey could engage in evangelism.

¹³⁹W. B. Riley, "The Christian Fundamentals Movement: Its Battles, Its Achievements, Its Certain Victory," Opening address, in *Scriptural Inspiration versus Scientific Imagination: Messages delivered at the Great Christian Fundamentals Conference* (Los Angeles: Biola Book Room, 1922): 7–8. The meetings were held June 25–July 2, 1922.

¹⁴⁰Riley used "geology" to refer to Leuba's "physical science" category and did not mention Leuba's statistics for sociologists and psychologists, which documented even less belief in God and immortality. See the summary of results in James H. Leuba, *The Belief in God and Immortality: A Psychological, Anthropological and Statistical Study* (Boston, MA: Sherman French, 1916), 278. The same table is found on the same page in the second edition (Chicago, IL: Open Court, 1921). The second edition, with only minor changes (and still based on the original survey), appeared just after fundamentalism had become a powerful movement in America. Leuba, on p. 173 of the second edition, notes that his work falsifies the claims of many preachers that "scientists and philosophers, with few exceptions, share with them the 'fundamentals' of the Christian faith." Bringing this assessment up to date, John West writes,

Although theistic evolution receives much attention from the news media, it clearly represents a fringe position among leading evolutionary biologists. Nearly 95% of the biologists in the National Academy of Sciences describe themselves as atheists or agnostics, a far higher percentage than in any other scientific discipline. [Larry A. Witham, *Where Darwin Meets the Bible* (New York: Oxford University Press, 2002), 271–3]

Similarly, according to a 2003 Cornell survey of leading scientists in the field of evolution, 87% deny existence of God, 88% disbelieve in life after death, and 90% reject the idea that evolution directed toward "ultimate purpose." [Cornell Evolution Project Survey]

www.discovery.org/a/10091 (accessed October 8, 2009).

¹⁴¹Riley, "The Christian Fundamentals Movement," 18.

¹⁴²Larson, *Trial and Error*, 43–4.

¹⁴³Martin cites a "Letter from Reuben A. Torrey, Jr., to Roger Martin, October 21, 1966. Roger Martin, *R. A. Torrey: Apostle of Certainty* (Murfreesboro, TN: Sword of the Lord Publishers, 1976), 245 and 249 (footnote 10). Torrey's own address at the Los Angeles WCFA convention included only a brief critical remark about evolution. R. A. Torrey, "The God of the Bible: A Personal God," in *Scriptural Inspiration versus Scientific Imagination*: 84–5. Torrey notes that when evolu-

tionists are asked for the evidence that supports their theory, they reply "all scholars are agreed upon it." But, when one mentions a specific Darwin doubter, the evolutionist will reply, "Oh he doesn't believe in Evolution, therefore he is not a scholar." Regarding "divisiveness and improper spirit," Torrey himself was sometimes guilty of this, according to Lyman Stewart in a letter to Torrey in which he cited Torrey's sermon reference to the Pope as not having "the brains of a chipmunk." Stewart's guests that day reportedly "went away mad, and declared that the Bible Institute and the Church of the Open Door were knockers." Lyman Stewart to R. A. Torrey, August 7, 1920, p. 5, Lyman Stewart Correspondence, Biola University Archives.

¹⁴⁴One of Torrey's earliest publications is an undated 23-page pamphlet that includes a case for inerrancy: R. A. Torrey, *Ten Reasons Why I Believe the Bible Is the Word of God* (New York: Fleming H. Revell, n.d.). In the opening paragraph of this sermon, Torrey indicates that he was a student at Yale "fifteen or sixteen years ago." He completed his Yale seminary degree in 1878, which would place this sermon in the year 1893 or 1894. A shorter version of this sermon appeared in Charles Leach and R. A. Torrey, *Our Bible: How We Got It and Ten Reasons Why I Believe the Bible Is the Word of God* (Chicago, IL: The Bible Institute Colportage Association, 1898). Torrey's earliest book was *How to Bring Men to Christ* (New York: Fleming H. Revell, 1893).

¹⁴⁵R. A. Torrey, *The Divine Origin of the Bible: Its Authority and Power Demonstrated and Difficulties Solved* (Chicago, IL: Fleming H. Revell, 1899), 53–4. On p. 63–4, he indicates his support for the gap theory as a way to reconcile an old earth with Genesis 1, and on p. 68–9, he notes that it is "one of the perfections of the Bible that it was not written in the terminology of modern science," but rather in the ordinary terms of how nature appears to us on earth.

¹⁴⁶Torrey, *Difficulties and Alleged Errors and Contradictions in the Bible*, 11. Much of this is a refined version of material in Torrey, *The Divine Origin of the Bible*.

¹⁴⁷*Ibid.* Although William Herschel discovered Uranus in 1781, fifteen years before Laplace published his first sketch of the nebular hypothesis in 1796, eighteenth-century astronomers had no data as to the direction of Uranus' rotation. In fact, scientists still debate whether Uranus' rotation is direct or retrograde due to the fact that its axis of rotation is within eight degrees of being parallel to its orbital plane. Torrey must have in mind a period of history in which astronomers considered the direction of Uranus' rotation to be *retrograde* and thus (by the standards of that time) anomalous, relative to the otherwise uniformly *direct* (eastward) motions of the rotations and revolutions of the other planets and moons of the solar system, which Laplace had used as evidence for his nebular hypothesis. See appendix two in Numbers, *Creation By Natural Law*, 1977, to read the relevant parts of Laplace's theory.

¹⁴⁸R. A. Torrey, *Is the Bible the Inerrant Word of God, and Was the Body of Jesus Raised from the Dead?* (New York: George H. Doran, 1922), vii. For a recent clarification of the confusion caused by the multiple meanings of evolution, see Stephen C. Meyer and Michael N. Keas, "The Meanings of Evolution," in John Angus Campbell and Stephen C. Meyer, eds., *Darwinism, Design and Public Education* (East Lansing, MI: Michigan State University Press, 2003), 135–56.

¹⁴⁹Charles Darwin to James D. Dana, September 29 [1856?], Dana Family Papers, Yale University Library, microfilm reel 2, box 2, folder 43.

¹⁵⁰Charles Darwin to James D. Dana, November 11, 1859, Dana Family Papers, Yale University Library, microfilm reel 2, box 2, folder 43. John Murray, the publisher of Darwin's *Origin*, officially launched the book on November 24, 1859, by releasing 1,250 copies.

¹⁵¹Torrey's lack of enthusiasm for the Scopes trial may be inferred from several points made earlier. First, Torrey's biographer Roger Martin, citing a letter from Torrey's son, concluded that Torrey withdrew from the WCFA soon after the 1922 Los Angeles meeting, partly because of its overemphasis on fighting evolution. Second, Torrey criticized both the "conservatives" and the "liberals" who were debating the merits of evolution in the early 1920s. Here he especially noted the equivocal use of the term "evolution" — see Torrey, *Is the Bible the Inerrant Word of God* (1922), vii. Finally, in October 1925, a few months after the Scopes trial, Torrey recalled, in a letter to his friend James Gray, editor of the *Moody Bible Institute Monthly*,

Even after I came to believe thoroughly in the Bible, and in its exact interpretation, I was, to a certain extent, an evolutionist. I later, with more thorough study, was led to give up the evolutionary hypothesis for purely scientific reasons.

In that same published letter, Torrey indicated that a fundamentalist Christian could be an evolutionist in at least some sense of the term. Unfortunately, Torrey's diaries from the Scopes period do not exist today, and so we can only infer his lack of support for the fundamentalist attack on evolution from the sources mentioned.



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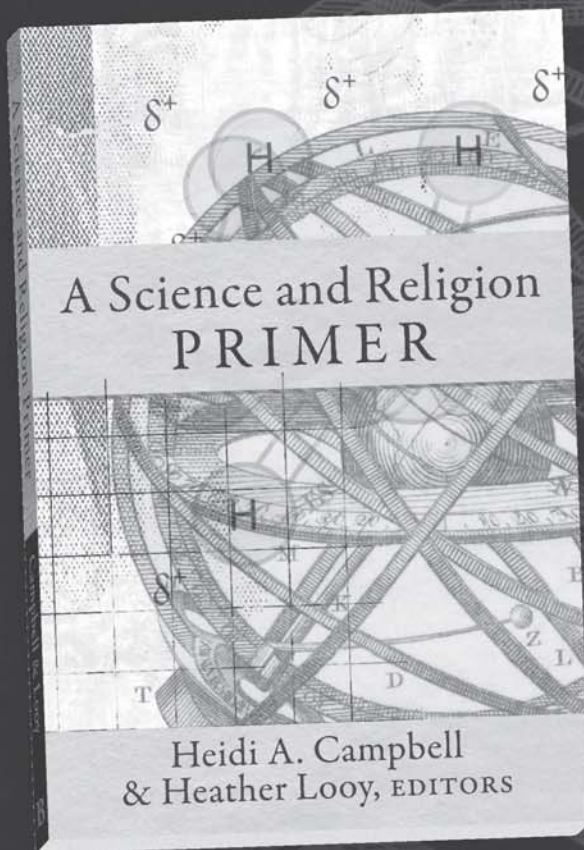
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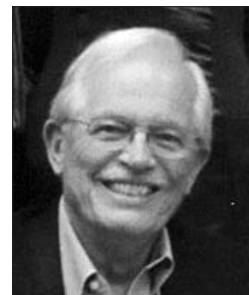
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John J. Compton

Arthur Holly Compton: The Adventures of a Citizen Scientist

John J. Compton

Perhaps one never knows one's parents, really knows them. You never know their early lives and, as a kid, you are living inside your own skin, not theirs. Growing up in Chicago, I never knew my dad was famous. He was just a firm, affectionate, if too busy father figure, who loved music and the outdoors, played tennis better than I could, was awfully good with tools, and could explain scientific ideas so well that I almost understood them. I knew he was a physicist and taught at the University of Chicago, and he and mother often took me on lecture or research trips, but I did not know what it was all about. During the war, when he was one of those in charge of the bomb project and we had moved to Oak Ridge, he was just a hard-working ordinary man doing a war job like everybody else.

August 6, 1945, brought a dramatically different perspective. My father was suddenly a national and world figure. That fall, as I went off to college, I began to hear something of his achievements—not only the bomb, but the cosmic ray studies and the Nobel Prize, with all that they seemed to entail.

That history has been an aura surrounding me ever since. Of course, this was, and is, a matter of much pride; it was also a source of misgiving. My father preceded me everywhere—the unacknowledged “elephant in the room” that opened doors and created expectations. I had to prove myself, all by myself, and I managed to find my own path. But, as I have thought back about it, I seem to have done so in two almost contradictory ways. It is evident to me now that I never did leave my father behind—the issues of his later life, as an interpreter of the philosophical import and social impact of the sciences, became my issues too, and we often had vigorous discussions about them. In this way, he was surely the reason for my going into philosophy. On the other hand, in spite of that inheritance, I have come to see how much of my father remained

hidden from me. Perhaps, out of self-preservation or preoccupation, I did not look closely enough. In any case, I see now how little I ever really knew of what he achieved. What follows is something of what I have come to know of my father's remarkable career. I have called it “The Adventures of a Citizen Scientist,” because his life was truly one adventure after another, propelled by his love for scientific discovery and his desire to be of service to the nation and to humankind.

I

The most powerful evidence of this, of course, came during World War II. In August of 1939, shortly after word reached this country about German work on uranium fission, Leo Szilard got Einstein to send his famous letter to President Roosevelt sounding the alarm. It explained the military possibilities of fission and warned that the Germans were aware of them too. However, responses to the letter by presidential advisors did little to advance the research needed to determine whether atomic energy was likely to be of any use to America in the coming war. Individual scientists were at work in their universities, to be sure, many of them European emigres anxious about the Nazi threat. But there was no high-level government office to coordinate scientific research and development; there was no National Science Foundation, there were no national laboratories. Citizen scientists had to step up. And since its

John J. Compton was educated at the College of Wooster and Yale University, with post-doctoral study at the Universities of Louvain and Paris. Following in the footsteps of his grandfather and father, he has devoted himself to reflecting on the human meaning and the intellectual and moral impact of the sciences. He has been on the faculty of the Department of Philosophy at Vanderbilt University for more than fifty years, teaching and writing on aspects of ethics, metaphysics, the philosophy of science, science and religion, and environmental philosophy. He is now Professor of Philosophy, Emeritus.

Article

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founding, the National Academy of Sciences was the place to find them.

In June 1940, after the fall of France, at the urging of Arthur Holly Compton and his colleagues in the Academy, President Roosevelt created a new governmental entity, called the National Defense Research Committee (NDRC), and named Vannevar Bush, formerly of MIT, as its chairman. Then in April of 1941, Bush asked Compton to chair a special committee from the National Academy—of both engineers and scientific people—to appraise the possible military value of atomic energy.

At the outset, there was universal agreement in the group that uranium fission would eventually prove to be an important source of energy to generate electricity and possibly to power ships and submarines. But, given the scientific and technical uncertainties and the immense anticipated cost of separating the rare, fissionable U-235 from tons of the common U-238, very few believed that it was likely to have any immediate use as a weapon of war. It was Ernest Lawrence, from the University of California, who changed the NDRC's thinking. The new element plutonium (P-239) had recently been discovered in his laboratory, produced from the widely available U-238. Like U-235, it was highly fissionable. By producing plutonium in a large, controlled reaction uranium pile, one could make enough—as little as 100 or so pounds would do—to make a powerful bomb. Lawrence met with James Conant and Compton in our house in Chicago in September of 1941, and, with this new possibility in mind, they determined to urge their National Academy committee to move quickly.

Compton consulted with Enrico Fermi at Columbia and Eugene Wigner at Princeton—they were convinced that the chain-reacting pile would work, and Compton confirmed their calculations. Thanks to Harold Urey's research, new possibilities for large-scale separation of U-235 emerged as well. Whether one used plutonium or uranium, the engineering challenges were going to be daunting. But by late November, the committee was unanimous. They were ready to recommend to Van Bush and the NDRC that a full-scale effort be launched to make an atomic weapon. It might, they said, determine the outcome of the war. Compton delivered their report on November 27, 1941. The NDRC approved it, Bush took it to President Roosevelt, and on

December 6, after consulting with his advisors, the president gave the go ahead. The next day, we were in the war.

The task of developing the plutonium option was put into Compton's hands. And in the fall of 1942, as the army was put in overall control, Compton sought out Robert Oppenheimer to manage the actual bomb construction at Los Alamos, while he gathered the remarkable group of scientists, engineers, and cooperating industrial people, centered at Chicago, in what came to be called the "Metallurgical Laboratory"—later extended to Oak Ridge and Hanford, Washington—that was to explore the fission science and invent the massive technology necessary to produce the plutonium raw material. The uranium option was to be pursued as well. In his National Academy report, Compton had made some estimates of how long it might take to actually come up with a working weapon—between three and five years, he said. The actual time from December 6, 1941, to August 6, 1945, was three years and eight months.

By now, the story is familiar; it has been told by one author after another. The immense scientific, engineering, and industrial challenges were met and the bomb was created and used. In 1956, Compton wrote his own book about it—he called it *Atomic Quest*, and for him that was what it was. In a time of world war and national crisis, he was proud to have been a part of the effort to secure atomic weapons and atomic energy for the United States. To him as a scientist, however, the most decisive moment, among many along the way, was the dramatic experiment that showed that a controlled, nuclear chain reaction was indeed possible and, thus, that the effort to employ such a reaction to produce plutonium on a large scale could proceed.

The experiment was to take place in an abandoned squash court under the west stands of Stagg Field, the University of Chicago stadium (now torn down and replaced with a handsome library). There was a problem, though—for obvious security reasons, Compton could not ask the president of the university, Robert Maynard Hutchins, for authorization to put the critical experiment on the campus. He had to make the decision himself. An attempt was going to be made, for the first time in history, to liberate energy from the atom in a controlled manner. It could quite possibly fail to work. Or

worse: if the reaction were to go out of control, it could result in a disastrous explosion—in the middle of the city of Chicago.

It was a shocking plan, acceptable only from a sense of great urgency to get on with it. But “the Italian navigator,” Enrico Fermi, the genius behind it, had carefully calculated what would happen and was confident that the danger was minimal. He and his scientific crew had for weeks been building the reactor pile, brick by graphite brick, around the uranium core. Cadmium-coated control rods, inserted in the pile, prevented the reaction from taking off. When they were withdrawn, the graphite should capture just enough of the uranium’s escaping neutrons to allow the process of fission to go on, but slowly. Compton checked the calculations himself. It was the morning of December 2, 1942. You need to hear Compton’s own description of what happened next:

We entered onto a balcony at one end of the squash-court laboratory. At the opposite end of the room was the massive pile of graphite blocks, within which the uranium was embedded. On the balcony with us were twenty others, including Fermi. Most of these were engaged in making various adjustments and reading a variety of meters. On the floor below was George Weil, whose task was to handle the control rods. On a platform over a corner of the pile was a group of three men whom we jokingly called “the suicide squad.” It was their responsibility, in case the reaction could not otherwise be stopped, to throw buckets of cadmium solution over the pile. Norman Hilberry was ready with an axe to cut the rope holding a safety rod if the reaction should begin to grow with sudden violence. The door to the balcony was through a concrete wall. A hundred feet further back, behind a second concrete wall, was another group of men, following the course of the experiments by remote control instruments and an intercommunications system. It was their task, if something should happen to those of us in the laboratory beside the reactor, to throw in the “safety rods” by remote control.

Fermi was conducting a systematic series of experiments, reading the meters as the final control rod was drawn out step by step. The results he plotted against his predictions. The data fitted his calculated line with remarkable

precision, showing that as the critical condition for the sustained chain reaction was being approached no detectable new phenomenon was affecting the results ... It was the middle of the afternoon before the preliminary tests were completed. Finally Fermi gave Weil the order to draw out the control rod another foot. This we knew meant that the chain reaction should develop on an expanding scale.

The counters registering the rays from the pile began to click faster and faster until the sound became a rattle. I was watching both a recording meter and a galvanometer. I could see the light from the galvanometer begin to move across the scale. The line traced by the recording stylus was now curved upward. Finally after many minutes the meters showed a reading that meant the radiation reaching the balcony was beginning to be dangerous. “Throw in the safety rods,” came Fermi’s order. They went in with a clatter. The spot of light from the galvanometer moved back to zero. The rattle of the counters died down to an occasional click. I imagine that I can still hear the sigh of relief from the suicide squad. Eugene Wigner produced a bottle of Italian wine and gave it to Fermi. A little cheer went up. Atomic power! It had been produced, kept under control, and stopped.¹

I have heard that story many times. But what amazes me still is not only the achievement of that first controlled reaction, but the fact that Fermi predicted and tracked it with such confidence, and that Compton could, with similar confidence, have calculated that the danger of its turning catastrophic was so slight that he could risk blowing up an entire city.

There was another decisive moment, during one of our rare family vacations in Michigan, when Robert Oppenheimer came to see Compton with the awful anxiety that an atomic explosion might actually fuse atoms of hydrogen in the water, or nitrogen in the air, and engulf the entire globe in a conflagration. He and his team (including Edward Teller) had discovered the principle of the fusion bomb. They almost stopped the entire project in its tracks, until further calculations showed that, under the conditions they envisioned, this horrific outcome would be beyond any reasonable probability. But what an incredible decision to have to make! How could you trust such calculations? How could

Article

Arthur Holly Compton: The Adventures of a Citizen Scientist

you trust yourself? Only, I think, through a kind of faith embedded in science itself. Only if you were part of a long history of experimental work, only if you were someone who had seen, again and again, that the physical world does follow precisely calculable, mathematical laws—and you had strong evidence that you knew what those laws were—could you confidently risk these things. From the time of Newton until the present space age, this is just what being a physicist has meant.

II

It is worth asking, though, what was it in *his* particular history that prepared Compton for this kind of wartime leadership position? For an answer, one has to go back to the decade before the war—to a time when the largest laboratory for studying elementary physical forces and particles was not in some university building, but in the air around us, where strange, high-energy radiation was coming into the earth's surface from outer space. In 1912 in Austria, Victor Hess was the first to identify this radiation when he found his electroscope discharging more rapidly as he ascended in a balloon. No one knew what it could be, and it soon became a focus of international study.

Robert Millikan—then probably America's most eminent physicist—framed the first theory of the origin of this new radiation, which he dubbed "cosmic rays." He called them "the birth cries of the stars," and proposed that they were high-energy light photons, emitted in interstellar space when simple atoms, like hydrogen, fused together to fashion the heavier ones which would, eventually, coalesce into the large celestial objects we see. But there was some counter-evidence to this. A Dutchman, Jacob Clay, found different intensities of cosmic rays at different latitudes, with decreasing intensity near the equator, suggesting that the rays, unlike photons, had electrical charge and were being affected by the earth's magnetic field. As the thirties began, however, Millikan's view prevailed and, according to his own measurements, it seemed to be confirmed.

Enter Arthur Compton, another student of radiation. The enormous penetrating power of some of these incoming rays—with energies far in excess of those normally associated with photons—seemed to him to argue for the charged particle hypothesis. So did Luis Alvarez and Tom Johnson's measure-

ments in Mexico—their results showed that there was a directional effect, more rays coming from the West than the East, which is just what should happen if the rays were positively charged. In order to get a definitive answer to the problem, Compton determined to launch a systematic, world-wide survey of cosmic ray intensities at differing latitudes, from Antarctica across the equator to the Arctic, in every hemisphere, East and West, up the highest mountains and down in the deepest mines. Supported by a grant from the Carnegie Corporation, he organized nine groups of researchers, some headed by his graduate students or colleagues at Chicago, others by colleagues in Mexico, Denmark, India, and South Africa. They were determined, as he put it once, to "decode the mystery of cosmic rays."

It was the scientific adventure of the age—and the largest group of scientific researchers that had ever been assembled on a common project. Why did Compton have the experience to imagine the much larger "atomic quest" later on? Because he had managed this one, what *Time* magazine later called his "cosmic quest." Over a period of two years, the teams covered the globe, packing their ionization chambers and electrometers with them. It was in the name of science, to be sure, but it was equally Indiana Jones—with all its risks. Although they secured the best high-altitude measurements of any, two members of one team lost their lives while climbing on Mt. McKinley in Alaska.

Compton himself climbed Colorado's Mt. Evans, flew in a plane inside the Arctic Circle, and led a group, on pack horse, into the high Andes of Peru and the Himalayas in India. My mother and elder brother went with him on many of these trips, sharing the duties of instrument reading—although I, at the tender age of 4, was left behind. In the course of all his travels, Compton crossed the equator five times. He sent a ship around Cape Horn and put Admiral Byrd in charge of measurements in Little America, and he commissioned a deck officer on a ship of the Canadian-Australasian Line, the HMS *Aorangi*, to carry his instruments from the Northern Pacific, past Hawaii, all the way to Australia and New Zealand.

There was another, lesser but no less fascinating, adventure lodged within this one. In 1932–1933, as the world survey results began to come in, Compton's position appeared to be supported more

and more strongly. There was nearly a 20% variation in cosmic ray intensity from the equator to the poles. Nonetheless, Millikan thought these numbers were inconclusive. His view was that there might well be charged particles near the surface of the earth, but that they were only “secondary radiation,” the product of his photons’ impact on particles in the atmosphere. If only one could get well above the atmosphere, one could tell! Millikan had been sending his own equipment up in airplanes to see whether this secondary radiation fell off with altitude, albeit with only modest success. The debate between the two scientists was played out in several tense scientific meetings and in the press. Cosmic rays had popular appeal.

Just at this point, the officials planning for the upcoming Chicago World’s Fair had an inspiration. They had already contracted with August and Jean Piccard, the Swiss brothers who had pioneered stratospheric balloon flight in Europe, to attempt an ascent during the World’s Fair, highlighting the Fair’s grand theme, “A Century of Progress.” What better strategy than to invite Compton and Millikan to put their competing electroscopes in a new gondola and balloon, this time made in America, and send it up, hoping for a new high altitude record and for cosmic ray measurements that would resolve the famous debate? This would show the world how far American science and technology had come!²

Dow Chemical Company was enthusiastic about showing off its new lightweight magnesium alloy, “Dowmetal,” for the gondola, and Goodyear-Zeppelin wanted to showcase its new rubberized cotton fabric for the balloon. Army and Navy aviators, who had been striving for altitude records themselves, were happy to cooperate as needed. There was even a rivalry with the Soviet Union—their balloonists were about to fly into the stratosphere too. Compton was delighted with the flight prospect and, although Millikan balked at first, he decided to go along. The press had a field day. The *Chicago Daily News* proclaimed, “The Piccard Flight May End Compton-Millikan Debate on Cosmic Ray Properties,” and added that the celebrated debate “may be settled once and for all this summer, the cosmic ray itself acting as referee.”³

When inflated, the Century of Progress balloon was taller than King Kong—more than 150 feet high.

After a long night of waiting for last-minute adjustments, in the early morning of August 5, 1933, a huge crowd watched as the flight took off from the middle of the Fair, in Soldier Field. Because of a contract dispute with Fair officials, the Piccards had bailed out, and it was Air Force Major Thomas Settle at the controls. Then, to everyone’s dismay, only twenty minutes after take off, the balloon came down in the nearby Burlington rail yards. Settle had had to abort because of a failure of a valve in the balloon vent control system. My mother always contended that, in the hasty descent, one of her precious down comforters, used for insulation, had somehow been thrown overboard, but the news accounts never confirmed her complaint! Another attempt, this one successful, was made in late November, but from Akron, Ohio, for by that time the Fair had closed. This second flight did in fact set a new altitude record—61,237 feet. Fair promoters touted the success and the aeronauts were paraded through main streets throughout the mid-West. But the pilots had not attended carefully enough to the scientific instruments, so the scientific rewards were of negligible value. The Compton-Millikan debate was not settled.

Over the next two years, however, as evidence from the world survey piled up, and as other investigators sent up smaller, unmanned balloons, showing that the latitude effect, far from decreasing in the upper atmosphere, actually increased by more than 90%, the scientific community moved decisively to the Compton side. Finally, on January 1, 1936, in a meeting of the Physics Section of the American Association for the Advancement of Science held in St. Louis, Compton wrote the concluding chapter to the drama.⁴

To a packed house, including newsmen, Compton recounted the long history of the investigation of cosmic rays and presented the overwhelming evidence that the primary rays were electrically charged corpuscles—predominantly protons and alpha particles, together with some positive and negative electrons. Directional measurements showed, he noted, a greater intensity of the radiation coming from the direction in which our Milky Way is moving relative to the stars, suggesting that Millikan was right that they come from the depths of space, but he rebutted the photon hypothesis point by point. Millikan attended the session, but made no comment. The January 13 issue of *Time* magazine

Article

Arthur Holly Compton: The Adventures of a Citizen Scientist

put Compton on the cover and commented that “[Although] his was but one of a thousand discourses made last week, ... for most of the audience it marked the end of the ‘mystery’ of cosmic rays, wrote finis to one of the most reverberating scientific controversies of the century.”⁵ Cosmic rays are still avidly studied today, chiefly to explore their detailed composition and their astro-physical origins—now thought to be within exploding supernovae—and to follow their trajectories through the galaxy. The Compton team’s conclusions have held up well.

Then, in the late thirties, Compton organized a number of conferences on cosmic rays, the last of which was held in Chicago during the summer of 1939. Many European scientists were in attendance, among them Werner Heisenberg, the brilliant discoverer of the “uncertainty principle.” But war clouds were on the horizon, and within two years, Compton and he were on opposite sides of the race to build an atomic weapon. Cosmic rays had proved to be Compton’s entry into atomic physics.

III

But how did Compton come into physics in the first place? The story is out of a Tom Swift or Hardy Boys novel.⁶ One could imagine a sketch of the plot on the back dust jacket that would read something like this:

Growing up in a small Ohio town at the turn of the 20th century, a boy becomes fascinated by astronomy and airplanes. Using savings from household chores, he buys a telescope from the Sears-Roebuck catalogue for \$3.95. Builds his own camera and mounts it on nearby college telescope to photograph Halley’s Comet. Makes and flies more than a thousand model airplanes, researching the properties of airfoils. At age 16, using hand tools, constructs and flies in his own 27-ft wingspan, wood and muslin glider with specially designed balancing system. Publishes first article in *Fly* magazine. Aided by older brother, begins experimental physics work on the recently discovered x-radiation while in college. Parents encourage service as missionary. But with their blessing, sees calling in life to serve others through scientific discovery, and follows brother to famous eastern graduate school where he continues x-ray studies. Teaches at a university. Tries industry.

Works for Westinghouse Electric, where he invents sodium vapor lamp now used on highways everywhere. During WWI, works for air force, invents first turn and bank indicator. Yearns to get back to pure research on own projects. Following post-doctoral year at renowned Cavendish Laboratory, becomes chair of little-known midwestern university physics department at age twenty-eight. Ends up making world-shaking discoveries about x-rays. Awarded Nobel Prize for Physics in 1927 at thirty-five.

The story seems incredible, yet it all happened. I almost hate to elaborate on it for fear of diminishing its genuine drama, but I have to dwell a bit on the discovery for which Compton is chiefly known and for which he won the Nobel Prize, the so-called “Compton Effect.”⁷

As one reads the history of science, things often look easy—one result after another, leading up to where we are today. What an illusion! In physics, during the early part of the twentieth century, the reality was a boiling ferment of discovery and extended controversy. And the young Compton was working in the middle of it. What his Compton Effect experiments demonstrated—precisely and for the first time—was Einstein’s conjecture that light is not just a wave, it also comes in “quanta”-like particles. His work provoked a crisis in physics—how, after all, could anything really be both a wave and a particle? Soon the other side of the coin would be turned up as well: seemingly material particles, like electrons, are not just particles, they are waves too! And within a few years, Heisenberg and Schrödinger outlined the synthesis we now call “quantum mechanics,” the most comprehensive, highly confirmed theory of matter and light we have today. No wonder Compton’s work seemed like Nobel material.

To understand what was going on, we have to recall some history. Max Planck had come up with the quantum idea back in 1900. He was studying the radiation emitted by hot, incandescent substances. He saw that the frequencies of such radiation do not range continuously over the spectrum, but are discrete and particular to each substance. The only way to make sense of this, he figured, was to imagine that the excited atoms which produce the radiation must somehow be restricted to certain specific energy states—as he put it, they

must be “quantized.” As a result, he argued, the atoms could only emit or absorb energy in integral multiples of these same unit amounts. He called these bits of energy, “quanta.” This seemed to be what the observations about radiation required.

So began the strange story of the quantum. The idea worked mathematically, but no one, not even Planck himself, believed it was more than a mathematical device, arranged to fit the data. Radiation was a wave phenomenon, and waves and discontinuous bits just do not go together. Somewhat later, however, in 1905, in one of the papers of that “miracle year” of his, Einstein showed that if you really go with Planck’s idea, you can use it to explain a remarkable phenomenon about light, the “photo-electric effect.” You can explain why light waves striking one side of a thin sheet of metal shoot off, not other waves, but electrons, discrete individual particles, from the other side. And shoot them off with an energy precisely correlated with the light frequency you use—just as Planck’s hypothesis suggests might be the case. Maybe light waves could behave like little particles, knocking other particles around! Einstein had formulated a “quantum theory of light.”

But no one believed in Einstein’s light quanta—or “photons,” as they came to be called—any more than they had believed in Planck’s. So the years went by. By the early twenties, physicists had accepted Einstein’s astonishing theory of relativity and even the amazing 1915 theory of gravity, but *no one* accepted his quantum theory of light! Even those, like Niels Bohr, who used Planck’s original quantum idea in creating his own beautiful theory of the planetary atom, did not give any credence to Einstein’s application of it to light. Everyone knew that light really was a wave. Light could be diffracted and polarized and, when two light beams hit each other, they interfered with each other, just like water waves do. Maybe light frequencies just came in “bunches” that were somehow like jolts or pulses, but *never* particles.

In the meantime, the close study of x-rays was advancing apace. No one was completely sure what x-rays were, but they clearly seemed to be waves—high frequency electromagnetic waves, produced in an x-ray tube by a stream of electrons striking a metal plate. Essentially, they were light at frequencies above the visual range. But what were

their specific properties? All through the early 1900s, experimenters played with them, reflecting, diffracting, and polarizing them, filtering them, and sending them through and bouncing them off various substances to see what effects there were. In graduate school and, later, at the Cavendish, Compton was studying these effects. X-rays went right through human bodies, but when they hit metals or crystals, they were found to “scatter” in all directions, much as ocean waves send up spray when they hit a rocky shore. Some observers had found that this scattered or “secondary” radiation did strange things—it seemed to have a directionality to it and, most extraordinarily, to have a different, longer wavelength than the primary rays. What could be going on?

IV

When he arrived at Washington University in the fall of 1920, Compton immediately began a close examination of the question. He relished being on his own. He had gone there, he said, and not to a larger, more eminent institution, precisely so that he could think his own thoughts and pursue his own line of experiments without being unduly influenced by others. He designed his own equipment and blew his own glass for his x-ray tubes. He worked nights, in the basement of the science building, so that the vibrations from student and faculty feet would not disturb his measurements, and my mother often brought him meals. Over two years, in experiment after experiment, he accumulated the evidence he needed: yes, that odd x-ray behavior did take place; the direction of the secondary, scattered rays depended on the angle at which the incident rays impacted a surface; and their wavelengths did increase. He measured these effects precisely. The problem was that nothing in standard electro-magnetic theory “allowed” this to happen. Respectable waves can bounce around, penetrate things, be diffracted, and all the rest, but what makes them what they are, is their wavelength. That does not change.

As one historian put it, it is as if you held up a red rose to a mirror and its reflection turned violet.⁸ This does not happen with visible light—when you look in the mirror you see a red rose. The wavelengths seem to stay the same. But with x-rays, with high frequency light in other words, it *was* happening. Compton tried for months to explain this in terms of wave theory, but finally

Article

Arthur Holly Compton: The Adventures of a Citizen Scientist

gave up and turned to Einstein's idea of light quanta instead. Everything fell into place. You could treat the light quanta just as if they were like little billiard balls, and they could be envisioned colliding with billiard-ball-like electrons on the surface of the target. Just as with the balls on the pool table, what should happen does happen—the collision sends the quantum and the electron in precisely predictable directions, at precisely predictable angles with respect to one another, and with precisely predictable momenta and energies. In the process, you can predict that the light must give up some energy, and should relax somewhat as it bounces off. It should then have a precisely calculable, longer wavelength—just as his observations showed that it did. Theory and experiment were in perfect agreement.⁹

In December of 1922, Compton reported his discovery to the American Physical Society's annual meeting. It so happened that a German physicist, Arnold Sommerfeld, was visiting in the United States and heard the lecture. He wrote in great excitement to Niels Bohr, "The most interesting thing that I have experienced in America ... is a work of Arthur Compton in St. Louis. After it, the wave theory of Roentgen-Rays will become invalid ..."¹⁰ He was right. The word spread through Europe. Sommerfeld named it the "Compton Effect" and put it in his 1923 textbook on quantum theory. It took a few years more, but the proposition that light is both wave and particle was here to stay.

However, during the interval, there was disagreement back in America. Classical electro-magnetism was not going down without a fight. In a lovely confrontation, the work by the little-known young man from the small midwestern university was strongly disputed by the well-known elder statesman from the elite university in the East. Harvard professor William Duane asserted that his measurements failed to accord with those of young Compton. They debated at the next meeting of the Physical Society and exchanged visits to each other's laboratories, but to no avail. At the summer 1924 meeting of the British Association for the Advancement of Science in Toronto, another debate was staged. Afterwards, a friend of Compton's, a distinguished Indian physicist named C. V. Raman, said to him, "Compton, you are a very good debater, but the truth isn't in you!"¹¹ In the end, though, it *was* in him: Duane himself found defects in his own experiments and went on to confirm and refine Compton's results. The two

ended up close friends. This is not always the way science works, but the way it is supposed to.

Arthur Holly Compton did not aim to remake modern physics. He was a smart, ingenious, dirt-under-the-nails experimentalist who never let up. He was too modest when he once wrote to his father that he was just someone who was good at hand-work and "a plain, everyday hard plugger." But he was close. Compton was the polar opposite of an Einstein or a Bohr—he let the experiments guide his thought, not the other way around. And those experiments helped to bring down classical physics and usher in a new era. His later adventures with cosmic rays and plutonium were more public; this adventure was a solitary one.

In later life, he went on to other things—to help his little-known midwestern university begin its journey to national leadership, and to write and lecture on education, religion, and public policy. He was indeed a citizen scientist. He helped win a war and, after it was over, he worked for world peace. NASA named one of its space telescopes the "Compton Gamma Ray Observatory." And there is now a Compton crater on the moon. Much of this will fade from memory. But the "Compton Effect" is destined to live on beyond him—as long as science is done, his "effect" will be there. Not bad for a small-town Ohio boy. ☉

Notes

- ¹Arthur H. Compton, *Atomic Quest* (New York: Oxford University Press, 1956), 141–3.
- ²David H. Devorkian, *Race to the Stratosphere: Manned Scientific Ballooning in America* (New York and Berlin: Springer Verlag, 1989).
- ³Dempster MacMurphy, "Piccard Flight May End Compton-Millikan Debate on Cosmic Ray Properties," *Chicago Daily News*, May 27, 1933.
- ⁴Arthur H. Compton, "Cosmic Rays as Electrical Particles," *Physical Review* 50 (December 15, 1936).
- ⁵"Cosmic Clearance," *Time: The Weekly Newsmagazine* 27 (January 16, 1936): 28–32.
- ⁶James R. Blackwood, *The House on College Avenue: The Comptons at Wooster, 1891–1913* (Cambridge: MIT Press, 1968).
- ⁷Arthur H. Compton, "X-rays as a branch of optics" (Nobel lecture, December 12, 1927).
- ⁸Edmund Blair Bolles, *Einstein Defiant: Genius versus Genius in the Quantum Revolution* (Washington, DC: Joseph Henry Press, 2004), 106.
- ⁹Roger Stuewer, *The Compton Effect: Turning Point in Physics* (New York: Science History Publications, 1975).
- ¹⁰Bolles, *Einstein Defiant*, 102.
- ¹¹Arthur H. Compton, *The Cosmos of Arthur Holly Compton* (New York: Alfred Knopf, 1967), 37.



ENVIRONMENT

THE NATURE OF BEING HUMAN: From Environmentalism to Consciousness by Harold Fromm. Baltimore, MD: The Johns Hopkins University Press, 2009. 288 pages. Hardcover; \$35.00. ISBN: 9780801891298.

Harold Fromm is a literary critic and one of the founders of the ecocriticism school of thought within the Modern Language Association. This book is a collection of his essays that trace the evolution of Fromm's thought concerning the meaning of being human and fully part of the natural world. He draws on everything from evolutionary biology to neuroscience and consciousness studies, to explore the issue of free will as opposed to genetic determinism, spirit as opposed to pure matter, and mind versus body.

Fromm rejects any notion of the social construction of nature and social constructivism, clearly moving toward a fully materialistic view of reality. As he states in his introduction, the essays will describe "ways in which evolution, ecology, the 'environment,' physical matter, the brain, the self, the mind, and culture gradually merge into one protean substance of variable expressibility" (p. 9). Sadly, his bias that religious belief is primitive and naive, a mythology with utilitarian uses that allow us to avoid harsh reality, pervades the book. This limits his ability to draw on rich theological traditions that have struggled with the central issues he addresses.

The early essays in this book are the weakest, and they describe Fromm's discovery of "the environmental" through his encounter with air pollution. They tend to be narcissistic, and rarely show any understanding of the social structures that shape human decisions. For example, he makes no connection between air pollution and his long commute by car to Chicago.

The book becomes more interesting in the following chapters, which comprise overviews of debates among public intellectuals, debates related to humans and nature. Each chapter engages a few key pieces of literature. For example, in one key chapter Fromm addresses Foreman's *Confessions of an Eco-Warrior* and Bookchin's *Remaking Society*, books that represent two streams of early ecological thought—Deep Ecology and social ecology.

Other chapters range from discussions of Leopold's *Sand County Almanac* to the topic of policy and health discussed in three books—*Bodies in Protest* by Kroll-Smith and Floyd, *Thinking Ecologically* by Chertow and Esty, and *Primitives in the Wilderness* by van Wyck—to the issue of animals in the works of Coetzee's *The Lives of Animals*, Peter Singer's *Animal Liberation*, and the work of Elizabeth Costello on animal rights.

Part Two of this book takes on the broad category of "Nature" and Evolution. Essays address the intellectual processes that lie behind the procedures of the sciences, drawing on the works of Levitt and Gross, Sandra Harding, Donna Haraway. The discussion concerns the theme of the nature of rationally situated knowledge, and the social construction of scientific practice. Fromm rejects the notion that science is just one story among

many, and claims that many authors blur the distinction between the fruits of science, the politics of science, and the nature of scientific rationality. The essay that engages the debate between E. O. Wilson's *Consilience* and Wendell Berry's *Life is a Miracle*, clearly shows Fromm's commitment to "objective" science. He embraces socio-biology, and is critical of Berry's perspective and belief that not all can be known.

The issue of nature versus nurture is viewed through the works of Steven Pinker. The progression shows Fromm's increasing commitment to Pinker's position that there is no conductor of the orchestra, but just billions of neurons forming systems that feel like a self. Fromm goes on to try to link the assumption about what it means to be human, to the arts and esthetic evaluations. He draws on the works of Dissanayake, with a Darwinian twist, to suggest that art-inclined individuals survived better than those that did not.

Fromm's thought becomes yet more committed in this direction as he writes of the exhausted fictions of both human-environment separation and the fiction of there being a "soul." His consistent equating of a human-environment dualism with religious belief, all of which is fiction, keeps him stuck in a track. From Emerson to Dawkins, Fromm resonates with works that dismiss the "cheap simplistic supernaturalism that explains nothing beyond human fantasies and desires" (p. 229).

Section Three of Fromm's essays moves on to the challenge of consciousness, arising out of the cognitive sciences and neuroscience. Dealing with the works of Calvin, Pinker, and Barash, he fuses psychology, physiology, biology, and neuroscience with insights from the humanities. His goal is to use this body of work to force his audience to accept "spook-free" explanations of consciousness. Causation is a closed material system with no intervention by "spooks." There is nothing external to our physical selves. Fromm sounds increasingly shrill in his rejection of any self that is other than one constructed by involuntary neurons with vast prehistory that are reformulated by culture. Humans become more and more constrained in their ability to make choices, as Fromm's reflections progress.

Fromm's concluding essay is, "My Life as a Robot," bringing us to the inevitable endpoint of this journey of thought. He demands that we restrict any fantasies we might have about human freedom. Darwinian evolution and behavioral ecology have put to rest any illusions of human autonomy. Yet he struggles with his conclusion. He is caught in socio-biology's problem of not being falsifiable. He admits to skepticism of his skepticism. But he cannot see a way out, and concludes that any so-called spiritual life remains a "self-regarding hoax" (p. 274). We are, in fact, robots who do not have the ability to choose or to will. In reaching this conclusion, he is confronted with reality—how can there be a system of morality, law, and punishment if people are not responsible for what they choose to do? The shallowness of his answer unmasks his unwillingness to wrestle with some of the best theological philosophical thinkers who have faced the question of evil and suffering in the world. Fromm simply concludes that we must punish those who are "bad," such as murderers and terrorists, because to do otherwise would bring about an end to civilized life.

Book Reviews

However, to pretend that those who are punished have chosen to misbehave, is a form of cruelty and denial. Ultimately, he has led us in mental circles.

Reviewed by Janel Curry, Byker Chair in Christian Perspectives on Political, Social, and Economic Thought, Calvin College, Grand Rapids, MI 49546.

DOMINION OVER WILDLIFE? An Environmental Theology of Human-Wildlife Relations by Stephen M. Vantassel. Eugene, OR: Resource Publications, 2009. 208 pages. Paperback; \$26.00. ISBN: 9781606083437.

Instead of proffering a theology of human/wildlife relations as the title suggests, this book is primarily an *apologia* for Christians who hunt, trap, and work with animals. The principal aim of the book is to fend off interference, whether intellectual or vocational, from Christian writers who object to the ways in which humans have traditionally dealt with animals.

Stephen Vantassel's preferred term for such persons is "Christian animal rights activist" or collectively, "the CAR Movement," which perhaps claims too much for the smattering of writers who address such issues. While the Christian intellectual community has responded to broad environmental concerns with numerous books and articles in a field identified as "eco-theology," the field of Christian animal rights has not attained even nominal status as a cottage industry.

Vantassel's contribution is a welcome and important one. As project coordinator for wildlife damage management at the University of Nebraska, he brings the realities of human/wildlife interactions to a discussion that frequently lacks grounding in the real world. One criticism of writers such as Andrew Linzey and Stephen Webb is that they manifest a naiveté regarding ecological and biological realities. Unfortunately, Vantassel seldom delves into real-world examples, and the reader does not encounter a case study until the last third of the book.

Vantassel recognizes that the traditional Christian position (referred to as Dominionism) has been buffeted by serious criticism. He sees little theological or biblical reason, however, to abandon an anthropocentric orientation in which creation exists to serve humans. Humans are ontologically superior, being made in the image of God (the gist of which is left undefined). God intended humans to use the creation, including its creatures, to meet human needs. Vantassel's theological position is in line with the conservative Wise Use movement; the evangelical writer cited most approvingly is Calvin Beisner.

Vantassel suggests that the term Dominionism be abandoned for his own neologism "Shepherdism." As Vantassel states, "Shepherdism is fundamentally related with Dominionism except that Shepherdism avoids the negative stereotypes held against Dominionism, while upholding God's decree that humans maintain their superintendence over animals." The only claims that animals legitimately impose on us are the obligation to preserve kinds (protecting endangered species) and to minimize suffering if feasible under current techniques and technology. Even this latter duty is mild. As Vantassel states, "... in light of Christ's oversight of

the treatment of harvested fish and drowning pigs, it is reasonable to conclude that humans may inflict and/or ignore a fair amount of animal suffering."

While Vantassel voices vague appreciation for the intentions of those within the CAR movement, he is more concerned with deflecting their bolder and more intrusive claims, such as vegetarianism and non-exploitation. His deflection strategy follows two courses: (1) caricaturing their theology; and (2) assessing and countering their biblical and ethical strategies. With a broad brush, Vantassel paints CAR activists as hermeneutically modernist, neoorthodox, and liberal, as well as guilty by association with feminist theologians. Readers interested in an assessment of Christian animal rights theology that is both sympathetic and critical will find the treatment almost entirely slanted toward the latter.

The deeper problem with Vantassel's treatment is that he misses nuances of argument that are truly valuable. To give just one example, Anglican theologian Andrew Linzey quite willingly espouses human uniqueness and superiority. What is innovative about Linzey is the telling twist he makes in the Aristotelian-Thomistic logic, that lesser things exist to serve the greater. For Linzey, Christ taught that the greater serves the lesser, such that human greatness is defined by our role to serve the rest of the creation. This is a valuable insight, even if one stops short of Linzey's vegetarianism and insistence on non-exploitation.

Ultimately, Vantassel's work needs further refinement. He would be helped immensely by wrestling with Christian thinkers such as Holmes Rolston, who expound theocentrism and who understand that this world may be anthropo-apical (i.e., humans have the highest value of any organism in the biotic community), but nevertheless that there are legitimate limits on what may be done to God's creatures, and the uses to which they may be put.

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HISTORY OF SCIENCE

THE AGE OF ENTANGLEMENT: When Quantum Physics Was Reborn by Louisa Gilder. New York: Knopf, 2008. 443 pages, illustrations by author, index. Hardcover; \$27.50. ISBN: 9781400044177.

Quantum physics, despite having been with us now for over a century, continues to mystify and challenge physicists, philosophers, and the general public alike. Gilder's first book offers an accessible and creative unpacking of the origin, development, and reception of some of its central features, while providing intriguing glimpses into the often quirky lives and interactions of many of its developers, emphasizing the thread of "entanglement" throughout. Her explicit treatment of the intrinsic human cultural character of science can help in rejecting positivistic and objectivistic views.

The Age of Entanglement opens with an amusing account of Bertlmann's astonished encounter with the 1981 paper, "Bertlmann's Socks and the Nature of Reality,"

in which John Bell ties together the reliably unmatched footwear of his eccentric colleague with the enigmatic connections found in the quantum world. This narrative also serves to introduce a complementary theme of the book, the curiously entangled lives of quantum physicists throughout the entire twentieth century. From the outset, one encounters Gilder's methodology, as she imaginatively weaves together a believable narrative of dialogue, encounter, and circumstance, taking as her sources existing historical texts, such as letters, memoirs, conference records, journal articles, and biographies, supplemented by her own correspondence with practitioners. Instead of the usual quotes and citations, Gilder's seamless narrative is supported by an extensive 58-page documentation of the origins of words, sentences, or ideas used from these records. No quantum physics knowledge is assumed, and footnotes and a glossary should help reach a broad audience. Fortunately, vague or circular definitions are rare, but saying "electrons [are] electricity-carrying subatomic particles that are a crucial component of all matter" (p. 6) does little to gain the reader's confidence. She does offer welcome help on obscure pronunciations: E. T. H. (p. 32), Blegdamsvij (p. 53), Helgoland (p. 74), Zajonc (p. 309).

Gilder's main thesis is that the recent resurgence of interest in the interpretation of quantum mechanics afforded by new experiments demonstrating entanglement (what Einstein disparaged as "spooky action at a distance"), remains intimately connected to the most basic questions faced by its founders. She therefore follows the entanglement thread through its illustrative history, from long before Schrödinger's 1935 coining of the term, right up to the present. Entanglement is the way in which the parts of a system (e.g., two photons) retain a uniquely quantum-mechanical linkage despite complete isolation from one another, such that the type of measurement performed upon one part is correlated with the results of a measurement done upon the other, even when these are too remote to allow for causal influences. This feature of quantum physics was used by Einstein and others in 1935 to claim it must be incomplete (the famous "EPR paper"). Bell, in 1964, derived an inequality whose violation would entail that either a classical realism of local hidden variables, or the principle of causality, must be false. And in 1981, Alain Aspect's experiment showed precisely that violation, leading most physicists to retain causality and adopt the entangled quantum picture in place of classical realism.

Gilder discusses how quantum physics, unlike classical physics, cries out for interpretation. Sommerfeld is quoted as saying to Einstein, "You know I can only contribute to the technology of quantum theory – you have to create its philosophy" (p. 55), as part of an imaginatively recreated conversation between these two and Bohr as they travel absent-mindedly on a Copenhagen streetcar. Bohr, opposed to reductionism, correctly concludes as they return to their missed stop, "everything does not always boil down to calculations" (p. 58). Throughout the book, Gilder vividly depicts how physicists, the more they learn, truly and deeply grappling with the ideas and realities with which they are faced, are never content to settle for "saving the phenomena"; furthermore, many in the mainstream entertain metaphysical and even theological questions. Gilder details the intricate work

of experimental physics as well as how, in gatherings of physicists, the scheduled talks are far outweighed in value by the unplanned conversations.

The essentiality of unique personal interactions can be seen throughout the history of the subject. Joviality, camaraderie, teachability, drive, deference, trust, competition, adventure as well as longing, jealousy, loneliness, suspicion, desperation, racism, stubbornness, and war all feature to varying degrees; even adultery, murder/suicide, abortion, and kidnapping appear. Gilder's detailed narrative is chock full of anecdotes which can at first appear marginal, but are later revealed to be entangled with the tapestry. Her prose often waxes poetic, with delightfully creative turns of phrase, metaphors, or alliteration: "... in a manner palely reminiscent of [Jauch's] old teacher Pauli" (p. 245) and "web of experimentalists who wanted to work with entanglement ..." (p. 275).

A few physics errors reveal the author's nonphysics background, but these do not detract from the story and likely annoy only physicists. (Two examples: she refers to Planck's solution of "the ultraviolet catastrophe" for "light in a box" [pp. 26f.] while the essential point of a black box and the simple nature of the catastrophe are entirely missed; and she says, "an electron ... changes its speed [by] turning" (p. 33), whereas "speed" should be "velocity.") I have begun a collection of errata at www.csc.twu.ca/sikkema/gilder in hopes that a future edition can be cured of these blemishes. A glaring omission is the entire concept of decoherence, which has, for almost the past two decades, also played a central role in the classical/quantum interface (e.g., wavefunction collapse).

I highly recommend the book to anyone seeking a novel account (pun intended) of many of the questions of quantum physics.

Reviewed by Arnold E. Sikkema, Associate Professor of Physics, Trinity Western University, Langley, BC V2Y 1Y1.



MATHEMATICS

NAMING INFINITY: A True Story of Religious Mysticism and Mathematical Creativity by Loren Graham and Jean-Michel Kantor. Cambridge, MA: Harvard University Press, Belnap Press, 2009. 227 pages, notes. Hardcover; \$25.95. ISBN: 9780674032934.

Loren Graham is a specialist in the history of Russian science who has written many books and articles on the subject. One such book, *Science and Philosophy in the Soviet Union*, was a finalist for a National Book Award. One of his most recent books is *Russian Religious Mystics and French Rationalists; 1900–1930*. Jean-Michel Kantor is a French mathematician whose main interest is topology, and he is a popular writer on science. His website details his interest in the *diffusion* of science. (I will use G-K for the book's authors.)

As students of mathematics we invariably confront infinite sets. We learn about the natural numbers 1, 2, 3, 4, ..., but, early on, we form the infinite set, {1, 2, 3, 4, ...} where we complete the formation of natural numbers in

Book Reviews

our minds and append the ellipsis with the symbol } to form the set, N , of all natural numbers. Continuing this process, we study and name the following infinite sets: the set Z of integers, the set Q of rational numbers, and in an explosive burst—to include the set A of all algebraic numbers, and the set of all transcendental numbers, T , finally arriving at the set of real numbers, R , so familiar to scientists today.

In a similar way, we form the set of all US states, and we say that the cardinal number of this set is 50. But since mathematics is the science of the infinite, we dare to take the position that *every* set should have a cardinal number and that sets have the same cardinal number if, and only if, they can be put into one-to-one correspondence.

In 1873, the German mathematician Georg Cantor published a paper in the *Crelle Journal* which proved that the set R of the *continuum* of real numbers is non-denumerable; that is, there is no one-to-one correspondence from the set N to the set R . Furthermore, he proved that there is a one-to-one correspondence between R and the set of all subsets of N . Cantor named the cardinality of the natural numbers N_0 and the cardinality of R by the German letter c and later also by 2^{N_0} .

Later, in his now famous speech given to the International Conference of Mathematicians at Paris in 1900, David Hilbert posed as his first problem (of 23) whether there are any nondenumerable sets whose cardinal numbers lie between N_0 and c . He proposed the name N_1 , for the first such, the name N_2 for the second such, and so on. The Continuum Hypothesis is that $N_1 = c$.

As is obvious from the following quotation, this book breaks some new ground in the way that this history of mathematics is written.

This book is devoted to a little known but exemplary episode in the recent history of the relationship of mathematics and religion, all within the context of much larger issues of religious heresy, rational thought, politics, and science. It is intended for general readers, although we hope that mathematicians will also find it worthwhile. It is the story of an initial breakthrough by a German mathematician (Georg Cantor), that was picked up and developed further by the French, who eventually stalled, but who taught the new development to Russian mathematicians; the Russians then returned to their homeland to push onward to a fundamental insight.

At the center of the story is an encounter at the beginning of the twentieth century between mathematicians on set theory and the religious practices of the heretical Name Worshipers in Russia. Set Theory was, at first, developed in France but then underwent a profound crisis, only to have the Russians enter the scene with new energy. We will describe how two different states of mind connected with two different cultural contexts led to contrasting results; French skepticism and hesitation, Russian creativity and advancement. A central idea of this book is that religious heresy was instrumental in helping the birth of a new field of modern mathematics.

I suggest that the book is *multidimensional* in its treatment of the various topics it considers. I shall discuss a few of its dimensions.

- **A Comprehensive Look at the Personalities.** There are deep and detailed biographies of some of the mathematicians featured, which include their family history, their education, their personalities, their mathematical work, their foibles (including sexual preferences and practices), their illnesses, their psychological struggles, and the untimely deaths of some of them.
 - **The Set-Like Structure of the Book.** The first set of importance is a singleton consisting of the German Georg Cantor, the second set is a singleton consisting of the German David Hilbert. The third set is a trio consisting of the French mathematicians René Baire, Emile Borel, and Henri Lebesgue, while the fourth set is a trio of Russian mathematicians consisting of Pavel Florensky, Fedor Egorov, and Nicholi Luzin. There is another set of 661 monks who stated that they did not support the doctrine of "Name Worship," and another set of 517 monks living in the same monastery who supported the doctrine and also declared that they would remain there till death.
 - **Pictures and Illustrations.** The book features a gallery of some thirty-six illustrations which are scattered in the commentary. Yes, the gallery includes formal pictures of the mathematicians who played important roles in the story, including an unflattering picture of the villain in it. But there are several other photographs which will be of interest to the reader. One is a photograph of the St. Panteleimon monastery on Mount Athos in Greece; another, the buildings of the Moscow State University where the mathematics seminars were held. There is a picture of Egorov's gravestone in Kazan, the city where he was exiled, and also a sketch of the genealogical chart of the Moscow School of Mathematics.
- For first-time readers, it may be helpful to view this gallery of photographs as one begins to read the book. Each photograph plays an important role in this gripping story. I found that I returned to the gallery again and again, since it contributed much in making the story come alive.
- **Worship and Prayer.** An important entity which plays a pivotal role in this history is the famous Jesus prayer, *Lord Jesus Christ, Son of God, have mercy on me, a sinner*. As practiced in the Eastern Orthodox tradition, it is intended as a way to obtain quietness and peace, by physical and mental fusion with God, by combining hundreds of repetitions of short sequences of the same words. There are three stages of immersion in praying this prayer. First, the words are intensely heard by the worshiper. Then the prayer enters the mind of the believer, making the mind cling to the words so that the worshipers find themselves in the presence of God. Finally, the prayer goes to the heart of the worshiper, giving illumination, with the result that the person achieves a oneness with God.
 - **Heresy and Controversy.** Now comes the controversial part. Does the name *Jesus Son of God* become identified with God through this fervent worship? The Eastern Orthodox Church has always said "No!" to this question and has declared that this view of the Name Worshipers is heretical. The Name Worshipers, including theologian-mathematician Pavel Florensky and mathematician Dmitri Egorov, believed "Yes."
 - **Historical Contrast.** The authors add the most important dimension to the story by describing a historical event:

the French trio in their choices and practice of mathematical work proceeded in another direction from that of the Russian trio. The result was that the French did not continue to contribute to the deciding of the Continuum Hypothesis, whereas the Russians became enthusiastic participants in such research.

- **Philosophical Explanation.** Now comes the interesting part of the book. The reason given by G-K that the French trio changed the direction of their research is that they began to see that the problem posed by Hilbert was very hard and required new techniques in defining uncountable subsets of reals numbers. True, they had decided to use the context of Axiomatic Set Theory, ZF, as developed by Zermelo and Fraenkel for their work. After becoming aware of the hidden assumptions they had made in their arguments, and on hearing about some of the possible paradoxes in Axiomatic Set Theory, they lost their verve and nerve for the problem, and expressed such publicly. Graham and Kantor attribute the Frenchmen's judgment to their *rationalism* as developed by René Descartes, and also to the philosophy of Auguste Comte known as *positivism*. Thereafter, they discontinued their work on the problem.

The Russian trio consisted of two Name Worshipers, Florensky and Egorov, and a third member, Luzin, who had often traveled to France and was aware of the work of France's prominent mathematicians. G-K document the fact that Luzin was at a low point in his life. He had lost his zest for mathematical research. Notwithstanding, he read the theology of Florensky as found in his now famous work, *The Pillar and Ground of the Truth*, and in the manuscript for *Holy Renaming*. Along with this, his letters show that he read Plotinus and William James. The result was that he became a Name Worshiper! Because of his conversion, he discerned the value of *naming* certain uncountable subsets of real numbers, and of proving theorems about them. By doing so, he created the area of mathematical research called Descriptive Set Theory. G-K summarize their historical findings in the following quotation.

The Russians who developed descriptive set theory and assigned names to subsets of the continuum posed the possibilities of the existence of new entities in the mathematical universe, and they went on to provide a program for future research which resulted in substantial agreement of mathematicians all over the world about the new entities. That achievement might have occurred without the inspiration of a religious heresy, but as researchers loyal to the historical record, we maintain that the way it actually happened was within a context of mystical, Name Worshiping stimulation. (P. 192)

This book will take mathematicians and interested scientists on a fast-paced, intriguing, challenging but enjoyable journey. Graham and Kantor have indeed told a true mathematical story with a well-documented interpretation, a Russian view of the infinite in mathematics. I predict that readers of this book from the ASA community will find it a terrific read. Furthermore, I believe that some scholars in this Christian community might want to discuss, analyze, criticize, or amplify the argument of this well-written book. Theologians who read the theological essays of Florensky will better understand some fundamental doctrines and practices of the Eastern Orthodox

Church of the early twentieth century, doctrines which will benefit us today.

I will give Pavel Florensky the final word. What follows is a quotation from his book, *The Pillar and Ground of the Truth*. Maybe this theological statement is what the Russian mathematician Nicholi Luzin needed to read!

Neither "the contradictions of the Holy Scriptures and the dogmas" nor "spiritual illuminations" contain anything absurd and therefore if both an honest rationalist and an honest mystic refer to them they do in fact exist. But that which is a contradiction, and an unquestioned contradiction, for the *ratio*, stops being a contradiction at the highest level, is not perceived as a contradiction, is synthesized. And then, in a state of spiritual illumination; there are no contradictions. Therefore, there is no need to try to convince a rationalist that there are no contradictions: they exist, they are unquestionable. But a rationalist must believe a mystic when the latter states that the contradictions turn out to be a higher unity in the light of the Sun that does not set, and then they precisely show that the Holy Scriptures and the dogmas are higher than fleshly rationality, and thus could not be thought up by man; i.e., are Divine. (P. 358)

Reviewed by Paul J. Zwier, Professor of Mathematics, Emeritus, Calvin College, Grand Rapids, MI 49546.



ORIGINS & COSMOLOGY

CREATION OR EVOLUTION: Do We Have to Choose? by Denis Alexander. Oxford: Monarch Books, 2008. 382 pages, notes, index. Paperback; \$18.99. ISBN: 9780825462924.

Denis Alexander is well known to the ASA, as editor of *Science and Christian Belief* and director of the Faraday Institute for Science and Religion. He has led a distinguished career as a research biologist, including leadership of the Molecular Immunology Programme at the Babraham Institute in Cambridge. In *Creation or Evolution*, he offers a clear and compelling case for theistic evolution, the view that God used evolution to bring about all the species on Earth, including humans. This is one of several recent books on evolution for evangelical audiences, four of which were reviewed by Bethany Sollereder in the March 2009 issue of *PSCF*.

Alexander begins by discussing principles of biblical interpretation and the doctrine of creation. This is an excellent approach for his predominantly evangelical audience since it addresses faith concerns first, rather than diving straight into the scientific evidence. These chapters are full of biblical references, including examples of biblical characters who interpreted God's word literally and were mistaken (consider David's response to Nathan's rebuke, or Nicodemus's response to Jesus).

Chapters 3-5 provide an excellent summary of scientific evidence for evolution, at a level accessible, although challenging for readers who have not had college science. He briefly reviews the evidence for great age, but quickly

Book Reviews

moves on to fascinating details of fossils, genes and development, the many types of mutation (from point mutations to chromosome fusions), and the interplay of environmental pressures and adaptation. He includes a variety of excellent examples, from retroviral insertions to “ring species,” which allow scientists to study speciation processes as they are happening. Anyone but an expert will learn some fascinating science from the examples Alexander provides.

In chapter 6, Alexander responds to some common objections to evolution, both scientific and theological. In chapter 7, he returns to biblical interpretation, this time focusing on Genesis 1 and its meaning for us in light of Ancient Near Eastern cosmology. Chapter 8 is an interesting historical review of the church’s response to evolution, including Warfield, Orr, and Wright who wrote positively of evolution in *The Fundamentals*, while critiquing the unfortunate atheistic and other baggage it has acquired.

Chapters 9–13 tackle human origins—the biblical account of Adam and Eve, the fossil and archeological evidence for hominids, the genetic evidence for common ancestors with apes, and the theological issues of death before the Fall, pain and suffering, and original sin. He centers the discussion on five interpretative models of Adam and Eve, ranging from an ahistorical parable meant to teach eternal truths, to the miraculous creation of two ancestors of humanity 10,000 years ago. This is a useful device for giving readers a range of options, although some of the options receive little attention in favor of his working hypothesis: that the human race began about 200,000 years ago, but Adam and Eve were a pair of Ancient Near East farmers living about 10,000 years ago.

When discussing the difficult faith issues, Alexander digs into the Bible, reviewing many relevant passages. At times, it would have helped to hear more about the theological positions Christians have historically held on issues such as the transmission of original sin and the soul. His discussion of pain and suffering is compassionate and pastoral.

Chapters 14 and 15 are a response to intelligent design (ID), critiquing both the scientific and philosophical arguments. Supporters of ID probably will not feel that Alexander has addressed some of their best recent arguments; however, it is clear that Alexander has read several ID books and articles and is replying thoughtfully to the arguments presented there. The final chapter, 16, tackles the wide-open research area of how life first arose on the early Earth. While acknowledging that the gaps in our scientific knowledge are far greater than what we know, Alexander has no theological trouble with origin of life research. He writes, “In none of this account have we been talking about ‘blind natural forces.’ ... These are God’s chemicals and God’s molecules that we are talking about.”

Alexander’s stated goal is to promote dialogue, to help Christians learn to disagree in a loving way without adding to the Gospel. We highly recommend it for consideration by Christians who are open to an old earth but are unsure about evolution, and as an excellent resource (especially with its extensive endnotes and use-

ful index) for Christians who accept evolution as the means God used.

Reviewed by Loren Haarsma and Deborah Haarsma, Physics and Astronomy Department, Calvin College, Grand Rapids, MI 49546.



PHILOSOPHY & THEOLOGY

CREATING SCIENTIFIC CONCEPTS by Nancy J. Nersessian. Cambridge, MA: The MIT Press, 2008. 272 pages. Hardcover; \$32.00. ISBN: 9780262141055.

Perhaps it has almost become a truism that scientists access and understand the phenomena they study, through models. Nersessian’s book adds to the growing literature on model-based reasoning and gives a plausible, explicit account of such reasoning.

In chapter 1, she lays out her basic approach, combining methods from both historical and cognitive science research. A key assumption of her approach to model-based reasoning is what she calls the continuum hypothesis: scientific reasoning developed out of ordinary cognitive capacities and reasoning. Many readers will be sympathetic to this continuum hypothesis, and recognize that it contrasts sharply with the old positivist picture of scientific reasoning, which tried unsuccessfully to find some special criteria demarcating scientific reasoning from ordinary reasoning that we apply in everyday life situations.

What is characteristic of scientific reasoning, in Nersessian’s view, is that scientists employ specialized knowledge, which the nonscientist generally does not possess, to carry out mental simulations—manipulations of mental models, such as running the workings of a proposed device in the imagination over and over again, varying the parameters. But even this sophisticated form of simulation is a refined or augmented version of a basic cognitive capacity that we use in everyday life.

Nersessian marshals much evidence in favor of her core thesis, that scientists use the ability to imagine and manipulate mental models in their research. Chapters 2 and 3 describe two case studies (Maxwell’s papers on electrodynamics and an explicit reasoning experiment on a spring oscillation problem, respectively), while she discusses the cognitive science literature on the subject in chapter 4. Perhaps the most important conclusion that she draws from this evidence is that scientific reasoning and inference draw more on model manipulation than on the manipulation of propositions following fixed rules (e.g., deductive or inductive logic). Although this conclusion runs against the grain of a core assumption of much analytic philosophy—that mental contents and manipulations are primarily matters of operations on propositions or proposition-like statements—her case seems quite persuasive, that mental models not reducible to propositions are a key feature of the scientist’s reasoning toolkit. I find this emphasis on exploring nonpropositional forms of knowledge in scientific reasoning helpful, because not everything we think, do, or say is either propositional or the result of manipulating propositions.

The core of Nersessian’s view of model-based reasoning is presented in chapters 4 and 5, while chapter 6

applies the model to the formation and revision of scientific concepts. The key idea in the latter is that the scientist's manipulation of models—while paying attention to the various constraints implied by the models, as well as the affordances or windows to understanding the models give—is the basis for creativity in exploring new concepts and producing conceptual change. Readers interested in these questions will find it instructive to compare her view on conceptual change with that of Kuhn. Both give insightful discussions of how scientists can ground their conceptual shifts in reason without being beholden to the more wooden picture of rationality characteristic of positivist philosophy of science.

Depending on background, some readers might be nervous that Nersessian sometimes adopts typical cognitive science and neural science language that has reductionistic overtones. However, I think one can profitably read her book as expressing the more circumscribed idea that some cognitive centers of the brain are involved in scientific reasoning, without committing oneself to any reductionist thesis. Other readers may worry that the representational epistemology that Nersessian uncritically adopts may introduce distortions into her account of model-based reasoning (e.g., those who have read Charles Taylor's mammoth *A Secular Age*). Here, it is helpful to keep in mind that she explicitly restricts her view of model-based reasoning to the construction and manipulation of models in scientific contexts, in which a representational epistemology perhaps finds its highest degree of plausibility and appears least problematic. However, her view does not automatically imply that all human cognitive function—particularly our everyday copings—is representational. Indeed, it is helpful to have a cognitive scientist arguing strongly in favor of a thesis that model-based scientific reasoning is not “all in the head,” but draws substantially on those affordances and constraints that the environment of the laboratory—telescopes, computers, and even our bare hands—give us (so-called extended cognition).

On the whole, Nersessian presents a balanced, thoughtful treatment of model-based reasoning, concept formation, and change that is focused on her narrow (but important!) target of scientific practice. The ultimate plausibility of her own model of this process will depend on the incoming evidence and interpretation of that evidence as is always the case in science.

Reviewed by Robert C. Bishop, John and Madeleine McIntyre Endowed Professor of History and Philosophy of Science, Physics Department, Wheaton College, Wheaton, IL 60187.

THE OPEN SECRET: A New Vision for Natural Theology by Alister E. McGrath. Oxford: Blackwell Publishing, 2008. 372 pages, including bibliography and index. Hardcover; \$99.95. ISBN: 9781405126922.

William Alston defined natural theology as “the enterprise of providing support for religious beliefs by starting from premises that neither are nor presuppose any religious beliefs.” Since the beginning of the Enlightenment, natural theology has primarily taken the form of efforts to prove God's existence by an appeal to the natural world. McGrath rejects the enterprise that Alston sets forth in his

definition, and proposes a new approach that he hopes can revitalize natural theology. Although McGrath is uncomfortable with radical postmodernism, he offers what is essentially a postmodern perspective, arguing that nature is not self-interpreting, but that, if one starts from an interpretive framework based on Christian principles, nature can speak richly of God.

The Open Secret is organized into three parts. The first argues for the ubiquity of the human search for transcendence, and positions natural theology as a systematic way of undertaking such a search. In the second, McGrath attempts to lay a Christian foundation for his new approach, arguing for the ambiguity of nature, the sterility of the Enlightenment approach, and articulating a framework of Christian belief that can inform one's perspective on the natural world. The last part discusses what his approach to natural theology offers toward understanding how we are to think, feel, and act toward nature. He organizes his conclusions by means of the Platonic triad of truth, beauty, and goodness.

The second part is the strongest. McGrath makes a compelling case that nature is not self-interpreting and thus lends itself to many interpretations. Hence the Enlightenment approach is a dead-end; his exposition of its methodology and ultimate failure is clear and insightful. McGrath's formulation of a set of foundational Christian principles for interpreting nature is trinitarian and incarnational, and rightly insists that any Christian interpretation of nature be rooted in the person of Jesus Christ.

Part III provides the bottom line; this is where McGrath discusses the kind of fruit that might reasonably be expected from his new approach, by focusing on a few big-picture issues. The chapter on truth provides two examples, the anthropic principle and the so-called “unreasonable effectiveness of mathematics in the physical sciences.” McGrath's foundational principles lead one to understand these phenomena as expressions of God's orderliness and providential care for his creation. The chapter on beauty affirms that the beauty of the natural world points us to the beauty of God, and that natural theology must not be so propositional that it neglects affective dimensions. The chapter on goodness offers a thoughtful discussion of the persistence of the concept of natural law and the difficulties it encounters, especially in the light of natural evil.

McGrath's approach awakens the hope that the post-modern recognition of the centrality of interpretation could breathe new life into an ancient but languishing discipline. McGrath is indeed breaking new ground by applying this insight to natural theology, and for that he is to be commended. Unfortunately, however, all of the insights offered in the third part have been thoroughly discussed elsewhere; while his “new vision” provides a helpful way to synthesize some existing understandings, it does not add to them. *The Open Secret* may indeed revitalize natural theology, or it may represent an interesting idea that ultimately proves to be relatively fruitless. Until we see whether it leads to some significant new insights, it will not be clear which it will be. There are many questions at the interface of science and religion that involve interpretation. It would be a

Book Reviews

worthy scholarly endeavor to apply McGrath's approach to some of these questions.

Reviewed by James Bradley, Professor of Mathematics Emeritus, Calvin College, Grand Rapids, MI 49546.



RELIGION & SCIENCE

QUANTUM GODS by Victor J. Stenger. Amherst, NY: Prometheus Books, 2009. 292 pages. Hardcover; \$26.98. ISBN: 9781591027133.

Victor Stenger's latest book is a follow-up to his 2007 book, *"God: The Failed Hypothesis,"* and it probably does not have much new that Stenger has not written before. In the preface, Stenger says he will concentrate on disproving two concepts:

Quantum spirituality asserts that quantum mechanics has provided us with a connection between the human mind and the cosmos ... *Quantum theology* argues that quantum mechanics and chaos theory provide a place for God to act in the world without violating his own natural laws.

The former concept has not been of much interest to ASA and is more a product of Eastern philosophers such as Fritjof Capra and Maharishi Mahesh Yogi. Stenger does a reasonable job of debunking this quantum spirituality. In contrast, Stenger never really argues his case against quantum theology. He repeatedly states that any action by God would violate God's natural laws, but he never explains how he reaches this conclusion, nor does he explore the various ways God could act in nature.

This book is presented using the techniques and tricks of a debater, rather than as an honest attempt to educate the reader. It contains a plethora of extraneous statements, typical in a verbal debate. For example, Stenger repeatedly states that the founding fathers of the United States, including the first four presidents, were deists, not theists. The main purpose of this book is to disprove theism, the belief that God is actively and continuously involved in his creation. Stenger defines "Premise Keepers" as Christian theologians who accept the results of science but "assume that a world beyond matter exists." In this twelve-page section of his book, he summarizes key ideas of twelve of these theologians such as Murphy, Polkinghorne, Barbour, and Davies, making brief comments about each. The final summary is "that theologians have not solved the problem of divine action and they know it." This section of the book is far too brief to be of much value.

Stenger intersperses a lot of physics throughout the text, but I do not see this as being an integral part of his arguments. His extremely negative view of religion creates for him a distortion of the facts. For example, the following misstatement is very revealing.

Kauffman wants to define a new religion in which "god" is inserted into a cold, lifeless universe. Davies has been sufficiently fuzzy about God in his writings to win the 1995 million-dollar Templeton Prize ...

In fact, Kauffman, in his own words, states,

What about all the aspects of the universe we hold sacred—agency, meaning, values, purpose, all life,

and the planet? We are neither ready to give these up nor willing to consider them mere human illusions.

The cold lifelessness of Kauffman's worldview is that his pantheistic god is impersonal. Davies points to the abundant fine-tuning of our universe (anthropic principle) as evidence of purpose and a Creator God, but he does it in such a way that he does not clearly reveal his own personal "subjective" beliefs. This bothers Stenger, since he views all religion as purely subjective. Furthermore, the fine-tuning is never mentioned by Stenger, even when talking about the creation of life.

Let me finish this book review by examining the concepts of time and causation, both of which I have great knowledge. Early in the book, Stenger makes the blunt statement, "Like all the quantities of physics, time is a human invention." He follows this up by saying that a year is defined as 365.2425 days. Obviously, this numerical value is the ratio of the earth's orbital period to its spin period, which is true whether or not humans exist to define it. Later Stenger says, "the arrow of time of common experience is purely a statistical effect" (second law of thermodynamics). Later he says,

It is important to keep in mind, then, that the universe has no fundamental direction of time. Effects can precede causes and the whole idea of creation, which has a built-in assumption of the direction of time, needs to be rethought.

In between these two quotes, he tries to debunk both Dinesh D'Souza and William Lane Craig's arguments that the universe has a beginning, defined as a first cause in a causal chain. Stenger wants to argue that quantum phenomena do not have causes and that science has done away with the concept of causation. I would like to make it clear that causation is a metaphysical concept, which probably can never be proved nor disproved by science. If events are causing events into the future, then this causation is the dominant human awareness of the arrow of time.

In summary, I view this book, which distorts the truth, as propaganda without novelty. It is not worth reading, except to learn more of how Stenger thinks. The foreword is written by Michael Shermer and the cover has five flattering quotes by such people as Richard Dawkins and Sam Harris.

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NATURE'S WITNESS: How Evolution Can Inspire Faith by Daniel M. Harrell. Nashville, TN: Abingdon Press, 2008. 165 pages. Paperback; \$18.00. ISBN: 9780687642359.

The relationship between science and faith has unfortunately been misapprehended by many as incommensurable and even conflicting. Debates on evolution/creation issues, in particular, are especially inflated with much emotion, if not ire, of opponents from both sides. The vast amount of information and data involved can be confusing. Further, people are often forced to choose between evolution and creation as if the decision determines their salvation. In *Nature's Witness: How Evolution Can Inspire Faith*, Daniel Harrell has made a contribution to the

evolution/creation discourse, not by trying to resolve the issue, but by communicating an alternative perspective to people who are struggling with the problem.

In the introduction, Harrell states that the purpose of the book is "to look at Christian faith in the face of evolution as essentially true, as most scientists assert." He intends to rethink and rework his theology in order to arrive at "a more dependable and resilient theology." For Harrell, truth can be sought through God's revelation "both in Scripture *and* in nature." The sentence "all truth is God's truth" keeps surfacing in the book.

With a nonspecialist audience in mind, Harrell prepares the readers for understanding his working theology by first explaining the science of evolution. A reasonable number of topics are covered in this section, ranging from the basics of natural selection, to DNA and fossil evidences, to the Big Bang. It is fascinating to see the anthropic principle being discussed together with evolutionary topics, whereas evolutionary topics are often presented with an atheistic assumption. The science section is followed by a chapter on theology. Harrell rightly points out that the "who" and "why" of creation are theologically more important than the "how." Several problems are raised, such as the apparent incompatibility between the purposelessness of evolution and a purposeful God, and the conflict between evolutionary struggle and a loving God.

Harrell then presents how he sees evolution and faith fitting together. Basically, he advocates that God creates through evolution. Using a Las Vegas analogy, the problem of purposefulness is addressed. "If a casino operator can use randomness to achieve a profitable goal," then all the more can God "use randomness to accomplish his purposes." Regarding the problem of evolutionary struggle and a loving God, God allows freedom in nature "for the sake of creaturely exploration," just as God grants humans free will to choose between right and wrong so that a meaningful relationship of love between God and humans becomes possible. Quoting Gordon J. Wenham's commentary on Genesis, Harrell reconciles the biblical creation account with evolution by pointing out that chapters 1 and 3 of Genesis "don't begin with the phrase 'this is the account,' [and so] these earliest chapters are to be read differently than what follows (*account* meaning 'read this as literal history')." Genesis 2, however, contains an *account* of human appearance, and therefore Adam ought to be taken as a historical figure. Jesus and Paul also regarded Adam as a historical person. Harrell then interestingly suggests that Adam and Eve might "exist as first among *Homo sapiens*, specially chosen by God as representatives for a relationship with him."

In the midst of ongoing debates between certain evolutionists and some Christians that are often sensationalized by the media, Harrell's commendable attempt in reappropriating the creation doctrine in the light of modern scientific discoveries is refreshing. Effort is clearly demonstrated to remain faithful to Scripture. Also, the book is written in a style that is easy to follow with story telling, conversations, prayer, and often a humorous tone. There is no problem with information or jargon overload.

Just as with any theology, Harrell's argument is not without loose ends. For example, the analogy between

God granting humans free will and nature free will in randomness is not satisfying. Human free will might be essential to a meaningful relationship with God, but nature does not think. Randomness in genetic variation and "creaturely exploration" might not be the parallel process the author suggests.

No matter where one stands on the issue of evolution and faith, there is bound to be something illuminating in this book, if it is read with an open mind. Those who are dissatisfied with the prevailing dichotomy between the subjects will particularly benefit from the book.

Reviewed by Tommy Tsui, PhD (Biology), MDiv (in process), McMaster Divinity College, Hamilton, ON L8S 4K1.

CHANCE OR DANCE: An Evaluation of Design by Jimmy H. Davis and Harry L. Poe. Conshohocken, PA: Templeton Foundation Press, 2008. xx + 236 pages. Paperback; \$24.95. ISBN: 9781599471334.

Chance or Dance: An Evaluation of Design is a revised edition of the authors' *Designer Universe*, originally published in 2000. In their preface to this update, they note their surprise that many reviewers interpreted their original as support for the belief that "intelligent design is science." They express concern with the "tendency to confuse all statements about design with the intelligent design movement" and likewise a "tendency to confuse any affirmation of creation with scientific creationism." Considering these two trends as "a problem in the intellectual discussion of ideas" they have responded with this second edition.

Throughout the text there is a clear concern about the fragmentation of knowledge that has taken place in Western culture and its adverse effects on attempts to integrate academic disciplines and different ways of knowing. The authors provide an overview of the history and current status of our understanding of the religious, philosophical, and scientific approaches to the concept of design in the universe. They then proceed to summarize aspects of cosmology, physics, chemistry, biology, and mathematics that have contributed to the perception of design. Finally, a discussion of the intelligent design movement, including an evaluation of its effectiveness, is followed by consideration of other possible implications and responses to the many aspects of our world that can be interpreted as evidences of design.

In the first three chapters, Poe, Charles Colson Professor of Faith and Culture at Union University, considers the historical development of the concept of design in the universe from religious, philosophical, and scientific perspectives. He provides an informative summary of the views that several world religions have had regarding the concept of design, making it clear that "design" has a wide variety of meanings and implications depending on initial worldview assumptions. Next, a panoramic view of the development of ways of perceiving creation begins with Plato and Aristotle and on to Augustine's belief that only God can provide the basis for understanding the world. This contrasts with Descartes' reasoning that leads to "proving the existence of God from nature" and then separation of science and faith. Poe discusses Hume's contribution to the development of naturalism, a move-

Book Reviews

ment that would “blossom through the work of Charles Darwin.” As philosophical naturalism evolved into science, “it appeared that a formal break had occurred that separated science from the philosophical discussions that had accompanied it since the time of the Greek philosophers.”

In chapters 4 through 6, Jimmy Davis, university professor of chemistry at Union University, provides an informative overview of aspects of science consistent with the concept of design. Chapter 4, “A Fine-Tuned Universe,” discusses the big bang model and its implications for a beginning to the universe. He then summarizes the properties of Earth that make possible the existence of life on the planet. Davis describes the structure of atoms and molecules and the diversity of life and their implications for the concept of design. In discussing the information content of DNA, Davis states, “The major challenge for those denying design is the origin of the information contained in the DNA.” In the context of considering the physical and chemical properties of the universe is also a discussion of the materialistic and the intelligent design responses to the many properties of the universe that can be interpreted to support design, and how these responses depend upon the basic assumptions and worldviews of the observers.

In the last two chapters and Epilogue, Davis and Poe together consider the history, nature, and effectiveness of the recent ID movement, and then provide some thoughtful reflections of their own on the “awe and wonder” of the universe, and implications of the evidence for design. The description of the ID movement and the related citations provide a helpful source of information for those who have not followed this since it began in the early 90s. Davis and Poe clearly do not see ID as science but as an indication of “... the possibility that spiritual reality and physical reality are intrinsically related. The old fragmentation may give way to an older integration.” ID may, in fact, have the potential to play an important role in helping bring together fragmented knowledge derived from different academic disciplines. The attempts of the ID movement to identify itself as science may have, in fact, been counterproductive in making it even more likely to be viewed as another attempt to establish a form of scientific creationism.

In stating, “if intelligent design is not yet a scientific theory, it has more than succeeded as a very good philosophy,” the authors clearly do not presume to know the future of this movement. On the other hand, they say in the Epilogue, “The renewed interest in design creates an opportunity for a new discussion of the nature of human knowledge that could lead to an integration of ways of knowing which have been largely absent from Western thought since Aristotle disagreed with Plato.”

In this book, resulting from the cooperation of a professor of faith and culture and a professor of chemistry, the authors demonstrate a step toward the integration of ideas from separate disciplines. The book provides an excellent introduction to the historical, philosophical, and scientific aspects of the design concept, and the citations provide a very good source for those who would like to learn more about both the ideas related to design in the universe and the interaction between academic disciplines. It is surprising that in the discussion of the

fragmentation of knowledge derived from these disciplines, there was no reference to biologist E. O. Wilson’s 1998 book, *Consilience: The Unity of Knowledge*. Perhaps this is but another indication of the lack of communication between disciplines? For those who would like to consider the relationship between the fragmented aspects of knowledge, particularly those interested in the ID movement, *Chance or Dance*, is a good place to begin your interdisciplinary search.

Reviewed by Roger H. Kennett, Strohschein Professor of Biology, Wheaton College, and Emeritus Faculty, Department of Genetics, University of Pennsylvania School of Medicine.

ATHEIST DELUSIONS: The Christian Revolution and Its Fashionable Enemies by David Bentley Hart. New Haven, CT: Yale University Press, 2009. 253 pages. Hardcover; \$28.00. ISBN: 9780300111903.

The new atheism is a significant, albeit troubling, force in contemporary intellectual culture. Its outspoken “four horsemen” — Richard Dawkins, Daniel Dennett, Christopher Hitchens, and Sam Harris — have lashed out against the superstitions and downright ignorance of organized religion, especially Christianity, which, they claim, stands in the way of social progress. There has been no dearth of responses to the new atheists. People as diverse as John Haight, Ravi Zacharias, and Chris Hedges have taken them on. Now a formidable new voice, Orthodox theologian David Bentley Hart, has joined the chorus, objecting to these fashionably antireligious antagonists. Unlike other critiques, however, Hart’s does not systematically refute the new atheists’ claims. They appear, of course, but he dismisses their polemics as inconsequential and vapid. In *Atheist Delusions*, rather, Hart turns the tables on the new atheists and attacks some of their cherished myths.

His thesis is simple: Christianity was profoundly revolutionary. It effected “a truly massive and epochal revision of humanity’s prevailing vision of reality, so pervasive in its influence and so vast in its consequences as actually to have created a new conception of the world, of history, of human nature, of time, and of the moral good” (p. xi). Although Hart makes no claims to offering a comprehensive history of Western civilization, he contends that “Christianity has been the single most creative cultural, ethical, aesthetic, social, political, or spiritual force in the history of the West” (p. 100). But it has also been profoundly destructive. It demolished the very order of the ancient cosmos, and in its place a new world gradually emerged, one that provided “an unimaginably exalted picture of the human person” (p. 213).

Hart reminds us that we live in “the long twilight of a civilization formed by beliefs that, however obvious or trite they may seem to us, entered ancient society rather like a meteor from a clear sky” (p. 169). He is eloquent and persuasive in arguing how subversive and cosmically seditious Christianity was to the Roman world. For example, we easily forget how incredible it was for the Gospel narratives to mention Peter’s torment after betraying Christ. The feelings of a Galilean peasant were utterly insignificant in that world. And how scandalous it must have been for these early Christians “to grant full humanity to persons of every class and condition, and of

either sex" (p. 169). We are so familiar with these stories and are so shaped by their sensibilities that we lack the ability to appreciate their utter strangeness and novelty.

Atheist Delusions is an ambitious historical essay that takes particular aim at modernity's smug grand perception of itself as an age of reason overthrowing a superstitious age of faith. While careful to avoid idealizing the Middle Ages, Hart effectively refutes many simplistic and widely-held views about medieval Europe. He concludes that "early medieval society, for all its privations, inequities, and deficiencies, was in most ways far more just, charitable, and (ultimately) peaceful than the imperial culture it succeeded, and, immeasurably more peaceful and even more charitable (incredible as this may seem to us) than the society created by the early modern triumph of the nation state" (p. 86). Continuing this line of thinking, he argues that while medieval Christian society never "fully purged itself of cruelty or violence," it also "never incubated evils comparable in ambition, range, systematic precision, or mercilessness to death camps, gulags, forced famines, or the extravagant brutality of modern warfare" (p. 107).

It should be noted that the triumphal narrative of modernity that Hart pummels is not always sustained by the best historical scholarship. But a simplistic and self-congratulatory account has indeed permeated our modern historical consciousness, and it is clearly evident in the writings of the new atheists. It is commendable to correct such popular misunderstandings, but Hart gives the impression at times that he has selected straw men for some of his rhetorical executions. So in a chapter on the rise of science, he challenges Charles Freeman, who makes the outrageous claim in *The Closing of the Western Mind* that in killing ancient rationality, Christianity set back Western civilization a thousand years. It is not a fair fight. And one wonders whether Freeman is the best opponent? I suspect Hart would argue that he is, because it is people like Freeman whose caricatures of Christianity have influenced the overall intellectual culture and provided the historical framework for the new atheists.

Atheist Delusions may not be everyone's cup of tea. Hart can get carried away at times by the sweeping nature of his argument. Nevertheless, he has written an important, provocative, and often brilliant book that hacks at the roots of the new atheists' arguments with devastating force.

Reviewed by Donald A. Yerxa, co-director of The Historical Society and senior editor of Historically Speaking, Boston, MA 02215-2010; Professor of History Emeritus, Eastern Nazarene College, Quincy, MA 02170.



SOCIAL SCIENCE

SCIENCES FROM BELOW: Feminisms, Postcolonialities, and Modernities by Sandra Harding. Durham, NC: Duke University Press, 2008. 283 pages. Paperback; \$23.95. ISBN: 9780822342823.

In *Sciences from Below: Feminisms, Postcolonialities, and Modernities*, Sandra Harding attempts to bring together the study of modernity with feminist and postcolonial thought. By considering the arguments and positions of these disciplines simultaneously, she argues convincingly

that these independent areas of thought can be even richer and more relevant. Harding is a renowned scholar in the fields of feminist, postcolonial, and standpoint theory, and in their application to science studies. She earned her PhD in philosophy from New York University, and is currently professor of women's studies and education at the University of California, Los Angeles.

The book is organized into three distinct sections. In Part 1, Harding highlights the work of three theorists of modernity: French ethnographer and philosopher of science Bruno Latour, German sociologist and advocate of "risk society" Ulrich Beck, and a team of European sociologists of science headed by Helga Nowotny, Peter Scott, and Michael Gibbons. With a chapter devoted to each theorist, Harding outlines the arguments from each school of thought. In each case, the original authors seem to recognize the need to discard the general idea that technological advances alone signal modernization. By equating technology with modernization, one is required to define "modern" as a single state of being relative to a time before a particular piece of technology was invented. Each of these authors understands that this simplistic view lacks the nuance that is required to properly characterize something as modern. Given that it is only possible, by this definition, to be modern in comparison to something else, these authors argue for a view of modernity that is multidimensional.

Since there are many different traditions, environments, and situations that can exist prior to modernity, there must be multiple modernities, each relating to a specific past. Harding supports this argument fully, but questions whether it goes far enough. As members of the dominant Northern¹ science studies community, she argues that these theorists may not have enough perspective to truly consider the roles of non-Northerners and women in modern society. In each instance, she contends that if these writers were to engage with feminist and postcolonial theories, they would find additional depth for their arguments. Without doing so, Harding suggests that these studies of modernity are truncated and therefore less likely to result in actual reform. As presented, none of these theorists, including Harding herself, have given much consideration to the role that religion plays in modernization.

In the second section of the book, Harding presents three chapters, covering the relevant literature from feminist science studies, postcolonial science and technology studies, and feminist postcolonial science and technology studies. These chapters provide an excellent summary of the state-of-the-art thinking in these fields, and may be useful either as a primer for those who are new to the field or as a good review for those already working in the area.

In the final section of the book, Harding begins to draw all of these ideas together to address the concept of modernity and its relation to science and technology. She argues strongly from a postcolonial perspective that there are, and indeed must be, as many conceptions of modernity as there are cultures to be modernized. As each culture's history differs, so too must their sense of modernity. Harding continues this argument by evaluating the role that gender has played in conceptualizing times of modernization. She points out that "progress"

Book Reviews

is generally categorized by a shift in power to include a group of people who were previously considered to be lesser. She points out that for one group to gain authority, another group generally must forego theirs. Often during history, it has been women who have paid the heaviest price for such progress. For example, the modernization of medicine moved healthcare out of the home and into hospitals where doctors (male) were in charge of care rather than the women who had been the care givers previously. In this way, women's role and value were reduced as we moved into a more "modern" situation. This idea makes a strong argument for redefining what constitutes modernity, and requires us to question whether all people, male and female, Northern and Southern, are really treated as "fully human" when we determine what constitutes a better and more modern society.

Finally, Harding closes with a chapter in which she attempts to look into the future with the goal of "trying to keep simultaneously in view some five different kinds of research agendas which do not much include each other's concerns" (p. 215). She recognizes the need to shed the binary between tradition (the old) and modernity (the new). She argues that as long as tradition is viewed as the antithesis of modernization, then those whose job it was to maintain the traditions of the past, largely women and non-Northern men, will continue to be marginalized and their ideas viewed as less significant than those associated with Northern science and technology. One of her goals seems to be to direct our attention to how research questions are chosen, and to point out that Northern science and technology have long dominated the discussion as to what type of knowledge is considered to be "science." She contends that most research agendas are controlled by funding and are therefore dictated by those fields and questions of greatest interest to historically male-dominated Northern institutions. As such, the concerns and interests of Northern women and non-Northern populations tend to be ignored. Unfortunately, this has led to a single view of what constitutes science, and, by analogy, a modern society. Harding stresses that we must be willing to engage scientific questions from groups outside this dominant Northern male culture before we will be able to move forward and truly engage modernization.

I believe that this book serves to bring the efforts of modernity studies into focus with feminist and postcolonial studies of science. In this way, Harding has created a bridge for practitioners in these fields to easily consider the arguments and richness provided by the others. It seems that a work of this nature is long overdue and, will significantly improve the communication between modernity theorists and those working in feminist or postcolonial studies. I would caution, however, that while Harding's writing is generally easy to follow and her arguments and examples are illustrative, this text might be a bit challenging for those not already "fluent" in feminist theory.

Note

¹In feminist and postcolonial thought, "Northern" science studies are contrasted with "Southern" science studies. As such, northern populations and northern science can be roughly equivalent to the more familiar conception of Western thought and science.

Reviewed by Carolyn Anderson, Assistant Professor of Chemistry and Biochemistry, Calvin College, Grand Rapids, MI 49546. ©

Book Notice

A CORD OF MULTIPLE STRANDS: An Evidence-Based Assessment of Christian Truth Claims by Kenell J. Touryan. 2008. 48 pages. Paperback; \$5.00.

For the right audience, an audience that is indeed of particular interest to *PSCF* readers, this essay is unique and engaging. On behalf of the Department of Energy (USA), Kenell Touryan (current Fellow and former President of the ASA) was helping post-Soviet-bloc nuclear scientists to redirect their skills to civilian research. He had many opportunities to discuss with them what matters most in life, and particularly wanted to show them that science is not contrary to Christian faith. To spur on those conversations, he first wrote this essay in Armenian and Russian. Now translated into English, these packed forty-eight pages can reach scientists in the English-speaking world as well.

The essay is written for capable and busy colleagues. Touryan is free with university-level vocabulary such as "innate sense of the noumenal" and "ontological naturalist." Further, he assumes that his readers will recognize scientific notation and concepts such as time dilation, the Planck energy constant, and quantum mechanical wave function coherence. For his audience, the many examples from the sciences will be intriguing in themselves, and make concrete Touryan's thesis that science and Christian faith are compatible. One of the first sentences of the essay is that "almost every major breakthrough in science and technology, especially in chemistry, physics, and thermodynamics was accomplished by persons who exhibited a strong faith in a Creator." An exemplary list then follows.

Basil Mitchell or Alister McGrath would probably call Touryan's approach "comprehensive coherence." Touryan calls his argument an evidence-based assessment with multiple strands to form a cumulative case. Evidence is cited from the physical world, human nature, history/archaeology, historical context of the Gospels, the unique person of Jesus Christ, and personal experience of God. Touryan states that each of these lines is "necessary but not sufficient." It is likely that he means that together they make a strong case (sufficient), not that if one strand is rejected, the argument is lost (necessary).

His citations are consistently relevant and respectable, even if not always including the latest sources. The first appendix describes a hierarchy of knowledge with theology at the apex, and the second appendix uses a striking illustration from solar radiation to describe what God does through the cross. Short and to the point, with references to wide scholarship, this essay could serve as a stirring invitation to conversation with colleagues in the sciences. Touryan generously makes copies available at cost at PO Box 713, Indian Hills, CO 80454.

Reviewed by James Peterson, R. A. Hope Professor of Theology and Ethics, McMaster University Divinity College and Faculty of Health Sciences, Hamilton, ON L8S 4K1. ©

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Editorial

| | | |
|-----------------------------|---|----------------|
| Living as Part of the Story | 1 | Arie Leegwater |
|-----------------------------|---|----------------|

Articles

| | | |
|---|----|--------------------|
| Understanding Medical Relationships through a Covenantal Ethical Perspective | 3 | James J. Rusthoven |
| What General Revelation Does (and Does Not) Tell Us | 16 | Mary L. VandenBerg |
| Darwinism, Fundamentalism, and R. A. Torrey | 25 | Michael N. Keas |
| Arthur Holly Compton: The Adventures of a Citizen Scientist | 53 | John J. Compton |

2009 Reviewers

| | |
|-------------------|----|
| Reviewers in 2009 | 15 |
|-------------------|----|

Book Reviews

| | | |
|---|----|--|
| <i>The Nature of Being Human: From Environmentalism to Consciousness</i> | 61 | Harold Fromm |
| <i>Dominion over Wildlife? An Environmental Theology of Human-Wildlife Relations</i> | 62 | Stephen M. Vantassel |
| <i>The Age of Entanglement: When Quantum Physics Was Reborn</i> | 62 | Louisa Gilder |
| <i>Naming Infinity: A True Story of Religious Mysticism and Mathematical Creativity</i> | 63 | Loren Graham and Jean-Michel Kantor |
| <i>Creation or Evolution: Do We Have to Choose?</i> | 65 | Denis Alexander |
| <i>Creating Scientific Concepts</i> | 66 | Nancy J. Nersessian |
| <i>The Open Secret: A New Vision for Natural Theology</i> | 67 | Alister E. McGrath |
| <i>Quantum Gods</i> | 68 | Victor J. Stenger |
| <i>Nature's Witness: How Evolution Can Inspire Faith</i> | 68 | Daniel M. Harrell |
| <i>Chance or Dance: An Evaluation of Design</i> | 69 | Jimmy H. Davis and Harry L. Poe |
| <i>Atheist Delusions: The Christian Revolution and Its Fashionable Enemies</i> | 70 | David Bentley Hart |
| <i>Sciences from Below: Feminisms, Postcolonialities, and Modernities</i> | 71 | Sandra Harding |

Book Notice

| | | |
|---|----|-------------------|
| <i>A Cord of Multiple Strands: An Evidence-Based Assessment of Christian Truth Claims</i> | 72 | Kenell J. Touryan |
|---|----|-------------------|