

PERSPECTIVES on Science and Christian Faith

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

In This Issue ...

Do the Polls Show That Science Leads to Atheism?

In Defense of Uniformitarianism

Background Beliefs, Ideology, and Science

Stewarding the Gift of Land: Christian Campuses as
Land Management Models

Engaging the Evangelicals of Peru in Creation Care

*"The fear of the Lord
is the beginning of Wisdom."*

Psalm 111:10

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James C. Peterson

Accurate

When we consider essays for *PSCF*, we look for a thesis related to our mission, clarity of expression, a contribution to the ongoing conversation, and accuracy in the involved disciplines. As to that last stated requirement, a published essay needs to be accurate in what can be checked, situated with full acknowledgment of relevant argument to date, and well argued beyond.

By accurate in what can be checked, I mean not only correct and full citations, but also a paper trail showing that the author has taken into account the byways already tried and found wanting. This saves the reader time. As is always said, why reinvent the wheel? And it creates a ready resource for the interlocutor who wants to check a source or delve more deeply into a referenced argument. One of the best ways to start research in a new area is to read a thorough and well-referenced article published on the topic. The endnotes document how the conversation has developed so far, both for and against the author's thesis. It is invaluable in development of such an article that colleagues with applicable expertise confirm for the author that this is done well. They will remember other relevant arguments and sources that the author missed and should include. They can also help the author to be sure that the arguments extending the conversation into new territory are coherent and compelling.

When the essay is then sent to the journal, it may be selected for peer review. That review further tests the essay on its own evident merits. This vetting process assures the reader that the argument has been questioned and found intriguing by experts in the relevant fields. The author then rewrites, in light of the reviews, to strengthen what the piece offers.

The resulting collection of articles, communications, and reviews in the journal has drawn then

from the expertise and cross checking of varied perspectives. The authors for just this issue—not even including the book reviewers, to make this list manageable—are writing across generations as graduate students, a pastor, post doc, program director, activists, and professors teaching, assistant, associate, and full. Geographically, the authors of this June issue wrote from Kansas City, Houston, Greater Toronto, Chicago, Vancouver, Grand Rapids, Edmonton, Miami, Ottawa, and San Diego. Disciplines directly present include theology, sociology, philosophy, physics, history, zoology, ecology, environmental studies, paleobiology, and computational cell biology. The ASA and CSCA that sponsor this journal gather together the best thinking of a striking breadth of people, place, and disciplinary perspective. When such work together, what a rich resource results. The parochialism that comes so naturally to our tribes of generation, location, or specialty is difficult to maintain when so many are listening and contributing to the conversation.

This process provides a significant advantage over daily news accounts or quick columns that are often written not only on a deadline of a few hours, but also without background or expertise to fully understand what is reported. Such accounts, dominating the web and the daily news feed, can be useful for raising questions or starting ideas, but too often they pool ignorance more than enlightenment. The contents of this journal can be counted on to be current and informed. Here is a place where there is a good chance that people can be oriented and launched on a topic from an extended and nuanced base. That enables us to build toward fresh new mistakes; there is no need to keep repeating ones already rightfully set aside. That such a head start toward insight can be found here is a gift to be appreciated and put to good further work.

James C. Peterson, *Editor*

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In This Issue

Specifically in this issue, Eugene Curry considers the use and abuse of surveys concerning the convictions of leading scientists. He finds that some of the surveys offer too blunt an instrument to report accurately what scientists believe, and even the results in hand are often misinterpreted. He points out then what expert trends can tell or not tell us, even when a survey is well done.

The next article by Bruce Gordon challenges the common phrase “methodological naturalism” as inadequately reflecting the theological convictions that he enumerates. For Gordon, “uniformitarianism” better states and guides the approach that Christians should use in science and that non-Christians would benefit from using. All could do science with greater understanding and more success if they were to recognize that the material world cannot be adequately described by material causation alone.

From a different approach, Jitse van der Meer explains why he sees science as able to progress by

means of the cooperation of people who do not have the same basic beliefs. He argues that background beliefs are deeply influential, even essential to the practice of science, but can be checked and corrected by the sheer givenness of the created order.

Turning to the care of that created order, Karen Steensma, David Clements, John Wood, Randall Van Dragt, and Ben Lowe describe how Christian colleges have been trying to achieve and exemplify for their students the best care of the land entrusted to them.

In our continued series of communications on scientific vocations, Oscar González describes his passion and practice in bringing his environmental studies at the University of Florida and creation care to the evangelical churches of Peru.

The always appreciated reviews of the latest books are followed by Jordan Mallon’s thoughtful letter to the editor about Kathryn Applegate’s “A Defense of Methodological Naturalism” (March PSCF). That is followed by an equally thoughtful response from the author.

James C. Peterson, *Editor*

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WORKSHOPS

*preceding the 2013 ASA Annual Meeting
Belmont University, Nashville, TN*

Friday, July 19, 2013, 9:00 AM–12:00 PM

WORKSHOP 1: Introductory Hermeneutical Principles for Science and Religion —Denis Lamoureux, Leader



The father of modern young earth creationism states, “The Bible is a book of science! It does contain all the basic principles upon which true science is built.” However, the beloved preacher of the gospel Billy Graham asserts, “The Bible is not a book of science. I think we have misinterpreted the scriptures many times, and we’ve tried to make the scriptures say things that they weren’t meant to say.”

This workshop will explore whether the Bible contains modern science, and it will offer an introduction to hermeneutical principles.

Friday, July 19, 2013, 1:00 PM–4:30 PM

WORKSHOP 2: The Human Genome as an Ancient Text —Dennis Venema, Leader



The Human Genome Project, and comparative genomics in general, have provided a wealth of information about how our species came into being. Viewed in this way, our genome is an “ancient text” that reveals details of our past.

This workshop will examine our story as written in our genomes, from prior to our origins in Africa, to our spread across the globe, and ending with our emergence as the last surviving hominin species on the planet.

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Do the Polls Show That Science Leads to Atheism?

Eugene A. Curry



Eugene A. Curry

Scientific findings are often cited to build a case for theism, but some critics respond that large numbers of American scientists are atheists; thus, such findings cannot have merit. This article examines the statistics concerning the rate of atheism among scientists, explores the causes of atheism in those disciplines, and concludes that atheism among scientists is not as extensive as often claimed, nor evaluative of the involved arguments.

In discussions concerning the existence of God, science and scientists are sometimes invoked. Theists will refer to certain scientific discoveries as evidence in support of God's existence. This or that finding, they say, renders theism more likely than not—or at least serves as a piece of a larger assemblage of data that, taken together, makes theism more likely than not. But atheists push back with appeals to the low levels of belief among American scientists relative to the general population. If science really supports theism, so the atheist retorts, then why do so few scientists believe? Indeed, far from providing support for belief in God, she or he continues, science seems to undermine the theistic worldview—thus all arguments for God ostensibly rooted in science must be ill-conceived.

This kind of atheistic counter-offensive can take many forms and appeal to many statistics. But one of the more common presentations of this argument relies on a 1998 survey of the National Academy of Sciences which indicated that conventional religious beliefs were quite rare among the members of that body.¹ Sam Harris made reference to this survey in a 2006 article on Edge.org, concluding that “there are few modes of thinking less congenial to religious faith

than science is.”² Richard Dawkins did the same in his best-selling book *The God Delusion*.³ And Alex Rosenberg of Duke University has adopted this line of attack in his *The Atheist's Guide to Reality*, published in 2011, taking the statistics as proof that an “unblinking scientific worldview requires atheism.”⁴ In his February 2013 debate against William Lane Craig at Purdue University, Rosenberg put the numbers before the audience rather forcefully:

There are two thousand members of the National Academy of Sciences—the *most* important body of the *most* distinguished scientists in the United States ... of these two thousand people, 95% of them are atheists ... Is it a coincidence that this number of the members of the National Academy of Sciences are unbelievers? I think it isn't.⁵

Of course, strictly speaking, these sorts of appeals to authority do not prove anything one way or another. Truth is not defined by majority vote. Nevertheless, as an informal heuristic, we generally recognize that the consensus of experts can be very helpful. When four out of five

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Article

Do the Polls Show That Science Leads to Atheism?

dentists recommend a certain toothpaste, one can reasonably assume that the toothpaste in question is good and not bad. Taken in this spirit, when someone considering the question of God first encounters statistics like those cited by Rosenberg, the information can be rather dispiriting. Is atheism really this common among our best scientists? And, if so, does this really mean that a scientifically informed case for theism is doomed, that science actually supports atheism instead?

First, some clarification is needed. It is not entirely accurate to say that 95% of scientists in the National Academy of Sciences (NAS) are atheists. Rather, the 1998 study that Rosenberg cited (along with Harris, Dawkins, and countless others) indicated that about 72% of the members of the NAS do not believe in a personal God while 21% are agnostics and 7% are believers. Even this is a little misleading, though, because the survey asked specifically about “a God in intellectual and affective communication with humankind.” So presumably a number of members of the NAS who believe in God, but think that God does not communicate with humanity (e.g., E. O. Wilson and Freeman Dyson), are being unhelpfully lumped together with the genuine atheists here as unbelievers. How much are these problems with the survey influencing the results? It is hard to say. Nevertheless, the problems are significant enough that Eugenie Scott of the National Center for Science Education concluded that the study is ultimately based on elements “not well designed for investigating the religious views of scientists,” and thus the study does not present us with “reliable data.”⁶

If we wanted to find more recent, more in-depth, and less problematic survey information on this topic, we could turn to the work of Elaine Ecklund, a sociologist at Rice University. In her book *Science vs. Religion: What Scientists Really Think*, she presents the results of a massive study involving both surveys and follow-up interviews with hundreds of professors of the various sciences at America’s elite universities. Her findings take up many pages, but the bottom line is this: 34% of America’s top scientists are genuine atheists, 30% are agnostics, 8% believe in some sort of vague “higher power,” and 28% believe in God with varying degrees of confidence.⁷ This is hardly a blowout for any one perspective; in fact, it is almost a three-way tie with belief

in God, disbelief in God, and confessed ignorance on the matter all enjoying the support of about one third of the respondents. Thus, things are not quite as bad as the NAS survey seemed to imply.

Still, 34% atheist is quite high, much higher than the rate of incidence of atheism in the general population. What is more, it seems that the percentage is growing. Let us look back at the NAS survey: for all its problems, the questions asked of the NAS members in 1998 are identical to the questions asked of scientists in 1933 and 1914. Therefore, while the findings may be skewed, they would presumably be skewed in a consistent fashion, allowing us to identify trends. Well, what trends emerge from the data? According to the survey, disbelief in a God in communication with humanity grew from about 53% in 1914 to about 72% in 1998. That is noteworthy.

Given the above, we might reasonably wonder if, despite his sins against statistics, Rosenberg and his co-irreligionists are onto something; perhaps the findings of science really do support atheism, and the progress of science in the twentieth century led to an increase in the already very high rate of atheism among scientists. But before we draw that conclusion, consider this: what specific scientific findings emerged between 1914 and 1998 that supported atheism and would thus explain the growth in that perspective? Frankly, nothing comes to mind.

While a Darwinian understanding of biological evolution remains controversial among the American public at large, by 1914 it had already won the day among elite scientists, dismantling Paley’s design arguments rooted in the functional complexity of living things.⁸ So Darwin’s discoveries cannot be responsible for any post-1914 uptick in atheism among scientists. Further, the mainstream understandings of both general and special relativity seem largely neutral to the question of God. The same goes for quantum mechanics. And the discovery of DNA was, at worst, another theologically neutral development.

Indeed, it seems that the only post-1914 scientific discoveries to have had any meaningful bearing on the question of God were the discovery of the anthropic fine-tuning of physics and the triumph of Big Bang cosmology. But how do these discoveries

bear on the question of God? Well, very nicely from a theistic perspective. As Robert Jastrow of NASA and then Dartmouth College declared concerning fine-tuning, it is “the most theistic result ever to come out of science.”⁹ And when it comes to the Big Bang, it has become a veritable hallmark of theistic apologetics, breathing new life into Al-Ghazali’s Kalam argument and leading Paul Draper, an agnostic professor of philosophy at Purdue University, to grant that “on the whole ... twentieth century cosmology supports theism over naturalism.”¹⁰

Now this leaves us with a rather baffling situation: while the only post-1914 scientific discoveries to bear clearly on the question of God were strongly supportive of theism and, conversely, seriously undermined the warrant for atheism, nevertheless scientists as a group became *more* atheistic during this same period! It is almost as if our scientists’ atheism does not really flow from their science.

Actually, that is not “almost” the case, it is exactly the case. As Dr. Ecklund writes,

For the majority of scientists I interviewed, it is not the engagement with science itself that leads them away from religion. Rather, their reasons for unbelief mirror the circumstances in which other Americans find themselves: they were not raised in a religious home; they have had bad experiences with religion; they disapprove of God or see God as too changeable.¹¹

So atheistic scientists have not been pushed toward atheism by science; they have been pushed toward it because as children they were busy playing soccer on Sundays rather than attending church services, or because they had a nasty run-in with an off-putting minister.

Add to that the possibility that a number of selection effects are at play and the 34% atheism rate becomes even more unremarkable. Consider that people who disbelieve in transcendence, who think that the material world is all there is, and incline philosophically toward scientism (whether consciously or not) will plausibly gravitate toward those fields of inquiry that study the material world and do so in a scientific fashion. Conversely, certain statistically significant groups of theists (e.g., Christian fundamentalists) regard mainstream science with suspicion—not because science conflicts with theism

per se, but because it conflicts with their biblical literalism. These groups, feeling that “we must shut up one of God’s books [i.e., nature] if we want to read the other one [i.e., the Bible],” implicitly discourage their members from pursuing careers in science. This dynamic thus reinforces the relative paucity of theists and the corresponding abundance of atheists operating in the sciences.¹²

Finally, Denis Alexander has speculated that perhaps the high rates of atheism among *very* accomplished scientists (like the prestigious group who teach in America’s top universities, or the even more prestigious members of the NAS) has more to do with their being very accomplished than with their being scientists. As with any profession, those who reach the highest echelons of achievement in science must invest huge amounts of time in their work to do so. As a result, those scientists who do not divide their time between their work and religiously informed priorities (as many theists do and most atheists do not) are more likely to reach those highest echelons and to therefore find themselves included in the polls we are discussing.¹³

The upshot of all this is that disproportionately many people who embrace atheism for nonscientific reasons (generally in their youth) subsequently enter scientific fields of study and therefore atheism comes to be statistically overrepresented in the sciences.¹⁴ These young atheists build careers in those fields, harden in their commitment to their worldview as they age (as people generally do), and then view their scientific findings through the lens of their “prior commitment ... to materialism,” as Richard Lewontin so famously confessed—even when those findings are strongly suggestive of theism.¹⁵ In summary, far from being pushed to atheism *by* science, atheistic scientists generally arrive at their atheism for reasons *unrelated* to their science, and then persist in their atheism *despite* their science.

It is important to note that none of this is to cast aspersions on the acuity of either scientists as a whole or atheistic scientists in particular; scientists are intelligent individuals, often engaged in vitally important work. But what we have seen here nevertheless calls to mind the sober and rather humble words of Lawrence Krauss: “Scientists are people, and they’re as full of delusions about every aspect of

Article

Do the Polls Show That Science Leads to Atheism?

their life as everyone else.”¹⁶ Of course, considering his own views, Krauss intended his words to explain why any scientists at all believe in God, but his admission is a knife that cuts both ways.

Given the above, we need not take vague appeals to the prevalence of atheism among scientists particularly seriously—at least no more seriously than we would take similar appeals to the prevailing religious beliefs of accountants or pastry chefs. Nor, clearly, do such appeals serve as an effective debunking of the soundness and usefulness of scientifically grounded apologetics. When a scientist speaks on matters clearly within his or her own specialty (e.g., the mere existence or not of fine-tuning), we ought to be very interested and receptive. But when that same scientist steps outside his or her narrow area of scientific expertise and waxes eloquent on the *philosophical significance* of, say, fine-tuning, we would do well recall what Einstein said about scientists often making for poor

philosophers and respectfully ask to see the actual argument.¹⁷ And when that happens, the arguments either stand or fall on their own merits, without reference to opinion polls about who believes what.

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Notes

¹Edward J. Larson and Larry Witham, “Leading Scientists Still Reject God,” *Nature* 394, no. 6691 (1998): 313.

²Sam Harris, “10 Myths—and 10 Truths—about Atheism,” Edge: The Third Culture, posted December 25, 2006, http://www.edge.org/3rd_culture/harris06/harris06_index.html.

³Richard Dawkins, *The God Delusion* (New York: Houghton Mifflin, 2006), 100.

⁴Alex Rosenberg, *The Atheist’s Guide to Reality: Enjoying Life without Illusions* (New York: W. W. Norton, 2011), viii.

⁵“Is Faith in God Reasonable? Full Debate with William Lane Craig and Alex Rosenberg,” Biola University’s YouTube channel, Flash Video file, 42:20, <https://www.youtube.com/watch?v=bhfkqh-CM84>.

⁶Eugenie C. Scott, “Do Scientists Really Reject God?: New Poll Contradicts Earlier Ones,” *Reports of the National Center for Science Education* 18, no. 2 (1998): 25.

⁷Elaine Howard Ecklund, *Science vs. Religion: What Scientists Really Think* (New York: Oxford University Press, 2010), 16.

⁸Karl W. Giberson and Francis S. Collins, *The Language of Science and Faith: Straight Answers to Genuine Questions* (Downers Grove, IL: InterVarsity Press, 2011), 157.

⁹Roy Abraham Varghese, ed., *The Intellectuals Speak Out about God: A Handbook for the Christian Student in a Secular Society* (Chicago: Regnery Gateway, 1984), 22.

¹⁰Paul Draper, “Seeking but Not Believing: Confessions of a Practicing Agnostic,” in *Divine Hiddenness: New Essays*, ed. Daniel Howard-Snyder and Paul K. Moser (New York: Cambridge University Press, 2002), 200.

¹¹Ecklund, *Science vs. Religion*, 16.

¹²Mark A. Noll, *The Scandal of the Evangelical Mind* (Grand Rapids, MI: William B. Eerdmans, 1994), 199.

¹³Denis Alexander, *Rebuilding the Matrix: Science and Faith in the 21st Century* (Grand Rapids, MI: Zondervan, 2001), 61.

¹⁴Benjamin Beit-Hallahmi, “Atheists: A Psychological Profile,” in *The Cambridge Companion to Atheism*, ed. Michael Martin (New York: Cambridge University Press, 2007), 309.

¹⁵Richard C. Lewontin, “Billions and Billions of Demons,” *The New York Review of Books* 44, no. 1 (1997): 31.

¹⁶“Beyond Belief: Science, Reason, Religion & Survival, Session 2,” The Science Network, Flash Video file, 42:22, <http://thesciencenetwork.org/programs/beyond-belief-science-religion-reason-and-survival/session-2-4>.

¹⁷Albert Einstein, *Out of My Later Years: The Scientist, Philosopher, and Man Portrayed through His Own Words* (New York: Open Road Integrated Media, 2011), 62.



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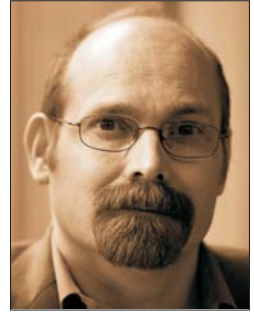
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Bruce L. Gordon

In Defense of Uniformitarianism

Bruce L. Gordon

The practice of science rests on the assumption of dependable regularity in the behavior of the physical world. It presumes that the world has an investigable causal structure and that scientific experimentation, observation, and theorizing provide a reliable pathway to its discernment. This much is not in dispute. What is in dispute is what warrants the metaphysical and methodological assumption – essential to the heuristic utility of science – that nature is uniform in such a way that the present can serve as a key to both the past and the future. This article focuses on the metaphysical foundation and justification for uniformitarian assumptions about nature and argues that they are inconsistent with both metaphysical and methodological naturalism.¹

It is important to be clear about our terminology. In this article, “naturalism” is a philosophical term, and “naturalists” are *not* those who study nature, but rather those who hold certain tenets *about* nature. In particular, *metaphysical naturalists* maintain that there is no such being as God and that there is no realm of being that transcends the physical; all that exists are material substances and processes and things that emerge from them. A *methodological naturalist* may or may not believe that metaphysical naturalism is true, but maintains that, for the purposes of science, one *cannot* appeal to transcendent causes, and therefore scientific research must be pursued *as if* metaphysical naturalism were true, that is, *in the same manner* as it would be *if* metaphysical naturalism were true.

Some think that the principle of the uniformity of nature is equivalent to this restriction—after all, they assert, if God intervened to change the course of nature this deviation would disrupt natural regularity and destroy the possibility of science—but, as we shall see, this is not

so, and uniformitarianism must be distinguished clearly from methodological naturalism.

It is, in my opinion, a grave mistake to call the principle of uniformity in the causal structure of nature “methodological naturalism.” Such nomenclature lends itself to conceptual confusion in the context of contemporary philosophical discussion and makes it more difficult to explain what is wrong and destructive in current conceptions of science and what efforts can be made to correct this situation. Robert Bishop, in his article “God and Methodological Naturalism in the Scientific Revolution and Beyond,”² takes a more sanguine view of “methodological naturalism” as a term and heroically tries to redeem it by associating it with an attitude and approach to science characteristic of the “scientific revolution,” and by dissociating it from contemporary conceptions

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Article

In Defense of Uniformitarianism

that cast it as the methodological handmaiden of metaphysical naturalism. In doing so, it appears that his conception of “methodological naturalism” is not far from what I mean by “uniformitarianism.” While our disagreement may therefore be more semantic than substantive, I can only say that I regard the effort to rehabilitate “methodological naturalism” by dissociating it from its dominant meaning in the contemporary context and projecting it anachronistically backward over the history of science, to be a hopeless task. The term is a modern one that played no part in the self-understanding of scientists prior to the late twentieth century, and in the contemporary context, its dominant meaning is precisely the one I have assigned to it. It seems best to me to let it mean just what it has come to mean and to use an entirely different and historically appropriate term—*uniformitarianism*—to represent the needed conception of scientific methodology.

Not that there has not been some controversy surrounding this term too, but most of it has been associated with the literature of young earth creationism, and as Del Ratzsch ably pointed out in *The Battle of Beginnings*, it involves a misunderstanding of what “uniformitarianism” means.³ Even classical (Lyellian) uniformitarianism recognized the fact that local geological occurrences (volcanoes, earthquakes, floods, mudslides, etc.) have acted catastrophically to geological and paleontological effect. The occurrence of catastrophes in the historical course of nature is *not in the least* contrary to classical uniformitarianism. More salient, however, is the fact that modern uniformitarianism goes beyond the classical conception to recognize the possibility of *global* catastrophes, for example, in the case of the extinction of dinosaurs, and that the rates and intensities of geological and cosmological processes can and have varied. In so doing, however, it has turned into a *methodological* as opposed to a *substantive* assumption and thereby a thesis about the *causal structure* of nature.

The normative stipulation of *modern* uniformitarianism is that geological explanations in particular and scientific explanations in general are circumscribed by the uniformly operating regularities of nature, or extrapolations from them. But this is precisely the idea of uniformity I have in view: the universe has a uniform and investigable causal

structure that provides a stable background for scientific experimentation, observation, and theorization. And as we shall see, this conception of uniformity is *perfectly consistent and helpful to the science of intelligent design*, which is a species of uniformitarian analysis.

At the risk of belaboring my point, let me emphasize that there are a number of compelling reasons for choosing to speak of *uniformitarianism* rather than *methodological naturalism* in a Christian context. Since the first of these reasons is related to the way in which providential action in nature is conceived, let me begin by defining two accounts of providential action that have dominated theological discussion. The first, and most popular, is Thomistic secondary causation; the second is occasionalism. Thomistic secondary causation holds that every material substance has been created by God to possess and exercise its own proper causal powers. God contributes to the ordinary course of nature only as a universal or primary cause. He sustains these material substances and their properties as secondary causes. As such, these material substances mediate God’s ordinary activity in the world and function as secondarily active and efficient causes in their own right. Occasionalism, on the other hand, holds that God is the sole efficient cause of everything that happens in that part of the universe not influenced by finite sentient agents—such as properly functioning human beings—who can themselves be the fiat initiators of divinely maintained causal chains. In short, in the occasionalist account, impersonal nature possesses no active or passive causal powers of its own, but rather all instances of causation in the inanimate world are occasions of God’s direct action—the regularity of nature just is the regularity of divine activity.

Now, why should Christians prefer uniformitarianism to methodological naturalism? First of all, as already intimated, assuming uniformity in the causal structure of nature is *not* the same thing as assuming the inviolability of *natural* causes. The latter assumption presumes something about *the nature of nature* that the former does not. If, as most Christians believe, the causal structure of nature has its ontological basis either in God’s active maintenance of secondary causes or in his *direct* divine action, then nature’s causal structure is properly grounded

in *supernatural* causation, not natural causation. In fact, if *direct* divine action is the fundamental source of natural regularity—as occasionalists maintain—then there is *no such thing* as natural causation where inanimate nature is concerned. We will return to this point later.

Secondly, the term “methodological naturalism” is of recent vintage and projecting it backward over the history of science is anachronistic and creative of misconceptions. While “naturalist” still has “one who studies nature and its development” as a possible meaning, “naturalism” carries no parallel import in present discussions of science or the philosophy of science. Rather, in the understanding that has dominated philosophical discussion for most of the last century, “naturalism” means the negation of supernaturalism. Metaphysically, it is the doctrine that there is no transcendent realm, that God does not exist, and that nature—constituted by the sum total of physical objects and causes—is all that there is. Methodologically, it is the agreement, for the purposes of doing science, to reject supernatural causation and to treat nature *as if* it were a closed system of causes and effects—in short, it is the *methodological* assumption of the causal closure of the physical universe for the purpose of doing science. While some may argue that this is not what the term was intended to mean when it was first introduced and it should not be ceded to those who would use it in this way, I respectfully dissent. Using the term “methodological naturalism” for a conception of the uniformity of nature compatible with Christian thought is clearly inapt in the present environment: the term has been appropriated to mean no more and no less than the *assumption* of the causal closure of the physical universe *for the purpose of doing science*, and this standard appropriation cannot be reversed. That advocates of metaphysical and philosophical naturalism use it as described above could not be otherwise.

But this also is the sense given to it in current discussions by many who are *not* philosophical naturalists. For example, Nancey Murphy goes so far as to call this causal closure principle “methodological atheism,” and despite being a theist, endorses it as a valid metascientific constraint.⁴ While less than sanguine about its status as a principle governing scientific practice, Alvin Plantinga, Del Ratzsch,

Stephen Meyer, William Dembski, and a host of others have also understood methodological naturalism in this way—some of them even in the pages of this journal. Thus there can be little hope in the present cultural milieu of redeeming the term “methodological naturalism” to mean something like “the methodological assumption of the uniformity of nature,” and I see no point in making the effort, for its natural association is with philosophical naturalism, not uniformitarianism.

Finally, when methodological naturalism is understood as the assumption, for the purpose of doing science, that physical reality is causally closed, given the fact that *this* is the dominant usage in the current milieu, the assertion that *this* assumption is necessary and integral to the practice of science *deserves to be critiqued* and—I claim—*rejected*. If I were to maintain, as other Christian contributors to this discussion have been inclined to do, that methodological naturalism should be understood as more akin to uniformitarianism, and as Christians we should therefore be quite content with it, then the conception of methodological naturalism that *dominates* current discussion would go unchallenged, and it very much *needs* to be challenged. As Christians, we must reject not only metaphysical naturalism, but also its methodological handmaiden.

Some might still think there is a conceptual confusion here that is removed, as one reviewer remarked, by regarding methodological naturalism (MN) as a constraint on the sorts of theories and specifications of data sets that count as scientific [rather than as] the assumption of the causal closure of the physical world ... Thus, for example, I might think God conserves the world in being, and also acts specially in it, so that the world is not causally closed; but consistent with that, I might think it makes sense to eschew scientific theories that invoke God or other supernatural entities.⁵

But there is no conceptual confusion here. I have *not* claimed that MN requires a metaphysical commitment to causal closure. What is more, the characterization of MN that I have offered is a direct logical consequence of the constraints that MN (as the reviewer defines it) places on what counts as “scientific.” Methodological naturalism is a *qualified* assumption that does not presume that causal closure is a metaphysical fact, but rather prescind from

Article

In Defense of Uniformitarianism

transcendent causes *for the purpose of doing science*. In other words, methodological naturalism, *for the purpose of scientific explanations*, precludes appeal to transcendent causes. But what does this entail? It entails that, in constructing *scientific* explanations, one proceed *as if* the universe were a causally closed system. Why? Simply because the only explanations countenanced *within* science (so constrained) are *naturalistic* explanations. This conventional constraint does not preclude the possibility of transcendent explanations that are *not* “scientific,” but it does entail that there are no “scientific” explanations that are not naturalistic. Thus, while my definition of methodological naturalism as the methodological assumption of the causal closure of the universe *for the purpose of doing science* may not be the preferred definition of some Christians who advocate MN, nonetheless, it is a *methodologically equivalent restatement* of the constraint their definition embodies. Once this is acknowledged, a conceptual pathway is cleared for an argument that uniformitarianism is conceptually distinct from MN and, from a *Christian* standpoint, superior to it as a criterion for the practice of science.

The uniformitarian principle assumes that the behavior of nature is regular and indicative of an objective causal structure in which presently operative causes may be projected into the past to explain the historical development of the physical world and projected into the future for the purposes of prediction and control. In short, it involves the process of inferring past causes from presently observable effects under the assumption that the fundamental causal regularities of the world have not changed over time. In *contrast*, methodological naturalism is the exclusion of supernatural causes—that is, causes transcending the physical realm—from scientific consideration: in the context of scientific explanations, divine action (or *any* transcendent cause) *cannot* be considered as a possible explanation in any scientific study, period. Thus defined, the principle might better be called *methodological atheism*—which, in fact, is what Nancey Murphy *does* call it—but we will retain the standard terminology.

This much said, I think we can see that the *methodological* assumption of universal causal closure that is integral to methodological naturalism is both *inconsistent* with what Christians believe to be the metaphysical basis for the regularity of the physical

world and *unnecessary* to the practice of science. Moreover, as I argue more completely elsewhere,⁶ methodological naturalism *lacks* the metaphysical resources to explain the constitution and causal integrity of the physical world. Therefore, not only is it unnecessary for the practice of science, but it also is an *obstacle* to the proper understanding of nature because it *requires an objective misrepresentation* of *how* the physical world actually retains its stable appearance and causal regularity. Efficient material causation, rather than being the mainstay of scientific explanation in the manner many contemporary historians of science portray it as having been since the Scientific Revolution, is instead a *phenomenological artifact* of a formal (conceptually designed) and final (purposefully actualized) causation that is metaphysically *fundamental*. Despite their preoccupation with contact mechanisms, the seventeenth-century Christian advocates of the Mechanical Philosophy may objectively be regarded as preserving Aristotelian *formal* causes in their conception of these mechanisms as having been *designed*, and as preserving Aristotelian *final* causes in their recognition of this mechanical design as serving an *intended purpose* in the created order of things. There are many quotations from the period that would make this point, but I offer one from the writings of the scientist Robert Boyle (1627–1691):

When ... I see a curious clock, how orderly every wheel and other part performs its own motions, and with what seeming unanimity they conspire to tell the hour, and to accomplish the designs of the artificer; I do not imagine that any of the wheels, etc., or the engine itself is endowed with reason, but commend that of the workman, who framed it so artfully. So when I contemplate the action of those several creatures, that make up the world, I do not include the inanimate species, at least, that it is made up of, or the vast engine itself, to act with reason or design, but admire and praise the most wise author, who by his admirable contrivance, can so readily produce effects, to which so great a number of successive and conspiring causes are required.⁷

If recognized, this state of affairs also obviates objections to transcendent intelligent causation as lacking a mechanism and therefore being unscientific, since it reduces material efficient mechanisms to mere phenomenological artifacts of an irreducible

and metaphysically basic *transcendent agent causality* that manifests itself in both regular (law-like) and exceptional (that is, complex-specified-information-infusing) ways. This state of affairs also means that the *ultimate* uniformity of nature is not *intrinsic* to it, but rather *extrinsic* to it and *transcendently* imposed upon it. What is more, if we take one of the lessons of quantum theory to be the *insufficiency* of efficient material causation as an explanatory basis for all physical events, we have also implicitly recognized that the uniformity we observe in nature is not just *ultimately* imposed upon it by transcendent intelligent causation, but *proximately* and *continuously* imposed upon it by such a cause as well. As one PSCF reviewer astutely (though, alas, not especially sympathetically) observed, accepting this perspective would mean that our scientific theories, particularly when they formulate general laws, are not describing a uniformity inherent in nature itself, but rather a uniformity of divine action (or, as he put it, we would be formulating “general laws describing *God’s* behavior”). Indeed we are (Acts 17:28; Col. 1:17; etc.).

It is, thus, not hard to see that methodological naturalism is *not* a necessary assumption for the proper conduct of science and, furthermore, even though it is indifferent to the possibility of divine causality *outside* scientific consideration, it is still fundamentally *inconsistent* with the Christian understanding of how nature functions. Methodological naturalism is not as strong as metaphysical naturalism in that, while it denies transcendent causality a role in scientific explanation, it does not deny the possibility that God exists and might act in history: methodological naturalism only prohibits considering such a possibility in the context of doing science.

A methodological naturalist might be quite sanguine about the possibility of miracles, regarding them as specific actions of God that alter the course of nature for specific purposes, but as lying outside the proper scope of scientific consideration. Nevertheless—aside from the fact that if God does act in history, such a prohibition prevents science from discovering the true cause of the effects in question—there is a much more profound point to be made that reveals methodological naturalism to be in *fundamental tension* with the Christian understanding of the *reason* for nature’s regularity. Suppose, as Christians do, that the *correct* explanation for the

regularity of nature is the regularity of divine activity. In other words, suppose that nature behaves in a regular manner either because of God’s necessary role in sustaining the existence and sufficiency of secondary causes, or because the regularity of nature just *is* the regularity of direct divine action. The former understanding is the one articulated by Aquinas and also adopted by *The Westminster Confession of Faith* (chapter V, section 2). The latter understanding is characteristic of occasionalism, in which God is the *sole* efficient cause of *everything* that happens in that part of the universe not influenced by finite moral agents—such as properly functioning human beings—who can themselves be the fiat initiators of divinely maintained causal chains. Occasionalism, which is my preferred view on quantum-theoretic grounds that mostly exceed the scope of our present discussion,⁸ is the understanding of divine providence variously articulated by philosopher-theologians such as George Berkeley and Jonathan Edwards.

The point that now needs making is quite simple: the historically orthodox Christian understanding of God’s essential role in the existence of natural regularities is the precise *opposite* of causal closure. Nature is regular *not* because it is closed to divine activity, but rather *because* (and *only* because) divine causality is operative. In orthodox Christian understanding therefore, it is precisely the *failure* of causal closure, and thus the *falsity* of methodologically naturalistic assumptions, that provides the metaphysical basis for the regularity of nature and the possibility of doing science. God’s existence and action are not prohibitive of science; they are the *basis* for the very possibility of doing science. What is more, since what is necessary for the practice of science is *just* the regularity of nature, not the absence of the very supernatural causation that provides the basis for it, methodological naturalism is an assumption that succeeds in being both gratuitous and heterodox in equal measure. As Christians, we not only *can* do without it, we *should* do without it. Uniformitarianism will suffice.

Having alluded to quantum theory at several junctures in our discussion, let me press an important point in short compass: while quantum theory gives us highly useful mathematical *descriptions* that allow incredibly accurate empirical *predictions*,

Article

In Defense of Uniformitarianism

it offers us absolutely *no explanation* of how physical reality *could* conform to such descriptions, nor any explanation of why any *particular* quantum outcome is observed. In short, it gives us *no understanding* of (let alone any real mechanism for) how things *actually* work. Attempts to provide a “mechanism” in the form of local hidden variables (whether deterministic or stochastic) that would provide such an explanation run afoul of quantum-mechanically violated Bell inequalities. So the lesson seems to be that, on pain of experimental contradiction, characteristically quantum-mechanical phenomena *have no physical explanation*. If they have an explanation at all, therefore, it is in the form of a *metaphysical* explanation that *transcends* the physical.⁹

How does this realization affect the two views of providential action mentioned earlier? Given its reliance on natural necessities presumed inherent in created things functioning as secondary causes in their own right, the Thomistic secondary causation model of providence proves inadequate in the quantum realm, among other reasons, due to the failure of sufficient physical causality. On a purely *physical* level in quantum description, while there are probabilistic *constraints* on the behavior of physical systems, most individual quantum outcomes have no sufficient physical cause, and are therefore incapable of being the result of some sort of secondary causation.

The remaining account of divine providence is the occasionalist one, which I take to be preferred on quantum-theoretic grounds. How does it function in the context of our current discussion? In the case of nonlocal quantum correlations, for instance, while there is no *physical* explanation for them subject to relativistic constraints, occasionalism provides a background *metaphysical* context that obviates a certain amount of ontological puzzlement: the correlations have a *nonphysical* common cause in the form of God’s direct action in the maintenance of the natural regularities they represent. More succinctly, God is the strong active (sole efficient) cause of quantum correlations and, indeed, of all the quantum phenomena that constitute our experience of the world. As regards the failure of unobserved quanta to have spatiotemporal location and individual substantiality, occasionalism offers a way of dealing with this conundrum too. Since they do

not possess any active or passive causal powers, the fundamental constituents of the “material” world are incapable of sustaining their own existence as quasi-localized phenomena. They depend for their existence instead on God’s direct action, and so only acquire existence as phenomenological structures in the context of interactive events, which, when they are the subject of measurement, empirically conform to the statistical regularities predicted by quantum theory. The picture this leads to is one in which God, rather than merely sustaining creation in existence from moment to moment, actually creates it *ex nihilo* from instant to instant. What we have, then, is a vindication of the doctrine of *creatio continua*. Arguably, this same metaphysic would emerge from the quantization of physical time on the Planck scale postulated in quantum gravity, so there is a consistency here, even though the justification differs in some ways.

What, more broadly, are the implications of the realization that a metaphysical explanation that transcends the physical is required? *Prima facie*, as a form of metaphysical abductive inference, it would seem that the existence of the order in nature that ontologically grounds uniformitarian principle—the methodological assumption of *regularity* in the causal structure of the world necessary to the scientific enterprise—finds its best and perhaps *only* justification in theistic metaphysics. It is thus not surprising that theistic conviction historically provided a powerful impetus to the development of science,¹⁰ for it is still the ontological basis on which the practice of science makes the best metaphysical and epistemic sense. Methodological naturalism is therefore not only unnecessary for the practice of science, it forever bars from recognition the metaphysical ground on which scientific investigation is justifiably regarded as a truth-conducive heuristic, and it forever precludes objective scientific recognition of how (and why) the world in which we live and move and have our being actually coheres.

It is transcendent intelligent design that accounts for the regularity of nature and provides the metaphysical justification for uniformitarianism in science. Nature is regular, but it is regular *because* of transcendent causation, not in spite of it. In this metaphysical understanding, *everything* that happens is either divinely intended or—by incorporat-

ing the effects of finite agency — divinely permitted.¹¹ Recognition of this state of affairs allows for an uncontroversial extension of uniformitarian analysis to intelligent causation. We may therefore recontextualize, in skeleton form, an argument first given sophisticated (and nontheological) articulation by Stephen Meyer.¹² Uniformitarian reasoning infers past causes from present effects under the assumption that the causal structure of the world has remained constant and permits reliable inferences. In this regard, we have a very clear conception of what can happen in the regular course of nature that forms a stable background to human activity, which can then be contrasted with what lies *outside* the regular course of nature and requires the particular and directed action of an intelligent cause. Structures and processes exhibiting a degree of complex-specified information exceeding universal probability bounds¹³ are habitually and uniformly associated with intelligent activity. This too is part of the uniformity we experience in the causal structure of the world and, as part and parcel of the uniformitarian assumptions integral to science, falls within the purview of scientific investigation both methodologically and substantively. What we therefore see in the *broader* metaphysical context of providential action, is that God is responsible *both* for nature's regularity *and* for certain exceptional events, but the mode of divine action (regular versus exceptional) associated with each is distinguishable, as indicated, by its characteristics.

The idea that parts of nature might best be modeled using mathematical tools that describe processes that have their end in view before it is achieved, or that characterize structures that result from such processes, is eminently reasonable in a theistic context and entirely compatible with the uniformitarian assumptions necessary to science. Having set aside the false constraint of methodological naturalism and relying instead on a uniformitarian principle that permits recognition from repeated experience of the objective and regular characteristics of intelligent causation, it becomes entirely plausible that nature exhibits a quantifiable teleology, and it furthermore becomes an entirely legitimate *scientific* enterprise to investigate this question. This is, in large part, the mathematical and experimental project associated with intelligent design theory.

Thirty-seven years ago, Nicholas Wolterstorff issued a challenge to the community of Christian scholars and researchers:

Science and ordinary life can be viewed as on a continuum with respect to the presence of theories and with respect to the actions performed [as a result of belief in] those theories. What is eminently characteristic of science is the use of theories to suggest and guide research programs ... Everyone who weighs a theory has certain beliefs as to what constitutes an acceptable *sort* of theory on the matter under consideration. We call these *control* beliefs ... [T]he religious beliefs of the Christian scholar ought to function as *control* beliefs within his devising and weighing of theories. This is not the only way they ought to function. For example, they also ought to help shape his views on what it is important to have theories about. Nor does that exhaust their function. But their functioning as control beliefs is absolutely central to the work of the Christian scholar ... Seldom, however, do the attempts of Christian scholars to "integrate faith and learning" suggest any research programs within the sciences. I consider this a sign of either a failure on the part of Christian scholars to see how their commitment can and should be related to theory-weighing, or of weakness of imagination. To make some comments at the beginning of a biology course to the effect that all biological reality has been created by God suggests nothing at all by way of any research program within biology. It consists merely of ... "setting within a Christian context." ... Christian scholarship will be a poor and paltry thing, worth little attention, until the Christian scholar, under the control of his authentic commitment, devises theories that lead to promising, interesting, fruitful, challenging lines of research.¹⁴

The mission of Christians who are scientific theorizers, field researchers, and experimentalists, should *not be to conform* to the pattern of secular research driven by naturalistic assumptions, *but rather to transform* the practice and impact of science (see Rom. 12:1–2). Intelligent design research is implicitly transformative in this way. As Christians, we must work to show that the patina of metaphysical and methodological naturalism that overlays the practice of modern science is conceptually inappropriate and deeply destructive. The historically

Article

In Defense of Uniformitarianism

appropriate term—*uniformitarianism*—better conveys the needed conception of scientific methodology than methodological naturalism and allows us to follow the scientific evidence wherever it may lead, including when that research is suggestive of transcendent intelligent causation. And this too is only appropriate, for the theistic worldview not only provides a natural context for the order in the world that science must assume, it also provides what is perhaps the *only* reasonable metaphysical context in which that order can be expected to be intelligible to the human mind. ¶

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Notes

¹For a more extensive and differently focused defense of the metaphysical and epistemic necessity of theism as a basis for scientific practice, see Alvin Plantinga’s most recent book, *Where the Conflict Really Lies: Science, Religion, and Naturalism* (New York: Oxford University Press, 2011). Plantinga argues that while there is a *superficial conflict* but *deep concord* between science and theism in terms of their historical interaction and present mutual disposition, there is in fact a *superficial concord* but very *deep conflict* between science and metaphysical naturalism. This seems to me exactly right. The deep epistemological conflict between science and naturalism especially manifests itself in the context of evolutionary theory and its implications under the aegis of naturalism for the reliability of human cognition, and these consequences extend not just to science, but to *every* human endeavor.

²Robert Bishop, “God and Methodological Naturalism in the Scientific Revolution and Beyond,” *Perspectives on Science and Christian Faith* 65, no. 1 (2013): 10–23.

³Del Ratzsch, *The Battle of Beginnings: Why Neither Side Is Winning the Creation-Evolution Debate* (Downers Grove, IL: InterVarsity Press, 1996), 47–53.

⁴Hence Murphy explains: “... there is what we might call *methodological atheism*, which is by definition common to all natural science ... This is simply the principle that scientific explanations are to be in terms of natural (not supernatural) entities and processes” (Nancey Murphy, “Phillip Johnson on Trial: A Critique of His Critique of Darwin,” *Perspectives on Science and Christian Faith* 45, no. 1 [1993]: 26–36). For a critical discussion of the acceptability of “methodological naturalism” and “methodological atheism” as terms appropriate to a Christian understanding of science, see the second part of Loren Haarsma’s essay “Christianity as a Foundation for Science,” <http://www.asa3.org/ASA/education/origins/mn-lh.htm>.

⁵Comment from an anonymous reviewer.

⁶See my forthcoming essay, “Quantum Theory, Sufficient Causation, and the Theistic Foundations of Natural Science”; also highly relevant is my essay, “A Quantum-Theoretic Argument against Naturalism,” in *The Nature of Nature: Examining the Role of Naturalism in Science*, ed. Bruce L. Gordon and William A. Dembski (Wilmington, DE: ISI Books, 2011), 179–214.

⁷*The Works of the Honourable Robert Boyle* [5 volumes, London: 1744], vol. 1, 447.

⁸See my essays referenced in endnote 6.

⁹Again, see the references in endnote 6 for an extended justification of this assertion and others in the subsequent four paragraphs.

¹⁰A sound scholarly treatment of this subject in an engaging format may be found in James Hannam, *The Genesis of Science: How the Christian Middle Ages Launched the Scientific Revolution* (Washington, DC: Regnery, 2011).

¹¹In stark contrast to methodological naturalism, this is what Boyle, Newton, and almost every other natural philosopher of the seventeenth and eighteenth centuries (and earlier) would have recognized as the proper basis for investigating the regularity of nature.

¹²See Stephen C. Meyer’s “Of Clues and Causes: A Methodological Interpretation of Origin of Life Studies” (PhD diss., Cambridge University, 1990) and his book *Signature in the Cell: DNA and the Evidence for Intelligent Design* (San Francisco, CA: HarperOne, 2009), among many other publications. For current exposition, see the extraordinarily rich collection of research papers in Robert J. Marks II, Michael J. Behe, William A. Dembski, John C. Sanford, and Bruce L. Gordon, eds. (forthcoming), *Biological Information: New Perspectives*.

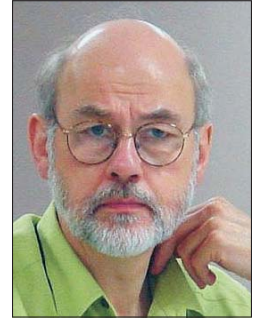
¹³For a technical discussion relevant to the establishment of a universal probability bound, see, for example, Seth Lloyd, “Computational Capacity of the Universe,” *Physical Review Letters* 88 (2002), <http://arxiv.org/pdf/quant-ph/0110141v1.pdf>, doi:10.1103/PhysRevLett.88.237901.

¹⁴Nicholas Wolterstorff, *Reason within the Bounds of Religion*, 2nd ed. (Grand Rapids, MI: William B. Eerdmans, 1984), 65, 67, 70, 105–6.

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Background Beliefs, Ideology, and Science

Jitse van der Meer



Jitse van der Meer

The notion that not only facts but also personal and communal beliefs contribute to scientific knowledge has become commonplace. It raises two important questions. How can people with very different belief systems work together in science? Can scientific knowledge be trusted if it is shaped and sometimes distorted by beliefs operating in the background of science? I begin by pointing out that scholars who believe in the existence of a mind-independent reality have the moral calling to oppose distortion in their understanding of natural phenomena. I then explain why background beliefs are required for the construction of theories in science. I argue that background beliefs do not necessarily distort scientific knowledge because God created an objectively existing reality that resists distortion. When distortion occurs, science has standard ways of detecting that distortion. These include convergence of mutually independent lines of evidence on the same explanation, the possibility to disconnect background beliefs from scientific explanation, and the self-destruction of background beliefs that assume a dogmatic function. Next I show that in their work scientists, in fact, do sometimes oppose their personal background beliefs. The conclusion is that the background beliefs of scientists do not dictate the content of scientific knowledge, and that people with different belief systems, including Christians, can work together in scientific research. This is not to suggest a return to a Christian form of neopositivism because it fully incorporates what has been learned over the last decades about the extent to which science is embedded in a sociocultural context.

The role of *religious* background beliefs in shaping knowledge became an influential research program in The Netherlands through the work of the theologians Abraham Kuyper (1837–1920) and Herman Bavinck (1854–1921), the philosophers Dirk Vollenhoven (1892–1978) and Herman Dooyeweerd (1894–1977), and the historian of science Reijer Hooykaas (1906–1994).¹ This role was not discovered in historical research. Rather, it was a normative claim grounded by both Kuyper and Bavinck in the comprehensive character of Christ's redeeming work. The need for a redemption of scholarship followed from the long-established notion that human cognitive ability had been affected by the fall into sin.²

The conviction that Christ uses people as instruments of redemption promoted the development of a program for the redemption of culture including scholarship. One of the implications of this program was that scientific knowledge has a subjective component consisting of background beliefs with a religious function that originate in the knower rather than in the nonhuman world.³

While the Dutch research program became internationalized, it never became widely accepted. The notion of the subjectivity of science was popularized, however, as the result of two develop-

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Article

Background Beliefs, Ideology, and Science

ments independent of the Kuyperian school. First, the issue was also explored in Poland, the United Kingdom, and the United States.⁴ This pioneering work in the history and philosophy of science and medicine led to a recognition of the role of background beliefs in shaping scientific knowledge. It also triggered the downfall of positivism, the view that not only scientific knowledge, but all knowledge depends only on what can be perceived by the senses and established by reason. These developments were independent of the Kuyperian school of Dutch neo-Calvinism, and they were not motivated by the religious notion of the redemption of scholarship. Their basis in historical scholarship and their justification by philosophical argument made them more widely acceptable. However, the acknowledgment of a subjective dimension of scientific knowledge led some to the extreme of denying that knowledge of nature was possible at all (relativism). Nevertheless, orthodox Christians in Europe and North America welcomed the new philosophy of science because it opened up a role for religion in science, at least potentially. An engagement between the Kuyperian and Kuhnian schools ensued. Few Christians, however, were aware of the relativism implied particularly in Kuhn's views.

The notion that background beliefs shape science is now common currency. It has been variously interpreted. At one end of the spectrum, we have the sociology of knowledge school. Its members hold that truth about nature depends largely or completely on the communal agreement of scientists (subjectivism), not on nature itself. The other extreme is represented by what is left of the logical empiricists also known as the positivist school. For logical empiricists, truth about nature is gained by observation and reason, with the understanding that the outcome depends solely on the object being explored and on the proper use of logic (objectivism). Some Christians have joined the sociology of knowledge school, not because they want to acknowledge the social dimension of knowledge acquisition, but because it allows them arbitrarily to deny the truth of those parts of science that are threatening to them. They reason as follows: if the content of scientific theories is influenced substantially or even completely by background beliefs, then this levels the playing field between, say, naturalism and theism. They do not realize that this move is very costly from a Christian

perspective. For one, truth about nature is made to depend completely on the beliefs of the community with the most power. For another—and implied in the previous point—truth no longer depends on what exists objectively as created by God. Is it possible to acknowledge the role of background beliefs in science (subjectivity) and avoid turning background beliefs into the sole source of knowledge of nature (subjectivism)?

The purpose of this article is to review some of the relationships between background beliefs and scientific theories and explanations that have been uncovered. I take for granted that, normally, background beliefs are needed for the construction of theories in the natural sciences.⁵ Examples are given in step 3 below. But I argue that this does not justify the popular myth that science consists of a collection of arbitrary opinions exemplified in the expression “it is just a theory,” or that relativism reigns supreme in science. My argument is developed in six steps.

Step 1: The Religious Duty of Theists in Science

Two of the less desirable uses of background beliefs have been in the promotion of relativism and in the distortion of scientific knowledge. Postmodern relativists deny that stable knowledge of nature can be attained, because this depends on one's belief of the day. A response to such abuse of background beliefs must begin with the notion that any scholar who believes in the existence of a mind-independent reality has a moral obligation to identify and avoid relativism and distortion. The majority of scientists irrespective of their religious commitments, acknowledge this responsibility and are *critical realists*. That is, they believe that scientific knowledge of nature is shaped by objects of nature and by the beliefs scientists bring to them, and they tend to be critical of the latter. Many are motivated by a desire to be socially responsible and work for the good of the community that supports them. Few want to spend a lifetime attempting to understand something that does not exist.

Theists believe that God created an objectively existing reality. They are *realists* in that respect. This belief gives them an additional reason for the obligation to understand nature with integrity. For

them, it is a religious duty to glorify God in the work of his hands. This cannot be done if one denies that humankind has access to this creation. Such a view is maintained by those who believe that knowledge of nature is a pure mental construction and truth is achieved when all the parts of this construction are mutually consistent (*antirealists*).

Scientific realists do not deny that, in coming to understand nature, humans contribute their beliefs, but they insist that reality decides whether a belief becomes knowledge. Moreover, like everyone else, scientists—both theists and nontheists—are familiar with failure and error. Christians have additional reasons to be sensitive to the imperfection of knowledge, for they recognize it as a consequence of their finitude and of living in a world affected by the Fall. Thus Christian and non-Christian scientists alike tend to be *critical realists*.⁶ A Christian's sensitivity to the danger of self-deception is a gift that equips one to be a good scientist. But sensitivity to self-deception is not enough. A range of measures is employed to guard against distortion by background beliefs in science. One of these measures uses the convergence of different lines of evidence on the same explanation or theory, which will now be discussed.

Step 2: Independent Lines of Evidence

A theory or explanation that is supported by evidence contributed by several independent scholars is better protected against distortion than one supported by a single scholar. This is a matter of common sense. News agencies give most credence to consistent reports that have been independently confirmed. When different reports agree among each other about an event, irrespective of the reporters, the reports are taken to be *true*. Likewise, patients decide to undergo medical treatment with more confidence when a second opinion agrees with the first. When a diagnosis is consistently given by different independent physicians who identify the same cause, this is taken to point to the *true* cause of the disease. The principle applied in such cases is that if the same event is reported by different journalists or the same symptoms reported by different physicians, the report is taken to be true—because it does not depend on the reporters. Rather, the report corresponds to

reality. The expression “independent lines of evidence” refers to the fact that the content of the reports does not depend on the reporters.

The principle of independent lines of evidence applies also in more complex circumstances in which, instead of simply seeing the same thing, two journalists see different things but infer the same cause. Likewise, two physicians can infer the same cause of a disease from two different sets of observations. For instance, a psychiatrist can attribute insomnia and depression to an abnormally low activity of the thyroid gland. A radiologist can attribute weight gain and an abnormally low level of thyroid hormone to an underperforming thyroid gland. When this happens, it is taken to be a stronger confirmation for the existence of the inferred cause—the malfunctioning thyroid—than in the simple example. In the simple case, two journalists report the same observation. In the complex case, two physicians not only infer the same cause from different observations, but they also make the observations using different methods. One has two different lines of evidence observed by two different people pointing to the same cause. In other words, the existence of the cause, though inferred, is independent not only of the persons doing the inferring, but also of the differences between what is observed and of the method by which the observations were made.

This complex case is analogous to what is meant by independent lines of evidence in science. I see three reasons why the background beliefs of scholars that enter the natural sciences today do not easily distort the interpretation of evidence in theories and explanations (from now on “explanation” for short). First, the number of scholars contributing different pieces of the puzzle is large. Below I will describe examples of scholars who converged on the same explanation despite holding mutually exclusive background beliefs. This shows that their personal background beliefs do not necessarily distort explanation.

Secondly, when convergence fails, science has standard ways of correcting distortions of explanations. In such cases, individual scholars may have to reconsider how their personal background beliefs entered their science. Therefore, taking these two reasons together, a convergence of evidence on the

Article

Background Beliefs, Ideology, and Science

same explanation is most likely due to the fact that the explanation is correct. It is possible that all participants in a research community distort the evidence in the same direction by contributing the same background beliefs. If these individual background beliefs are mutually independent, the probability of such a random convergence of background beliefs on the same belief is highly unlikely, due to the communal character of research. However, unlikely as that is, the members of a research community may share whatever background beliefs characterize their research community or tradition, if for no other reason than that they share the same education. Their education has socialized them into the background beliefs of a research community. These communal background beliefs may also distort their scholarship.

The third reason why background beliefs do not necessarily distort explanations and theories concerns such communally distorting background beliefs and why they can be excluded from science. Since the development of an explanation may take a long time, the contributing scholars may have lived in different eras, and they therefore tend to belong to different research traditions. When two research traditions separated in time converge on the same explanations, one has increased confidence in the validity of this explanation. This is what happened when quantum physicists realized that classical Newtonian physics remained valid as a special case of quantum physics. This also holds for scholars living in the same era and belonging to different schools of thought. In the history of biology, scholars in the mechanist and vitalist schools of thought eventually converged on the notion that organisms are like machines that can generate their own purposes.⁷ Earlier forms of mechanism assumed that purpose was externally imposed, whereas earlier forms of vitalism interpreted purpose as a non-material force. One can have confidence in the validity of an explanation independently arrived at by scholars in two communities that used to be considered mutually exclusive.

I shall explain why personal as well as communal background beliefs are open to questioning (steps 3 and 4). But let us first look at examples of convergence of different lines of evidence on the same explanation in the natural sciences. We will take

physics first and focus on the contributions of Galileo, Kepler, Newton, and Laplace to the theory of mechanics.⁸ Galileo (1564–1642) developed descriptions of the parabolic path of a projectile and of the relation between speed, time, and distance traveled by a body that falls with uniformly accelerated motion. Kepler (1571–1630) formulated mathematical laws for planetary motion. Isaac Newton (1643–1727) unified the work of Galileo and Kepler and expanded it in the three laws of motion first published in his *Philosophiæ Naturalis Principia Mathematica* on July 5, 1687.⁹ The first law states that every body persists in its state of rest or of uniform motion, that is, motion with constant speed in a straight line, unless it is compelled to change that state by forces impressed on it. This means that in the absence of a net force, the center of mass of a body either is at rest or moves at a constant velocity. The second law states that a body of mass m subject to a force F undergoes an acceleration a that has the same direction as the force and a magnitude that is directly proportional to the force and inversely proportional to the mass, i.e., $F = ma$. Alternatively, the total force applied on a body is equal to the time derivative of linear momentum of the body. Finally, the third law asserts that the mutual forces between two bodies are equal, opposite, and collinear. This means that whenever a first body exerts a force F on a second body, the second body exerts a force $-F$ on the first body. F and $-F$ are equal in magnitude and opposite in direction. This law is sometimes referred to as the action-reaction law, with F called the “action” and $-F$ the “reaction.”

Newton used his three laws to explain the motion of many physical objects and systems (including those studied by Galileo and Kepler), as well as the fall of an apple from a tree.¹⁰ For example, in the third volume of the *Philosophiæ*, Newton showed that these laws of motion, combined with his law of universal gravitation [$F = Gm_1 m_2 / R^2$ or $F = mg$ for earth], explained Kepler’s laws of planetary motion. Further included in Newton’s unifying account were Galileo’s descriptions of the parabolic path of a projectile and the relation between speed, time and distance traveled by a body that falls with uniformly accelerated motion. Finally, the mathematical description of planetary orbits in Newtonian mechanics was simplified by Lagrange (1736–1813) and given a historical explanation by Pierre-Simon

Laplace (1749–1827). Laplace postulated that the solar system began as a nebulous cloud which gradually separated into rings, each of which in turn eventually coalesced to form the planets. This explained why the planets moved approximately in the same plane and direction. The simplification was taken by many to imply that divine corrections were no longer required to keep the planets in orbit, as Newton had thought. Together, Lagrange and Laplace had shown how the solar system could stabilize itself.

The point is that Galileo was a Roman Catholic, Kepler a Protestant platonist, Newton a Unitarian deist, and Laplace an atheist. Despite these differences in personal religious and metaphysical background beliefs, they contributed to the development of mechanics. Kepler's commitment to Platonism caused him to expect planetary orbits to be perfect circles. Famously, it took him more than thirty years to come to grips with their elliptical shape. Laplace was an atheist and his nebular hypothesis was designed to replace references to purpose and design with those to the operation of physical laws. But note that this motivation plays no role in the question of truth which depends on the facts about our solar system. This illustrates that physical reality resists being distorted by the background beliefs of individual contributing scholars. On the other hand, they shared a view of the cosmos as a machine. But this only moves the question of how they could contribute to the theory of mechanics from the level of theory to that of background belief. What calls for explanation is how they could share a mechanical view of the cosmos given their different background beliefs. This will be explained in step 3.

We will next consider a more technical example of convergence of different lines of evidence on the same explanation in modern physics.¹¹ According to theory, the sun is powered by nuclear fusion. How do we know this? This claim is what one could call a high-level theory under which several unrelated models and theories are brought together. Each model and theory in turn employs several lower-level models and theories. Finally, each of the latter is supported by converging lines of evidence. So we do not have just one theory on which different lines of evidence converge. We have a network of such convergences. At the most directly experimental

level, an abundance of evidence gives strong support to a limited number of theories and models. The latter all point with great clarity toward substantiating the theoretical claim that the energy of the sun is produced by nuclear fusion. The number of contributors of all this evidence runs in the thousands. But it is not only the sheer number that ensures diversity of background beliefs. The scientists also lived in different places and times, and in nearly every case, they were confronted with completely unexpected results with which they had to grapple, and which were significantly resisted by the scientific community at large. Some of the evidence is listed below.

1. Models of gravitational/radiation balance in stars including the sun are based on

- Newton's theory of gravity, which is confirmed to high precision through solar system observations and through lab experiments.
- The mass and size of the sun, which are determined through distance ranging, the theory of gravity, trigonometry, the speed of light, and the length of the year. In turn, the speed of light is routinely measured and relied upon both in the labs and in the wider solar system, and is well understood in terms of classical electromagnetic theory and the electrical and magnetic properties of the vacuum.
- A theoretical understanding of radiation pressure based on electromagnetic theory and Einstein's theory of special relativity (to understand momentum of particles of light), and confirmed through thousands of unrelated experiments.

2. Models of the interior of the sun, confirmed through helioseismology and consistent with the conditions required for nuclear fusion.

3. Models of nuclear fusion consistent with Einstein's theory of special relativity to relate mass and energy; more generally, high-energy particle theory. Both are confirmed through thousands of unrelated experiments and billions of independent unrelated collision events analyzed in particle colliders all around the world.

4. Coherence with astrophysical explanations of observations of relative abundances of the chemical elements throughout the universe, as observed via

Article

Background Beliefs, Ideology, and Science

spectral analysis of stars, interstellar matter, and galaxies. The spectral analysis uses standard laboratory practices of wave optics, and probes the gas emission and absorption of electromagnetic radiation which are well understood using quantum chemistry.

5. Coherence with the measured rate of detection of solar neutrinos along with the later experimental confirmation of neutrino oscillations, which resolved an anomaly that lasted three decades.

6. Consistency with a wide range of applications of stellar astrophysics, such as the models of end states of stars in which nuclear fusion plays a well understood role even in the extreme conditions of supernovae, including the production of neutrinos.

In addition, there is the clear failure of every alternative scientific model considered (such as earlier suggestions that the sun is powered by chemical processes) to allow for the observed radiative energy output, stability, spectrum, resonances, etc.

The third example of convergence of different lines of evidence on the same explanation is from geology. We will take the theory of plate tectonics. This theory explains how the continents on Earth are formed by the breaking apart of a single continent into fragments that moved away from each other to form the currently known continents. A small selection of independent lines of evidence includes the geometric fit of the displaced continents (such as between West Africa and the eastern coast of South America), the similarity of rock ages and Paleozoic fossils in corresponding rock strata between continents, the deep trenches in the ocean floor where one plate descends under another plate (troughs), the mountain ranges in the sea floor midway between continents (mid-ocean ridges), and seashells on mountaintops, due to uplift of crust in collision zones.

Furthermore, sea floor spreading explains the movement of continents. Along the length of a mid-ocean ridge, new magma from deep within the earth rises up and erupts in hydrothermal vents or smokestacks to create new oceanic crust.¹² This process pushes continents away from each other and from the ridge. Lines of evidence supporting this explanation include radiometric dates, fossil studies, and earth magnetism. Radioactivity-based rock ages

are similar in equidistant bands symmetrically centered on the mid-ocean ridge. The age of the rocks increases as their distance from the mid-ocean ridge increases. Also, identical fossils are found in bands equidistant from the ridge. This shows that a particular band of crust shared a similar history as its corresponding band of crust located on the other side of the ridge. Just as similar age bands and fossil bands exist on either side of a ridge, studies of the magnetic orientations of rocks reveal bands of similar magnetic orientation that are equidistant and on both sides of a mid-ocean ridge. This list is very incomplete, yet its abundance is sufficient to make the point of independent lines of evidence.¹³

The final example concerns convergence of different lines of evidence on the same account in biology. The theory of biological species formation enjoys several instances of independent confirmation. For instance, studies of the history of over one hundred fruit fly species on the Hawaiian islands show a remarkable fit between geological, biological, and geographical lines of evidence. Geological studies of plate tectonics show that the Pacific Plate moves northwestward over a stationary hotspot in the core of the earth. The hotspot melts the plate moving above it spawning a series of volcanic islands as it goes.¹⁴ Thus, the oldest island is expected, and found, at the extreme northwest tip of the submarine mountain chain, 2,400 km from Hawaii and near Kamchatka Peninsula (Eastern Russia).¹⁵ This evidence from plate tectonics correlates with evidence from isotope ratios of $^{40}\text{Ar}/^{39}\text{Ar}$, showing that the oldest islands by argon dating are also the smallest, i.e., the most eroded, and are located in the northwest as expected. The youngest islands are the largest and located, as predicted, in the southeast (e.g., Hawaii).

These two lines of geological evidence are matched by three independent lines in biology. By and large, the same genealogy of fruit fly species has been obtained from comparison of morphological characters, DNA sequences, and chromosome mutations. Finally, looking at the geographic location of the different species, we see that the phylogenetically youngest species of *Drosophila* are found on the geologically youngest islands of the Hawaiian Archipelago, because they were the last to be colonized by the fruit flies.¹⁶ In sum, we have a cor-

relation among the history of mutations in their chromosomes, the geographic distribution of their species, the time sequence in which the islands surfaced above sea level as a result of volcanic action, and the direction of continental drift. This research program, started in 1963 and continuing, involves five independent lines of evidence. The list of contributors runs into the hundreds and includes people from different cultures around the globe. Their background beliefs are not known, but one can be sure that such an international cast of characters holds a diversity of background beliefs. Yet they all agree on a common reconstruction of the natural history of Hawaiian fruit flies. As in the previous examples, this agreement is likely underwritten by broad agreement about scientific methodology both general and discipline-specific. But, as before, this moves the question of how scientists could contribute to the natural history of Hawaiian fruit flies from the level of theory to that of background belief. The question is how they could share this natural history despite their differences in background beliefs. This will be explained in step 3.

Step 3: Background Beliefs *Can* Be Separated from Scientific Explanation

What happens when different lines of evidence do not converge on the same explanation? There are many reasons why this could happen. We will ignore all of them in order to focus on the possibility that a failure of convergence is due to distortion of evidence by background beliefs. Can this be undone? Logically, a background belief functions as a presupposition of a theory or explanation. Any explanation or theory presupposes one or more background beliefs. In this section, I argue that background beliefs can be logically disconnected from the explanation they support. The key point is that a background belief does not dictate a theory.¹⁷ The reason is that there is no simple necessary (logical) link between belief—Christian or otherwise—and scientific explanation. Background beliefs exist at different levels of generality. The following examples use ultimate beliefs—background beliefs that operate at the highest level of generality as metaphysical or religious beliefs. The conclusions apply also to lower-level background

beliefs that characterize schools of thought or research traditions.

A background belief alone does not dictate a theory

Evidence for the thesis that background beliefs can be separated from scientific explanation comes from the fact that mutually inconsistent explanations can be subsumed under the same theistic background belief. For instance, the background belief that God created animals with a purpose—the purpose to reproduce, for instance—has had at least two mutually exclusive explanations (fig. 1).

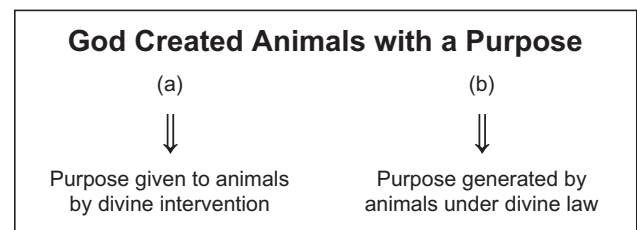


Figure 1. Mutually inconsistent theories (a) and (b) can be subsumed under the same background belief. The background belief that God created animals with a purpose can be specified in at least two different ways. (a) Adding the hypothesis that God acts by intervention makes the purposeful organization of animals directly dependent upon continuous divine intervention. It follows that organisms receive their purposes directly from outside of themselves. (b) By adding the hypothesis that God acts via natural law, it follows that he has created organisms with the capacity to generate their own purposes. That is, organisms receive their purposes indirectly from outside of themselves. Without the specifying hypotheses, the background belief does not dictate (entail) the theories. The theories presuppose the background belief.

If, with the Tübingen physiologist Carl Friedrich Kielmeyer (1765–1844), we add the specifying hypothesis that God acts via natural law, it follows that God has created organisms with the capacity to generate their own purposes. On the other hand, if, with the French zoologist Georges Cuvier (1769–1832) organisms are seen as depending directly on God for their purpose, it follows that organisms receive their purposes from outside of themselves when they were created. Thus, in conjunction with the shared background belief that God created animals with a purpose, different specifying assumptions on how God acts in the world—by natural law or by intervention—lead to different explanations for purposeful behavior of animals. Purposeful behavior is generated internally by the organism if God creates by natural law, but externally if organisms are created without this internal capacity. Both explanations logically presuppose the background

Article

Background Beliefs, Ideology, and Science

belief that God created animals with a purpose. But the background belief alone does not dictate (entail) either explanation.

A background belief is more general than a specifying assumption. A specifying assumption differs from a background belief in that it specifies the latter. The resulting explanation is less general than the background belief from which it is derived. The reason why two mutually exclusive explanations can be derived from the same background belief in the Creator lies in the different specifying assumptions about how God acts in the world. If theories were dictated by background beliefs, then a single theory would be associated with just one background belief without involvement of specifying assumptions.

The second example of mutually exclusive explanations under the same background belief is from astronomy. Isaac Newton (1642–1727) had developed a mathematical description of the planetary orbits. The description implied that a planet would gradually leave its orbit. To prevent this, Newton believed God would intervene from time to time to make a correction in the orbit. Gottfried Wilhelm Leibniz (1646–1716) objected that this was not in keeping with God’s perfections. God is all-knowing, and so he would have foreseen this problem by creating a planetary system without the need for intervention. The point is this: both Newton and Leibniz believed that God is the Creator of the cosmos. They agreed that God is all-powerful, all-knowing, good, and free. But they disagreed on the need for divine intervention in the planetary system because they emphasized different attributes of God (fig. 2).

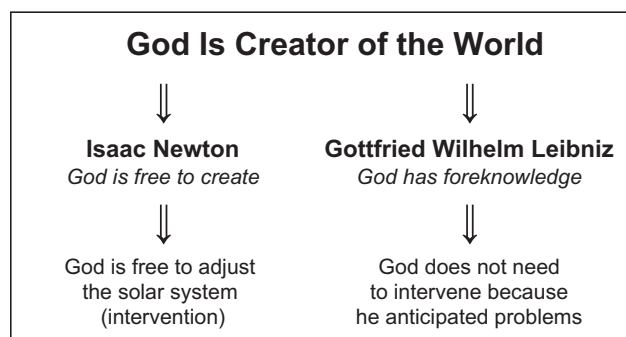


Figure 2. Newton and Leibniz disagreed on the need for divine intervention in the planetary system because they had different ideas on how divine omnipotence is manifested in divine action.

Newton emphasized divine omnipotence. This meant that God was free to create what he willed, leading Newton to add the specifying assumption that God acts in the world by intervention. In contrast, Leibniz stressed that God is omniscient. An all-knowing God can anticipate all the implications of what he wanted to create before he had created it, so that there was no need for corrections afterward. This led Leibniz to add the specifying assumption that God created things so perfectly that they act according to their own laws.¹⁸ Hence Leibniz rejected Newton’s specifying assumption.

Again, two mutually exclusive explanations of planetary behavior can be subsumed under the same theistic background belief. Each explanation presupposes the background belief that God created the world. But this background belief alone does not dictate the explanation. The difference between the two explanations of planetary behavior lies in the different emphases Newton and Leibniz placed on the attributes of the Creator—the freedom to create or the foreknowledge of what would happen in the products of his creative action. This led them to add different specifying assumptions to their common background belief.

These two examples show that mutually inconsistent explanations in biology and in physics can be subsumed under the same religious background beliefs by adding different specifying assumptions about divine action. Therefore, the background beliefs alone do not dictate explanations. They do so in conjunction with a specifying hypothesis. By changing the specifying hypothesis, the background belief can be made to dictate a different explanation. Therefore, if a background belief is suspected of disrupting a convergence of different lines of evidence on the same explanation by distorting the evidence, this can be undone by changing the specifying hypothesis. Conversely, the explanations dictate the background belief. But this is irrelevant for the purpose of removing distortion of evidence by background beliefs.

There is more evidence showing that background beliefs can be separated from scientific explanation. In the preceding two examples, mutually inconsistent explanations were subsumed under the same religious background belief. But the converse is also

possible. Different background beliefs can provide presuppositions for the same explanation. That is, the same explanation can be subsumed under mutually exclusive background beliefs by adding different specifying assumptions to the background beliefs. This would not occur if background beliefs dictated explanations. A case in point involves teleomechanism—the theory that organisms are machines that generate their own purposes. Christian teleomechanism is a background belief held by a number of nineteenth-century German biologists. They believed that organisms were designed by God with a built-in ability to generate their own purpose. Both materialism and Christianity have been made more specific in order to support the theory that organisms generate their own purposes (fig. 3).

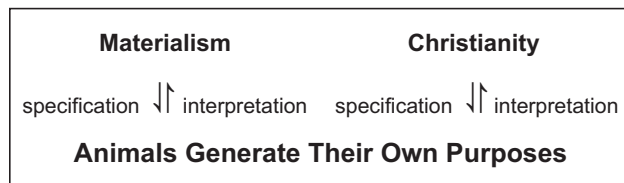


Figure 3. The same theory under mutually exclusive background beliefs. The theory does not dictate the background beliefs (materialism and Christianity do not dictate the theory).

Materialists, who believe that the purposive behavior of organisms is real and not only apparent, made their background belief more specific by adding the specifying hypothesis that matter has the potential to produce purposive organisms. Christians specified their belief in the Creator by adding that God designed organisms with the ability to generate their own purpose. In other words, the purposiveness of organisms can be derived from non-religious as well as religious background beliefs by adding different specifying hypotheses. Therefore, the theory that organisms generate their own purposes is logically independent of the background belief that God has created things for a purpose. God could have intervened to impose a purpose. Moving in the opposite direction from theory to background belief means that the purposiveness observed in organisms can be interpreted in religious and nonreligious ways. Logically, this example is identical to the previous ones in that the two background beliefs alone—materialism and Christianity—do not dictate the theory that organisms generate their own purposes. It is the background belief in conjunction with a specifying assumption that entails the theory that organisms

generate their own purposes. But this example is different from the previous examples in that the theory does not presuppose either background belief.

These examples show that the same theory can be subsumed under mutually inconsistent background beliefs. This also supports my thesis that background beliefs can be separated from scientific explanation by changing the specifying assumptions. As before, this conclusion applies to background beliefs at all levels of generality. Since the examples use religious beliefs this conclusion includes the highest level of generality or ultimate beliefs.

Interim conclusion

A particular philosophical or religious belief, operating in the background of science, cannot dictate or entail a particular explanation in a simple way because the explanation is connected with many other specifying assumptions. The examples show that, logically, an explanation can be separated from its background belief. This is possible because background beliefs of a high level of generality need to be made specific before they can be tested. This specification is achieved by adding specifying hypotheses to the background belief. Since the specifying hypotheses can be replaced, background beliefs do not simply dictate explanations of natural phenomena. This takes care of the scientific relativism implied if religious and other background beliefs dictated scientific explanations. Different religious background beliefs can be made consistent with the same observations and explanations by adding different specifying hypotheses.

It follows that scriptural presuppositions do not dictate a kind of scholarship with a uniquely Christian content. The difference between two kinds of scholarship remains limited to the background beliefs of scientists. This conclusion is supported by the existence of schools of thought in science which differ in their background beliefs. In physics, there are different interpretations of quantum physics. In biology, gradualism and punctuated equilibrium represent different schools of evolutionary theory. In geology, uniformitarianism and catastrophism were different interpretations of earth history. Scholars in different traditions have different background beliefs, but they share observations and ex-

Article

Background Beliefs, Ideology, and Science

planations. Likewise, Christians and non-Christians can share observations and explanations because science is rooted in an objective reality.

Conversely, a particular explanation in science may or may not presuppose a particular worldview or philosophy, as the case of teleomechanism shows. Unfortunately, the complexity of the relationships between background beliefs and explanations, and the associated complexity of separating ideology from science, provides a cover for those who abuse theories for the promotion of ideologies. Preachers of a secular religion, such as Carl Sagan, Richard Dawkins, and Daniel Dennett, have not done sober science a favor by promoting an aggressive anti-Christian atheism in the name of science. Christians need to learn to see through this abuse of science if they do not want to throw out the baby of science with the bath water of ideology. Otherwise, they will have failed their God-given calling to glorify the Creator in his creation. Sober atheists can see through the charade, as their critique of Richard Dawkins shows. The Canadian philosopher and religious skeptic Michael Ruse commented recently: "I am indignant at the poor quality of the argumentation in Dawkins, Dennett, Hitchens, and all of the others in that group [of atheists]." ¹⁹

It is unfortunate that many Christians have been unable to distinguish between the science and the background belief. Thomas Nagel—a self-declared atheist—recently whipped up a storm of protest among "the secular theoretical establishment and the contemporary enlightened culture which it dominates" by observing that it is devoted beyond all reason to a "dominant scientific naturalism, heavily dependent on Darwinian explanations of practically everything, and armed to the teeth against attacks from religion." ²⁰

Step 4: Scientists Have Kept Their Background Beliefs out of Their Theory

The examples just described focus on the logical aspect of connections between background beliefs and explanations in science. They show that, from a logical point of view, the two can be disconnected by changing specifying assumptions. This looseness of

connection between background belief and explanation also applies to the work of scientists at a personal level, as will be shown with two sets of examples.

First, one reason not to worry about distortion by background beliefs is the phenomenon of repeated independent discovery. For instance, in ancient Chinese culture, the scarcity of written records caused mathematicians often to rediscover or reinvent earlier achievements. ²¹ In Western Europe, the laws of Mendel in genetics were rediscovered independently in 1903 by three geneticists. This is analogous to four different reporters confirming the same event. Clearly, the content of such reports or discoveries does not depend on the background beliefs of the discoverer. The phenomenon of repeated independent discovery excludes a possible distortion by background beliefs at the individual level.

The discovery of the same mathematical and scientific knowledge in different and isolated cultures excludes distortion due to shared background beliefs such as found in research programs and schools of thought. For instance, mathematical knowledge discovered independently in Western Europe and ancient China includes the binomial theorem, the solution of n -th roots and polynomial equations via Horner's method, the earliest use of negative numbers, combinatorial analysis, Gaussian elimination for the solution of systems of linear equations, solutions of indeterminate integer equations, algebra with infinite series and finite-difference interpolation methods. ²² Further, in physics, Newton's first law (the law of inertia) apparently occurred to several different natural philosophers and scientists independently. The inertia of motion was described in the third century BC by the Chinese philosopher Mo Tzu, and in the eleventh century by the Muslim physicists Alhazen ²³ and Avicenna. ²⁴ The seventeenth-century philosopher René Descartes also formulated the law, although he did not perform any experiments to confirm it. ²⁵ These scholars are separated by many centuries as well as by deeply different cultural values. They could not have shared background beliefs that might explain their convergence on the same discovery.

Let's return to the distorting role of background beliefs held by individuals. The second set of ex-

amples is from the history of racism, which involves the interaction between society and genetics. I will focus on the social and individual background beliefs of the geneticists Karl Pearson (1857–1936), Ronald Fisher (1890–1962), and John Haldane (1892–1964). They resisted the temptation of allowing their personal background beliefs to distort their scientific knowledge.

Pearson is a founder of modern statistics. His statistical approach to human genetics has been shown to be motivated by biological problems, and not by the ideology of eugenics which he held strongly. Fisher is a founder of population genetics. He showed how difficult it would be to eliminate harmful genes from a human population despite the fact that this was the ideal of the eugenics movement which he endorsed. Finally, Haldane developed important parts of the theory of natural selection despite his suspicions of the eugenics movement which wanted to apply artificial selection to purify the human race.²⁶

These scholars did not allow their work in genetics to be distorted by their background beliefs, even though the two were contrary to each other. “The ideology of eugenics does not dictate a kind of scholarship with a uniquely eugenics-oriented content.”²⁷ The point is twofold: the theory of biological evolution does not dictate eugenics theories or practices; the theory is not evil just because some ideologues abused it for their evil purposes. Such a conclusion would be as unwarranted as characterizing the internet as evil because some terrorists post recipes for bomb making. This becomes even more obvious by considering that the theory of biological evolution actually worked against racism in at least two ways. First, the genetic theory of natural selection undermined the idea that parallel evolution of different human races would produce or had produced different human species. It did so by pointing out that races had not been separated long enough to have become different human species. Second, the genetic theory of natural selection emphasized the genetic unity of all humans by pointing out that all humans have a common ancestor. In that way, it opposed discrimination based on race.

So far, I have argued that a Christian has the responsibility to remove distortion by background

beliefs from scientific explanations, that the communal nature of research in science helps guard against such distortion, that the removal of distortion is possible from a logical point of view, and that scientists have developed explanations and theories that went against their personal background beliefs. Distortion is a derailment of the normal and generally constructive role of background beliefs. What is this constructive role, and how can background beliefs fulfill it without encouraging relativism?

Step 5: The Constructive Role of Background Beliefs

Normally, background beliefs help construct scientific theories and explanations. A scientific theory goes beyond the data—otherwise it could not explain anything.²⁸ Background beliefs contribute the part of a theory that goes beyond the data. Scientists are free to take any suitable background belief from their social and cultural context. Take, for instance, Galileo’s heliocentric cosmology, which suggested that the tides might be the result of the daily and annual movements of the earth. He came upon his theory of the tides one day as he observed the movement of water in a gondola in Venice. As the gondola moved forward, the water in it sloshed backwards, piling up at the stern. Galileo thought the tides might be water piling up on a global scale.

Picture the orbit of Earth moving around the sun once a year.²⁹ At the same time, Earth is also rotating daily anticlockwise around its axis. Now draw an imaginary line connecting the center of the sun with that of Earth. This line intersects the circumference of Earth at two points: one toward the sun (B) and the other (A) away from the sun opposite (B). At (A), the direction of Earth’s orbit around the sun coincides with that of its axial rotation. With the two movements reinforcing each other, Galileo reasoned that water in the oceans would pile up at the trailing end of Earth just as it did in the gondola: high tide. At (B), the two movements would occur in opposite directions, one cancelling out the other, and no water would accumulate. In fact, water would flow to the other side: low tide. The theory was based on a background belief and on the experience of everyday life in Venice.

Article

Background Beliefs, Ideology, and Science

Now let us consider the implications of this theory. For instance, Earth rotates around its axis in 24 hours. So Galileo's high tide moves around the globe in 24 hours and so does his low tide. But anyone living near the sea knows that there are two high tides per day. The background belief received no support from observation and had to be replaced.

I wrote that scientists are free to use any suitable background belief, but that is where the freedom stops. In theory construction, the support from a background belief can become permanent only if this belief corresponds with observation and with other well-established theories. Only then is it rational and justified to accept the background belief as scientific knowledge. Therefore, background beliefs do not necessarily distort scientific knowledge into a collection of arbitrary opinions (subjectivism). Nor do they make scientific knowledge of nature impossible (relativism). This is illustrated by the subsequent history of the theory of the tides which led to the acceptable theory as we have it today.

Scientists are called to construct their theories in the closest possible correspondence with an objectively existing reality. If a background belief does not become scientific knowledge, it will have to be specified by a different specifying assumption or make place for a better alternative. Failure to do so is one of the reasons why the constructive role of a background belief can turn into a destructive one distorting the truth. The transformation of an open-minded heuristic attitude towards an explanation to a close-minded dogmatic one can be a gradual one as the case of Galileo demonstrates. Scientists are human and they do not easily part with their work. There can be many reasons for this reluctance. Let us look at an example.

Galileo and his contemporaries were aware of the shortcomings of his theory of the tides because there are two daily high tides at Venice instead of one, about twelve hours apart. Galileo dismissed this anomaly as the result of several secondary causes, including the shape of the sea, its depth, and other factors.³⁰ While these were valid reasons for retaining his theory, Galileo had a far weightier reason to do so. His theory explained the tides as the result of the daily and annual movements of the earth. If true,

the theory of the tides would become evidence for his theory of a planetary system with the sun in the center. The latter was the crowning achievement of Galileo's career and the reason for his conflict with the church. The stakes were high. But in the end these personal and social interests made no difference. Observations shaped the understanding of the tides as we have it today. Already during Galileo's lifetime, his colleague, the astronomer Kepler, had suggested that the moon was one of the causes of the tides, and it is part of the explanation today.³¹ This shows how the communal character of scientific research screens out personal preferences.

When we look at the history of a theory such as the theory of the tides, we see that the recruitment by science of support from culture may go through cycles. When a theory needs to be reconstructed, a new background belief may be required again. Thus background beliefs need to be replaceable. They cannot be held dogmatically because, at one point or another, they will start to distort scientific knowledge.

The kind of background beliefs that are recruited to support a theory depend on local cultural and historical circumstances. In current pluralistic Western societies, a wide variety of other sources provide supporting background beliefs. From the Middle Ages through the Early Modern Era, the Christian religion was an obvious source of background beliefs because the European culture was largely Christian. In our time, this still holds for individual Christians. This raises a question. I wrote that a background belief will have to be specified by a different specifying assumption or make place for a better alternative, if it does not become scientific knowledge. If this background belief is one of the fundamental beliefs of the Christian faith, would this not imply that a Christian should be willing to live and die for an ordinary background belief in the same way as a Christian is committed to live and die for one's Savior and Lord? On the other hand, would this not imply that a Christian ought to be prepared to replace one of the fundamental beliefs of Christianity along with other undesirable background beliefs when necessary?

Both implications are wrong because they fail to distinguish the limited function of background

beliefs in scientific reasoning from a relationship with a person—in this case, the person of Jesus Christ. It is true, of course, that a Christian can lose the faith. But this is almost always due to personal experiences. Any personal relationship has a much broader basis than a rational commitment to a background belief, even though the latter is part of this basis. A Christian background belief, such as the belief that God is the Creator of all that exists, has this broader basis by virtue of being embedded in such a personal relationship.

Any specifically Christian background belief has a broad spectrum of functions by virtue of having this broad basis. When a Christian uses such a belief in a scientific argument, then the broad spectrum of its functions is modulated such that its intellectual function dominates.³² That intellectual function can be changed without affecting the entire spectrum of functions. Besides, the intellectual function might not have to be changed, because one can replace the specifying hypothesis that connects the background belief with a scientific explanation. Sometimes, however, the need to reconsider a specifically Christian background belief leads to loss of faith. This may be due to a leveling of the playing field between a personal relationship with Jesus Christ and background beliefs that function in science. This has the effect of reducing the personal relationship to a purely rational connection. The problem then lies with the reduced relationship, not with science.

Background beliefs that function dogmatically are not the only ones inadmissible in science. God also cannot be part of a scientific explanation. This is in part because asserting that God created volcanoes, for instance, while true, would not explain where volcanoes are located or why they erupt. Scientific explanation has the narrow goal of finding material causes by learning from experience, and God just is not a material cause because this would turn him into a creature. Rather, God is the Creator of all material causes. In this way, a scientist is like the farmer in Isa. 28:23–29 for whom learning from experience is the same as receiving knowledge from the Lord. Further, if God were to be a part of an explanation, this would mean that God would be treated as if he were a variable to be manipulated by an experimenter. To treat God that way would be blasphemous in my view and, therefore, totally

unacceptable from a Christian standpoint. Finally, is it not appropriate to explain material phenomena in terms of material causes, because God made them of matter?

Step 6: Self-destructive Background Beliefs

So far, I have argued that background beliefs are required for the construction of scientific explanations and that the two can be logically separated. But logical relationships between background beliefs and science are not the only relationship at issue.

Mary Hesse observed,

Those (like philosophers) whose business is logic and argument are too prone to neglect the fact that there can be very important tendencies and plausibilities among ideas which are less than strict entailment, but which are highly influential upon thought, and are not simply exorcized by pointing out that they are not logically conclusive. We should look very carefully at such tendencies to see how far we ought to be pushed for good reasons to accept them, and how far we ought to resist them.³³

Hesse made her observation in connection with reductionism. Reduction or redescription of reality, Hesse argued, can be a legitimate part of discovery. For instance, religion and morality can be redescribed as social or biological phenomena. This can be constructive if the social or biological redescription is intended heuristically with a mind open to other aspects of religion and morality. But the same redescription can become destructive when it is offered dogmatically as a complete characterization of religion and morality. In other words, while background beliefs function logically in arguments, they can assume a dogmatic function.

I have argued that background beliefs function at different levels of generality. I now add that at each level they can function heuristically or dogmatically. In our example, any background belief would function dogmatically if it denied the reality of aspects of religion and morality other than social or biological aspects. In that way, the constructive function of a background belief can turn into a destructive one when it becomes a rigidly dogmatic ideology. This is what I think Abraham Kuyper had in mind

Article

Background Beliefs, Ideology, and Science

when he spoke about the antithesis between the “two cities” of Augustine, Christianity and the world. He was pointing to the ideological functioning of background beliefs primarily at a higher level of generality, far removed from observation and theory.

I have also argued that background beliefs at any level of generality can be disconnected from associated theories by changing the specifying assumptions. One might ask whether the dogmatic attitude with which background beliefs can be held does not trivialize this freedom. I do not think so because ideologies can be disconnected from theories in other ways than changing specifying assumptions. Let me support this claim with two well-known examples of such ideologies: naturalism and empiricism.

Naturalism is the view that nature is all that exists and that knowledge consists of accounts in terms of natural causes. The example focuses on the reduction of mind to matter. Charles Darwin seems to have been the first to recognize the problem now referred to as “Darwin’s Doubt.”

With me the horrid doubt always arises whether the convictions of man’s mind, which has been developed from the mind of the lower animals, are of any value or at all trustworthy. Would any one trust in the convictions of a monkey’s mind, if there are any convictions in such a mind?³⁴

In his elaboration of Darwin’s reduction of thought to physics, Alvin Plantinga argues that it is irrational to believe in evolutionary naturalism because it denies that humans can develop reliable, true beliefs about reality.³⁵

The same arguments have been made when naturalism is specified as materialism. J. B. S. Haldane offers one of the most succinct renditions:

If my mental processes are determined wholly by the motions of atoms in my brain, I have no reason to suppose that my beliefs are true ... and hence I have no reason for supposing my brain to be composed of atoms.³⁶

In the words of Erwin Strauss: “Physics refutes physicalism.”³⁷ As Marjorie Grene explains:

If there is any knowledge, including, if that were possible, the “knowledge” that there is nothing but material particles in motion, then there must

be something other than material particles in motion, namely something—I don’t mean some “stuff,” but some process, some real existent who can make a competent, if not a veridical claim that this is so. But molecules make no claim to truth, anymore than they can err. So if there is any knowledge, even “molecular science,” there is *something* more than the subject matter of molecular science. There are at least molecular scientists. In other words, either there is no knowledge (including the knowledge of philosophical atomism), or there is at least the knowledge that philosophical atomism is false.³⁸

Grene explicitly acknowledges that “a one-level ontology contradicts itself.”³⁹ She uses self-contradiction as a criterion for identifying two levels.

Finally, Polanyi makes the argument in a critique of the machine view of organisms. He argues that biologists are mistaken when they claim that a mechanistic explanation of organisms is an explanation in terms of the laws of physics and chemistry. The mistake, Polanyi points out, is that the principles of operation of a machine cannot be explained in terms of the laws of physics and chemistry, but require a reference to design principles provided by engineers who impose a purpose on the machine.⁴⁰ In conclusion, denial of the existence of realities other than matter leads to self-contradiction. Self-contradiction can be avoided by acknowledging the existence of these other realities with their own irreducible lawful orders. This is a good reason for rejecting the ideological function a background belief may assume due to the dogmatic interests of the one holding that belief. It keeps open the possibility of disconnecting background beliefs and theories. Dooyeweerd has developed the notion of avoiding self-contradiction as a general strategy for distinguishing different kinds of lawful order in the universe.⁴¹

Empiricism is the view that sense experience is the ultimate source of all knowledge. Knowledge of nature cannot be had from visions, hallucinations, or mere reflection. The well-known problem of induction serves to illustrate the self-destructive character of empiricism. As Hume argued, the absolute truth and universal validity of empirical knowledge cannot be proven by experience because it presupposes what it aims to prove. According to Hume, insofar as the principle of uniformity is a generalization based

on experience, it suffers from the problem of induction. "It is impossible, therefore, that any arguments from experience can prove this resemblance of the past to the future; since all these arguments are founded on the supposition of that resemblance."⁴² That is, the experience of uniformity can be generalized only on the understanding that the truth of the generalization is not absolute, but probabilistic.⁴³ Hume's escape was to declare the experience-based expectation that the same causes are associated with the same effect a habit. Kant's answer was to declare the principle of uniformity to be a metaphysical principle. That is, Kant redefined knowledge as a product of both sensation and mentition, whereas Hume had defined it as a product of sensation only. Both responses disconnect the dogmatic form of empiricism from theories without the need to change specifying assumptions.

The problem of induction exemplifies that the scientific enterprise also requires the ability to argue about what is true and false. This ability cannot be established by science itself because truth and error are abstract realities. They cannot be perceived by the senses. Also, from this angle, it can be seen that science has needs that it cannot provide itself. Claims to the effect that sense perception can supply those needs are self-destructive, as in the case of naturalism. The implication of this limitation of science is that it cannot produce knowledge about things that are not perceivable, such as values and God. Yet there are many who ignore this limitation. One such value is the notion that sense perception is the only valid method of acquiring knowledge. Others hold that if God can be known, it must be by sense experience. Surprising as this may seem, this is how the controversial Protestant theologian H. M. Kuitert (1924–present) put it: all that can be known about God is known from below by experience, not from above by revelation. This is an example of how one kind of knowledge—empirical knowledge—has become the standard for all knowledge (empiricism). Empiricism fails because it ignores other ways of knowing, such as knowing by acquaintance, knowing by witness, knowing by authority, knowing by faith, tacit knowledge, self-knowledge, and knowledge from memory, all of which can be equally true. In sum, the problem with naturalism and empiricism is that they are self-referentially incoherent.

In general, one finds two basic attitudes toward such high-level kinds of background beliefs as naturalism and empiricism. There are those who take scientific knowledge as the standard for all knowledge—a distortion known as scientism. For instance, the co-discoverer of the structure of DNA, Francis Crick, wrote that "the knowledge we have already makes it highly unlikely that there is anything that cannot be explained by physics and chemistry."⁴⁴ The other group, which includes this author, believes that there are other kinds of knowledge, and respects the limitations of science. The Australian philosopher of science Alan Chalmers writes:

In addition to what is typically regarded as scientific knowledge, we have everyday, common-sense knowledge, we have the knowledge possessed by skilled craftsmen or wise politicians, the knowledge contained in encyclopaedias or stored in the mind of a quiz show expert, and so on.⁴⁵

Further, the British philosopher Mary Midgley asserts,

Science cannot stand alone. We cannot believe its propositions without first believing in a great many other startling things, such as the existence of the external world, the reliability of our senses, memory and informants, and the validity of logic. If we do believe in these things, we already have a world far wider than that of science.⁴⁶

Recently, Thomas Nagel expressed the same view.⁴⁷

Earlier, I pointed out that scholars in different *scientific* research traditions are unlikely to share background beliefs. This can now also be applied to the scholars in different schools of thought in the philosophy of science. Their agreement that there are realities other than matter shows that distortions due to background beliefs can be recognized independent of background beliefs. Such convergence of ideas can be taken as due to the fact that the idea is correct.

Conclusions

I began by pointing out that scholars who believe in the existence of a mind-independent reality have the moral calling to oppose distortion in their understanding of natural phenomena. This is possible because science has standard ways of detecting distortion of scientific knowledge by background beliefs

Article

Background Beliefs, Ideology, and Science

and because such background beliefs can be detached from scientific explanation. Next I showed that scientists, in fact, do oppose their personal background beliefs in their work. By and large, practicing scientists are thoughtful people who can distinguish between appropriate and inappropriate use of background beliefs. They understand that while background beliefs are required for the construction of fruitful scientific theories, background beliefs can be employed dogmatically beyond appropriate boundaries. I then asked whether the dogmatic attitude with which background beliefs can be held does not trivialize the freedom to disconnect background beliefs at any level of generality from associated theories by changing the specifying assumptions. Using naturalism and empiricism as examples, I argued to the contrary, that ideologies are self-destructive and can, therefore, be disconnected from explanations without changing specifying assumptions.

The difference between an appropriate and an inappropriate use of background beliefs is a matter of judgment. Such judgments are shaped by cultural influences. Authors have abused this situation to promote various nonscientific agendas cloaked with the authority of science. It is hard for the general public to separate the chaff from the wheat. This includes Christians who have mistaken the need for such judgment calls as an opportunity to dismiss uncomfortable scientific knowledge on account of background beliefs, as if there was no objectively existing creation that can resist distortion. Instead, they should engage in evaluating scientific knowledge in light of the facts of the matter and the roles, if any, of background beliefs. Inappropriate roles of background beliefs can be recognized when they become self-destructive.

A recent example of many such assessments is *Absence of Mind* by Marilynne Robinson.⁴⁸ This stance of critical realism is what underwrites the reliability of the planes we fly in, the medical procedures that heal us, and the computers we use. The practical success of the natural sciences gives confidence that scientists are in touch with reality and that their explanations and theories are not easily distorted by the background beliefs they bring to their work. Christians can interpret this state of affairs as the result of an objectively existing created reality that resists distortion. No one can escape

the force of this reality. This means that Christians can work with non-Christians in the enterprise of science. When there is a conflict of background beliefs, they can appeal to the limitations placed by objective reality upon scientific knowledge and/or to the limitations of scientific knowledge itself. ¶

Acknowledgments

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Notes

¹An earlier version of this essay was published online at *Reformed Academic* August 16, 2010.

²Peter Harrison, *The Fall of Man and the Foundations of Science* (Cambridge: Cambridge University Press, 2007), 26–7.

³A word on terminology. I will be using the term “background beliefs” loosely as a synonym for presupposition, worldview, control belief, ideology, and presumption. Whatever differences there are between these terms, I will ignore them because they are irrelevant for this article in which a background belief is a belief one needs before one can even start to think about the full range of realities from God and the world of fermions, frogs, and feelings.

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⁵John H. Brooke, *Science and Religion: Some Historical Perspectives* (Cambridge: Cambridge University Press, 1991); and John H. Brooke, Margaret J. Osler, and Jitse M. van der Meer, eds., *Science in Theistic Contexts: Cognitive Dimensions* (Chicago: University of Chicago Press, 2001).

⁶For example, Ian G. Barbour, “Commentary on Theological Resources from the Physical Sciences,” *Zygon* 1 (1966): 29; Ian G. Barbour, “Theology and Physics Forty Years Later,” *Zygon* 40 (2005): 508; John Polkinghorne, “The Metaphysics of Divine Action,” in *Chaos and Complexity: Scientific Perspectives on Divine Action*, ed. Robert John Russell, Nancey Murphy, Arthur Peacocke (Vatican City State / Berkeley, CA: Vatican Observatory Publications / The Center for Theology and Natural Sciences, 1997), 148; for a review of the history of the concept of critical realism, see Andreas Losch, “On the Origins of Critical Realism,” *Theology and Science* 7 (2009): 85–106.

- ⁷Charles T. Wolfe, "Teleomechanism Redux? Functional Physiology and Hybrid Models of Life in Early Modern Natural Philosophy," *Gesnerus*, special issue "Entre mécanisme et téléologie: Anatomie, physiologie et philosophie des fonctions," ed. Roberto Lo Presti and Nunzio Allocca (forthcoming), <http://philpapers.org/archive/WOLTRT-2.1.pdf>.
- ⁸I am grateful to Arnold Sikkema for help in developing this example.
- ⁹<http://csep10.phys.utk.edu/astr161/lect/history/newtongrav.html>.
- ¹⁰http://news.cnet.com/8301-1023_3-10438960-93.html.
- ¹¹With thanks to Arnold Sikkema for providing these examples.
- ¹²For a video of a smokestack: www.ceoe.udel.edu/deepsea/level-2/geology/vents.html.
- ¹³For more evidence, see http://en.wikipedia.org/wiki/Plate_tectonics#cite_ref-17; <http://www.physicalgeography.net/fundamentals/10i.html>; http://www.visionlearning.com/library/module_viewer.php?mid=65; <http://earthsci.org/education/teacher/basicgeol/platec/platec.html>.
- ¹⁴See http://en.wikipedia.org/wiki/Hawaiian_Islands.
- ¹⁵<http://maps.nationalgeographic.com/maps/atlas/pacific-ocean-geophysical.html>.
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- ²⁹<http://www.pbs.org/wgbh/nova/galileo/mistake.html>.
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Article



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Stewarding the Gift of Land: Christian Campuses as Land Management Models

Karen M. M. Steensma, David R. Clements, John R. Wood, Randall Van Dragt, and Ben Lowe

On land holdings of a few to thousands of acres, Christian colleges are preparing the next generation of leaders. We examined the importance of institutional land policies in conveying a sense of place and stewardship to students and campus communities. A survey of forty-three Council for Christian Colleges and Universities (CCCCU) colleges found collective ownership of over 15,000 acres, with an average of 65% build-out. In-depth case studies of seven institutions with exemplary land management revealed four key indicators of success: (1) environmental core values from the administration; (2) active faculty involvement in land advocacy; (3) dedicated staff positions; and (4) bioinventories as catalysts for conservation and research.

"Creatures, I give you yourselves," said the strong, happy voice of Aslan. "I give you forever this land of Narnia. I give you the woods, the fruits, the rivers ... Treat them gently, and cherish them." –C. S. Lewis¹

[T]he primordial and still continuing dark story of human rapaciousness begins to be accompanied by a vein of light which, however improbably and uncertainly, still accompanies us. This light originates in the idea of the land as a gift – not a free or a deserved gift, but a gift given upon certain rigorous conditions. –Wendell Berry²

Institutions of Christian higher education have been the collective recipients of many acres of land in the past century. Land, as a gift of God, comes to us with an ethical imperative to treat it gently and to cherish it. In regard to Christian college campuses, there are a few distinctive models of land management from which to draw information. The strategy of building ever-bigger structures on vacant parcels of land is a twentieth-century ethos that no longer carries us forward.³ Students express discontent as they question how campus buildings and grounds are managed; fully 69% of college applicants rank environmental sustainability as important in their college choice.⁴ These students, together with many in the

larger campus community, are seeking a philosophy of sustainability, not just a catalog of environmental ills. This is a crucial time for creating the context in which discipleship on creation care can happen.⁵ Such a concept requires deep sustainability thinking and a clear sense of geographic place: we need to know how to live on the land, not just how to do social justice or create sustainable business models.⁶

Sustainable land management at institutions of higher learning is challenging. Universities face increasing financial pressures, and often lack the ability to assess whether their land holdings are ecologically important. Given many competing demands on these

holdings, should land be managed in a strictly utilitarian way? A utilitarian approach was the default position of most academic institutions examined by Muller and Maehr in a 2000 paper published in the journal *BioScience*.⁷ They delivered a strong indictment of the American institutions they assessed, including many schools which, ironically, have been leaders in the field of conservation biology. By and large, these institutions have failed to be proactive in the conservation of their own lands.⁸ In this article, we use the same magnifying glass to look specifically at Christian institutions. In addition to the practical need to protect biodiversity, Christians have a biblical mandate to protect creation. Thus, we ask, "Have Christian institutions begun to move beyond utilitarian land management practices? And if so, how?"

Modern Context of Sustainability

In recent years, educational institutions have paid increasing attention to environmental stewardship on their campuses for ethical, economic, and public relations purposes. The concept of "sustainability" has become popular in many forms. Recycling, energy audits, carbon footprinting, and other environmental efforts have complemented the traditional scholarly activities of discussion and debate on such topics.⁹ However, in the midst of these "green awakenings,"¹⁰ in terms of stewardship of energy and materials, a business-as-usual attitude is often seen with respect to land. Colleges and universities tend to view their land holdings more as short-term real estate opportunities than as gifts entrusted to them indefinitely.

There are many reasons for managing university land for conservation value, including pedagogical, psychological, aesthetic, and recreational benefits. But Christian colleges, in particular, have a biblical mandate to *steward* the land. Much effort has been exerted to ensure fidelity to biblical ethics at Christian institutions in order to model and integrate Christian values educationally.¹¹ This has included a strong recent emphasis on ethics of creation care in general,¹² yet little of this renewed interest is focused on the significant impact of land management practices. As in secular institutions, Christian institutions are prone to say one thing but do another regarding sustainable land management. These

institutions are often lacking plans, policy, or personnel required to proactively steward the gift of land.

Land stewardship practices were highlighted at the 2006 American Scientific Affiliation (ASA) annual meeting held at Calvin College. Twelve speakers from Christian and secular colleges presented their experiences in a symposium entitled "Stewardship, Conservation and Land Management: A Cross-Campus Checkup."¹³ The common theme emerging from this session was the need to identify best practices and share information on the benefits of land use and natural area conservation planning and management. In this article, we report on practices at forty-three institutions in the Council for Christian Colleges and Universities (CCCCU) and then focus on seven campuses modeling exemplary land stewardship.

Methodology

In 2006 we surveyed the land management practices of sixty-two CCCCU schools.¹⁴ Faculty members designated as representatives of the Au Sable Institute of Environmental Studies on their respective campuses were asked to respond to a thirteen-question land management survey.¹⁵ This was intended to provide a snapshot in time, of land use and planning at the responding institutions. Subsequently we researched CCCCU institutional websites for mention of land management and sustainability practices, and interviewed personnel at more than a dozen campuses that had at least a few acres of natural area or agriculture use in order to narrow down choices for case study. In-depth interviews were then conducted with faculty members and staff most involved in land use at seven of the larger and more innovative landowners among these schools. Questions regarding history, size, and management of unbuilt property were asked of each interviewee. Resulting case study descriptions were then verified for accuracy by the interviewees in 2013.

Overview of CCCCU Respondents

The survey resulted in forty-three responses, for a 69% return rate on the questionnaire. We found that the majority (thirty-nine) of CCCCU schools addressed land management issues through a master planning

Article

Stewarding the Gift of Land: Christian Campuses as Land Management Models

process. Of these, eleven (26%) also had specific land management plans while only three (7%) had a separate land stewardship policy in place. Together the forty-three campuses controlled approximately 15,600 acres of land. The vast majority of the institutions (thirty-six) owned fifty acres or more, three held 500–1,000 acres, and two had up to 2,000 acres (figure 1). More than one-quarter of these land holdings were already developed, and 26% of the schools were nearing full development capacity, with 76–100% build-out on their land holdings. The majority of campuses were located in suburban or urban land use settings (figure 2), with a minority located in or adjacent to rural or industrial settings.

The primary purpose of undeveloped land holdings among more than half (58%) of respondents was identified to be either investment, space for future expansion, or urban buffer (figure 3). However, 40% also identified natural area values or outdoor class-

room uses for a portion of their land holdings, with numerous land-based stewardship activities indicated across these campuses (figure 4).¹⁶ Fifteen campuses had a field station, nature reserve, or property detached from the main campus. These holdings were typically within a few miles of the main campus, while two were over 400 miles away. There were thirteen scientific, outdoor classroom or retreat facilities and two investment or revenue-generating properties (ranching or energy developments).

The majority of college campuses were once located on the outskirts of urban centers. This often reflected the reduced cost of acquiring land for built structures, rather than intentionally taking up the task of land stewardship. These campuses acquired land for a variety of purposes, most of which have little to do with conservation.¹⁷ Urbanization at the rural-urban interface is at the heart of a long list of environmental problems affecting North America

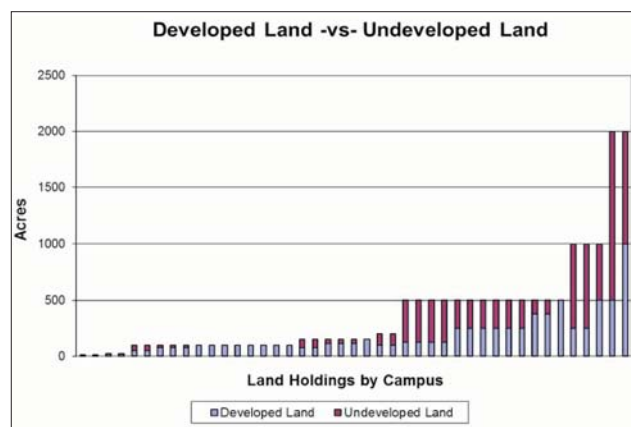


Figure 1. Land holdings and the disposition between built and open space for forty-three faith-based colleges and universities.

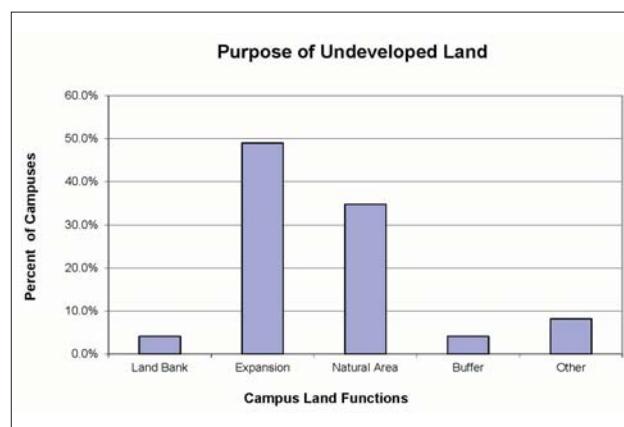


Figure 3. Designated purpose of undeveloped campus open space among forty-three faith-based colleges and universities.

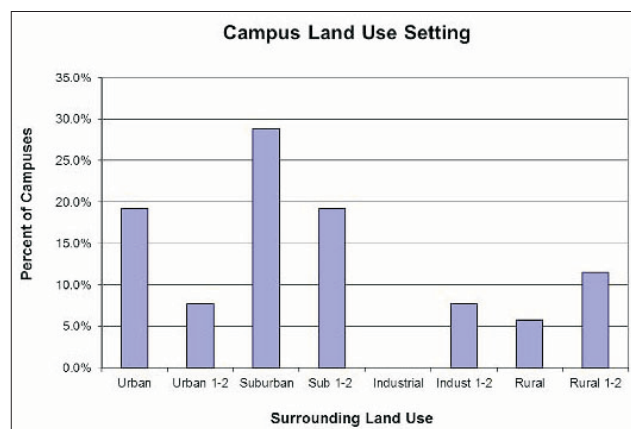


Figure 2. Predominant use of the landscape surrounding campus on one, two, or all sides among forty-three faith-based colleges and universities.

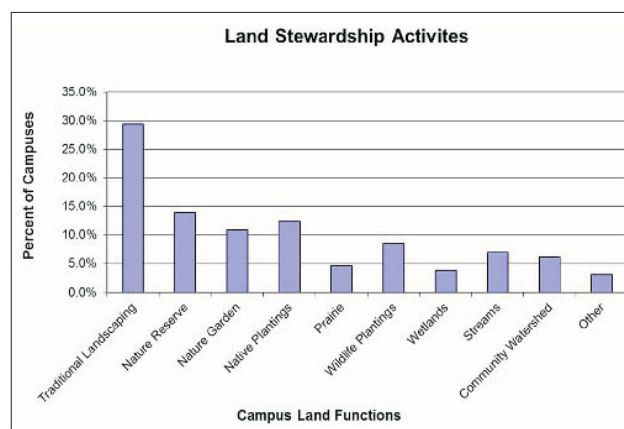


Figure 4. Land-based stewardship activities on forty-three faith-based university and college campuses.

today,¹⁸ and colleges located in these areas face the choice of either becoming part of the problem or taking measures to minimize their impact. Thus campus environmental stewardship has been increasingly seen as a significant educational issue in a variety of institutions.¹⁹

Most of the more than one hundred CCCU institutions control at least a few acres of undeveloped real estate on or beyond their immediate developed campus. Several campuses own or have long-term leases on 1,000 acres or more of land. A few have undertaken agricultural and natural resource enterprises for pedagogical and revenue-generating purposes. How are these institutions, whether large or small

land managers, approaching the lands entrusted to them? Why do they take these approaches?

Case Studies

A variety of campus sizes and intentionality of land-use practices exists among Christian institutions. There are many campuses engaged in excellent care of both small and larger acreage, and it was not our intent to comprehensively rank all of the well-managed CCCU campus lands represented among our respondents. However, several Christian colleges and universities come to the forefront in land management, due either to the sheer volume of land being managed, the uniqueness of lands managed, or

Table 1. Campus Land Management and Planning at Selected CCCU Institutions

Institution	Related majors ¹	Faculty ²	Staff ³	Land use articulated ⁴	STARS participant ⁵	Land description	Acreage with moderate access ⁶	Acreage with low access ⁷	Total Acreage ⁸
Calvin College	Environmental Studies, Biology	2	1	yes	no	Forest, Wetland, Meadow	95	100	195
Dordt College	Environmental Studies, Agriculture	2	0.85	yes	no	Prairie, Wetland, Agriculture	207	13	220
Gordon College	Biology, Environmental Studies	2	1	no	yes	Forest, Wetland	40	360	400
Goshen College	Environmental Studies, Agroecology graduate degree	4	2–4	yes; includes land policy	yes	Forest, Agriculture	65	1,184	1,249
Seattle Pacific University	Ecology, Biology	3	3	yes	yes	Forest, Wetland, Meadow	230	1,100	1,330
Taylor University	Earth and Environmental Science graduate degree	3	1	yes	yes	Forest, Agriculture	606	160	766
Trinity Western University	Environmental Studies, Geography, Biology	2	0.5	yes	no	Forest, Wetland, Meadow, Agriculture	80	129	209

¹Majors and/or course work requiring or incorporating access to campus lands.

²Number of faculty with administrative points related to campus land management; at least one of these faculty members was interviewed for detailed information in each case.

³Number of staff with campus land management aspects as part of job description; includes staff interviewed in some cases.

⁴Written vision statement and/or core values statement related to land management, either separately or within a campus master plan.

⁵Sustainability Tracking, Assessment and Rating System™ created by the Association for the Advancement of Sustainability in Higher Education (AASHE). In addition to the four listed here, only two other CCCU schools—King's University and North Park—are registered for STARS.

⁶Number of acres of campus lands in relatively natural state or agricultural use, open to the general campus community or public.

⁷Number of acres of campus lands in relatively natural state or agricultural use, not open to the general campus community or public.

⁸Sum of acreage in categories 6 and 7.

Article

Stewarding the Gift of Land: Christian Campuses as Land Management Models

the innovative approaches being taken in management (table 1). Choice of case-study schools was based on the presence of a nature preserve (with significant acreage being actively protected for biodiversity), natural resource management values (agroecology, community gardens, sustainable forestry, fisheries), and the public visibility of managed natural lands.

Case Study #1:

Calvin College, Grand Rapids, Michigan

Stewardship of creation has been a strong emphasis at Calvin College for many years. In particular, this movement can be traced back to a “meeting of the minds” held at Calvin in the late 1970s, which produced the well-known primer on creation stewardship entitled *Earthkeeping*²⁰ (later updated as *Earthkeeping in the Nineties*).²¹

At present, about one-third of the 390-acre campus is in some “state of nature,” meaning anything from small rain gardens, to native vegetation plantings by groundskeepers, to the Calvin College Ecosystem Preserve, a 100-acre landscape mosaic of woodlands and wetlands deliberately managed for native biodiversity and utilized for ecological research and environmental education (figure 5). Public trail access is allowed on about one-third of the preserve (figure 6), with student volunteer stewards assisting a faculty member who directs management.

Calvin College is located in the Plaster Creek watershed on the outskirts of Grand Rapids. The college relocated in the 1960s to what was then ex-urban land after outgrowing an earlier urban location. The college has recently acquired the 65-acre



Figure 5. The environmentally friendly Bunker Interpretive Center at the Calvin College Ecosystem Preserve.

Flat Iron Lake property 30 miles north of campus, which is being inventoried for biodiversity and used as a prairie and limnological research site.

Land stewardship practices at Calvin range from landscape-level master planning to retaining and protecting wild areas, to more sustainable maintenance of traditionally landscaped areas. Recently Calvin has been involved in converting some lawn areas to woodland as mitigation for old-growth woodland lost in the process of new building expansion. Calvin has applied both top-down and bottom-up techniques in trying to control eutrophication in two stormwater detention ponds that drain into a nearby lake. Calvin also initiated the Plaster Creek Stewards, a consortium with churches in the watershed, to help conserve Plaster Creek.

Case Study #2:

Dordt College, Sioux Center, Iowa

Dordt College distinguishes itself as one of the few CCCU institutions offering degrees related to both agriculture and environmental studies. Agriculture and ecology-purposed holdings total about 220 acres, with prairie and wetland restoration projects as well as the Agriculture Stewardship Center (ASC), all located on or near the main campus.

A century-old farm, sitting adjacent to the campus, accounts for sixty of these acres. Twenty-five acres are dedicated to experimental agriculture, fifteen acres to farmstead buildings and a soccer field, and twenty acres to upland prairie and wet prairie restoration sites. This area has become an island of open space, including public access, bike trails, and interpretive functions. The sustainable agriculture

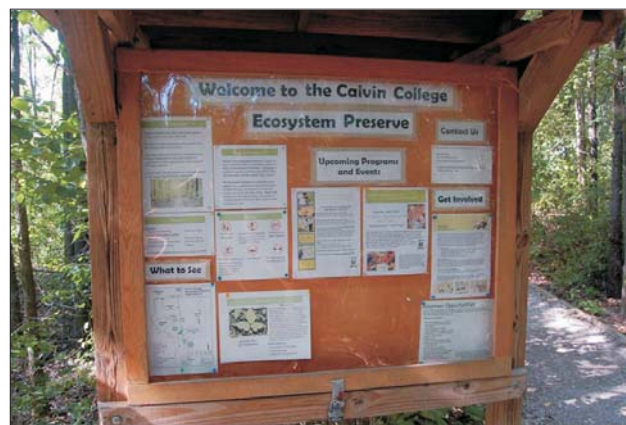


Figure 6. The Calvin College Ecosystem Preserve information board includes public outreach information.

demonstration project at this location is focused on energy use under different cropping regimes.

Several miles from campus are an additional 155 acres. This outlying land includes 24 certified-organic acres, allowing variety yield testing for small grains, rotated with corn and soybeans. Other acreage produces conventional commodities such as corn, soybeans, alfalfa, oats, and wheat, along with experimental crops such as amaranth and sweet sorghum. Thirteen acres within this outlying land have been placed in the USDA Conservation Reserve Program wetland and riparian restoration. Native prairie seed has been used for part of this restoration work.

Dordt has a dedicated 0.75 farm manager/greenhouse position that is topped up with seasonal student workers in summer. A 0.1 equivalent maintenance worker is also dedicated seasonally. Various faculty members have undertaken the prairie curator role, and agriculture and environmental studies faculty assignments are closely integrated. Both the ASC and the Dordt College Prairie have mission statements, and agriculture and environmental studies from a Christian stewardship perspective are strongly supported by the administration.

Case Study #3:

Gordon College, Wenham, Massachusetts

Gordon College has long had a strong environmental ethic, including mandatory recycling since 1988, biodiesel production, and green chemistry research. Faculty members have been prominent in the Christian environmental movement.²²

The 400-acre Gordon/Chebacco Woods are conserved by the college and two bordering towns, with the help of a group of conservation nonprofits. With native trees, vernal pools, permanent ponds, and numerous hiking trails, the landscape provides excellent opportunities for stewardship initiatives within an increasingly developed region north of Boston.

Conservation is partly intentional and partly an accident of history and topography. As the college grew, buildings were clustered due to wet lowlands. As a result of wetland regulations, 90% of the college's holdings are unbuildable. Construction of a parking lot on peatland during a dry year in the

1950s illustrated that such development was unwise: the parking lot soon began to sink and return to marsh. Decades later, the degraded marsh was restored by the removal of blacktop, the addition of flood control features, and the planting of thousands of wetland plants. Because of these realities, the college put much of the large wooded parcel into conservancy.

The conserved forests are facing a number of stressors from changing climate, including pests such as the hemlock wooly adelgid. Decades ago, biology faculty encouraged the college to switch from using a sewage drainage field to a town sewer. More recently, the biology department has inventoried plants and freshwater resources to highlight the natural value of the land. Current efforts include use of the trails and ponds as educational sites, and research on vernal pools and invasive species. Hundreds of elementary students have visited Gordon on field trips through a General Electric grant. Student interest in sustainability has also resulted in the development of an on-campus organic garden, more local foods in the cafeteria, and composting.

Case Study #4:

Goshen College, Goshen, Indiana

Goshen College is one of a small group of Christian campuses that have signed onto the Evangelical Climate Initiative, the American College and University Presidents' Climate Commitment, and the Sustainability Tracking and Assessment Rating System (STARS).²³ Goshen offers an undergraduate major in environmental science, a summer intensive program in agroecology, a sustainability semester in residence, and a Master of Arts in environmental education. The last three programs, along with the Institute for Ecological Regeneration, are based out of the Merry Lea Environmental Learning Center near Wolf Lake.

Goshen's main campus has a physical footprint of 158 acres, including a twenty-acre woodlot, and a two-acre retention pond converted into a wetland rain garden and seeded with prairie grasses and wildflowers. Grounds staff are also converting additional acreage from mowed lawn into native prairie. Goshen also maintains a 40-acre site in neighboring Michigan, managed to control invasive shrubs, and completely undeveloped except for a rustic cabin retreat site.

Article

Stewarding the Gift of Land: Christian Campuses as Land Management Models

In addition to these holdings, Goshen is well known for its 1,189-acre Merry Lea tract. This land includes an environmental learning center, a farmstead for hosting local school groups, the Glacial Retreat Center, and the LEED Platinum-certified Reith Village. Undeveloped natural areas make up approximately 1,123 acres, which are crisscrossed by well-managed walking trails. This diverse preserve includes habitats ranging from vernal pools, bogs, and lakes to meadows, prairies, and forests. All food and landscaping waste at Merry Lea is composted to support the agroecology program.

Merry Lea has a full-time director of land management, mandated to conserve diversity in native plant and animal habitats.²⁴ This includes controlling invasive species using hand tools, mechanical equipment, and herbicides. Prescribed burning is utilized to maintain early successional wildlife habitat, to restore wetlands, and to preserve the prairie, savanna, and oak woodlands.

Case Study #5:

Seattle Pacific University, Seattle, Washington

Seattle Pacific University (SPU) is completely integrated into an urban setting in the Queen Anne Hill area of Seattle, with less than one acre of undeveloped land at the home campus which includes a small urban wildlife habitat area. In 2009, an organic vegetable garden, the Seattle Pacific Agriculture for the Community and Environment project, was installed on an adjacent vacant lot.



Figure 7. Professor Eric Long and students have been conducting long-term ecological research on the deer of Blakely Island (foreground). The SPU dining hall / classroom / laboratory (background) incorporates earth-friendly design and materials. (Carina Long photo)

Off-campus parcels, however, place SPU on the upper end of Christian institutions in terms of undeveloped land holdings. The SPU Blakely Island Field Station, in the San Juan Island archipelago, encompasses 980 acres of mostly undeveloped land. The vast majority of this private island, including two lakes, is owned by SPU or available for educational use via easements. The Thomas B. Crowley family donated the land, custom-built the facility, and initially paid for facility management. Today, endowments created by the Crowleys and others underwrite the facility. A covenant with other island landowners allows access to most saltwater frontage on the island, and restrictive covenants protect the land from development. A full-time manager lives onsite year-round, with one biology faculty member serving as scientific director, while other faculty members spearhead various research projects (figure 7). Much of the land is under sustainable forestry management, with substantial pond and wetland areas in addition to five acres of field station facilities.

SPU also owns Camp Casey on Whidbey Island, encompassing 350 acres, of which 120 are undeveloped. A full-time manager lives onsite year-round. This acreage is adjacent to a similar habitat managed by the nonprofit Whidbey Camano Land Trust and includes the threatened golden paintbrush, *Castilleja levisecta*. Interaction with the nearby Pacific Rim Institute for Environmental Stewardship, an Au Sable Institute offshoot, allows scientific outreach.

Case Study #6:

Taylor University, Upland, Indiana

Taylor University has a strong reputation as a champion of environmental stewardship among Christian campuses. In 2003, the college expanded a decades-old undergraduate environmental science program by adding a new graduate degree offering. Based out of the Randall Environmental Studies Center, this became the first Master of Environmental Science degree offered by a CCCU institution.²⁵

Taylor's main campus has a physical footprint of approximately 200 acres, including a 55-acre state-registered nature preserve. Much of the campus is traditional lawn, though grounds staff have increased native tree plantings and unmowed grass areas over the years in an effort to beautify the

campus. There is a restored stream corridor leading to the eight-acre Taylor Lake site on the edge of campus, and a five-acre wet meadow that is left unmowed to support the growth of wetland plants.

In addition, the earth and environmental science department partnered with Avis Industrial Corporation to establish the nearby 25-acre Avis-Taylor Prairie Restoration. Taylor faculty and graduate students use this mature tall-grass prairie for various research projects, including the impact of management techniques on the development of the plant community, especially forb species.

In 2006, Taylor acquired an additional 686 acres of largely forested land, including an 80-acre forest preserve adjacent to the main campus and the Mississinewa River. The site contains multiple distinct wet- to dry-forest communities, active and fallow agricultural fields, and research projects, including tree planting.

Case Study #7: *Trinity Western University, Langley, British Columbia*

Salmon-bearing tributaries of the Fraser River criss-cross the campus of Trinity Western University (TWU). In its 50-year history, TWU has faced numerous riparian setback issues, but it has gradually embraced the pedagogical and research benefits of its natural setting. Events integral to land management included the formation of an ecological stewardship committee to address facilities impacts, the initiation of an environmental studies degree, and the acquisition of nature preserve areas.



Figure 8. The TWU wetland area adjacent to the Salmon River is home to many fish, bird, reptile, amphibian, and mammal species.

On the home campus, the Ecosystem Study Area (ESA) encompasses approximately 80 acres of second-growth temperate rainforest. This includes the Salmon River, its tributaries and wetlands (figure 8), and old-field meadow areas. The ESA serves multiple uses for recreation, reflection, and science lab/field activities. Most of the land is off-limits to development due to stream buffers and inclusion in the province's Agricultural Land Reserve program. An additional 57 acres of adjacent agricultural land includes ten acres of orchard and a community vegetable garden. The ESA hosts an outdoor salmon education program for hundreds of elementary students each spring (figure 9).

TWU also owns 72 acres on Salt Spring Island, off Vancouver Island. The Crow's Nest Ecological Research Area includes extensive Garry oak meadows. This endangered ecosystem serves as a field course and research site for students, faculty, and other scientists.²⁶

Although budget cuts have reduced staffing, an ESA manager has been key to managing these land holdings. A Rocha Canada and TWU also created a joint field resource position that was tasked with an ongoing biodiversity inventory. An endangered mollusk (the Oregon forestsnail, *Allogona townsendiana*²⁷), an endangered butterfly (the Propertius duskywing, *Erynnis propertius*²⁸), and other threatened species have been uncovered. The inventory resulted in additional conservation steps to protect the land, with a side benefit of



Figure 9. The Salmon in the Valley elementary school program at TWU provides experiential learning opportunities to hundreds of children each year.

Article

Stewarding the Gift of Land: Christian Campuses as Land Management Models

providing grant-funded conservation research experience for faculty and students.

Successful Strategies

There are men charged with the duty of examining the construction of the plants, animals, and soils which are the instruments of the great orchestra. These men are called professors. Each selects one instrument and spends his life taking it apart and describing its strings and sounding boards. This process of dismemberment is called research. The place for dismemberment is called a university.

—Aldo Leopold²⁹

Several commonalities appear in the case studies of successful campus land management approaches. Not surprisingly they center around people. The key to good land stewardship lies in faculty, staff, and administrators who daily embody the heart of a collective mission to love the Lord, serve one another, and care for creation. We find that these three groups of individuals and one practice play vital roles in campus land management.

1. Support of stewardship values from the *administration*, including articulation into institutional vision.

University administration must balance competing demands. Garnering support for stewardship values from administration is never easy. Each of the Christian institutions profiled here has an ongoing story of the challenge of convincing leadership to adopt a vision for land management. University leaders, by and large, have little experience in the science or praxis of environmental stewardship. Ultimately, success in any institutional venture rests in gaining broad support from administrators, including upper-level management. The general model for achieving such a consensus comprises a core group of dedicated natural science faculty who engage administrators and students on land issues, advocate protection, and work to inculcate conservation values for the sake of educational vitality and for the land's intrinsic value. Certainly that is the story repeated at Calvin, Dordt, Gordon, and Trinity Western (figure 10).

2. Active involvement of *faculty* in advocacy for land and in conservation-related research.

Although students represent a strong voice for change at educational institutions, the reality that drives long-term change is concerted, patient effort

by faculty members alongside successive generations of students. The language of a faculty position as a calling as opposed to simply a career is often used at Christian colleges and universities.³⁰ This special calling represents an opportunity among faculty members who make the study of God's creation and its stewardship a significant part of their life's work. Efforts to engage in restoration research and management of creation at off-campus sites would be clearly hypocritical if such faculty members ignored serious environmental issues on their own campuses. Indeed, many faculty members at the profiled campuses have devoted years of effort to campus stewardship. Often this is a thankless task. Scholarship opportunities arising from such efforts can be limited, and strong environmental advocacy may be met with derision, indifference, or opposition in the campus community. One remedy is the formation of stakeholder groups, such as the Ecological Stewardship Committee established since 1994 at Trinity Western. Any decision-making process that engages a broad spectrum of the community will be helpful.

3. Dedicated *staff* positions related to land management.

The third hallmark of successful, proactive land management is the provision of dedicated staff. This is a step that advances the process from the theoretical to the practical. Although faculty and administrators may agree on a vision, someone must carry it out. Certainly, students can be part of the equation. At Calvin, for example, students have been actively engaged in planting native species, controlling invasive species, and other earth-friendly activities such as reducing Calvin's carbon foot-

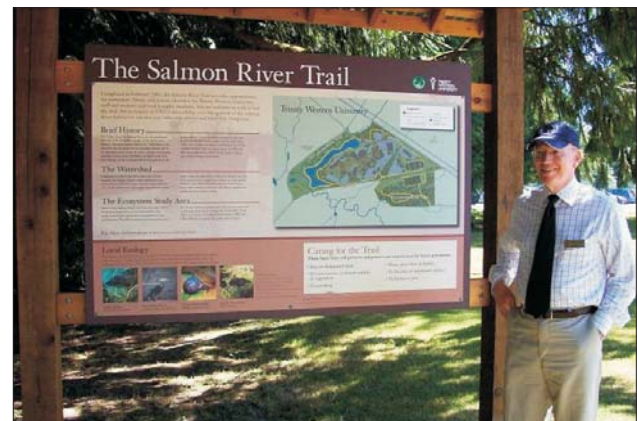


Figure 10. TWU President Jonathan Raymond supports conservation values, including public trail access through parts of the campus Ecosystem Study Area.

print.³¹ At the same time, it is difficult to integrate active land management into the busy schedules of faculty and students, and in many of the institutions examined, dedicated staff positions were key in providing a sustained approach. In cases where staff positions are not created or maintained, it is difficult to fulfill the vision set out by faculty.³² Such staff positions are costly investments to be sure, but can actually recover many costs normally incurred as a result of hiring outside consultants or payment of fines for infractions of government regulations.

4. *Bioinventory and mapping to lay out ecological value of the managed land, which may then be translated to economic value to the institution.*

The roles of land management staff can be tremendously varied and multifaceted. But one key role is in helping fulfill the fourth characteristic of successful land management: inventory and monitoring. Whether the land in question is newly acquired or subject to long-term restoration treatments, knowing what is there is vital to its stewardship. Extensive inventories of species and physiographic characteristics have been carried out for each of the seven institutions reviewed. The species inventory of the 100-acre Calvin Preserve is exhaustive. The thirteen-acre wetland placed in the Conservation Reserve Program by Dordt is well characterized. Species in the four hundred acres stewarded by Gordon are well known to professors and students there. Similarly, the land holdings of Goshen, Seattle Pacific, Taylor, and Trinity Western are also mapped and inventoried (figure 11). Placing the resulting species lists onto websites facilitates collaboration with government agencies and other interested parties.³³ Eco-

systems are dynamic and restoration efforts must be adequately resourced in order to monitor the success of these long-term efforts. This may require sacrificial attitude and effort, but it can also lead to unique research and restoration funding opportunities.

Benefits of Land Stewardship within a Christian Land Ethic

We have reported the strategies used by some of the CCCU schools to successfully manage their land holdings, but what are the benefits of managing within the framework of a specific Christian land ethic? Improved ecosystem services, reduced utility and infrastructure costs, and research funding opportunities are all economic benefits that can be realized from progressive land management policies. Of equal importance is the effect of these practices on all members of the campus community, and indeed on all who look to Christian higher education for examples of innovation and excellence. For students who have seen ubiquitous native plantings, eaten from a community garden, or studied at a field site, the impressions will have a lasting impact on their thinking and their actions regarding the creation. This becomes the less-tangible, but crucial long-term benefit of campus land management, the prophetic landscape for the future.

As Wes Jackson has suggested, we should “consult the genius of the place”³⁴—meaning, the genius of the land itself—in all of our consideration of human impact, if we are to retain our ecological capital. Today, in our maturing Christian academic institutions, we must begin to ask, “What does land stewardship really mean?” There are many proscriptive dimensions to land stewardship still needing exploration. We need to see the land through new eyes. As this survey and these case studies have shown, academics at Christian institutions are leading in new directions, with innovative strategies. Yet there is much to be learned about the practical matter of caring for the creation, and a biblical understanding of the gift is the place to start. ☾

Acknowledgments

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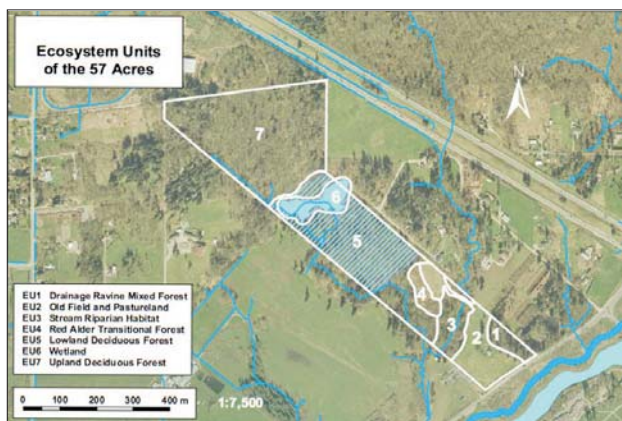


Figure 11. TWU-managed land holdings have been extensively inventoried and mapped by biology, environmental studies, and geography faculty and students.

Article

Stewarding the Gift of Land: Christian Campuses as Land Management Models

Katie Mayes undertook with a master's thesis on land stewardship at Trinity Western University. Many colleagues provided invaluable information and insights into the state of land stewardship at their respective institutions: Ron Vos and Robb De Haan at Dordt College; Dorothy Boorse at Gordon College; Bill Minter, Glenn Gilbert, and Luke Gascho at Goshen College; Tim Nelson and Darrell Jacobsen at Seattle Pacific University; and Mike Guebert, Paul Rothrock, and Paul Lightfoot at Taylor University. We are also grateful for countless other students, faculty, and staff at various CCCU institutions who responded to the survey.

About the Authors

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Notes

¹Clive Staples Lewis, *The Magician's Nephew* (New York: HarperCollins, 1954).

²Wendell Berry, *The Gift of Good Land: Further Essays Cultural and Agricultural* (New York: North Point Press, 1982), 270.

³Wendell Berry, *Home Economics: Fourteen Essays by Wendell Berry* (San Francisco, CA: North Point Press, 1987), 96–7.

⁴Jillian Berman, "College Students Are Flocking to Sustainability Degrees, Careers," *USA Today*, August 3, 2009, http://www.sas.upenn.edu/lps/news_091109_01; and see Mary Beth Marklein, "College Hopefuls Look for Green Universities," *USA Today*, September 15, 2011, <http://www.usatoday.com/news/education/2011-04-20-green-college-campus-princeton-review.htm>.

⁵Eric Norregaard and Kendra Juskus, eds., "Green Awakenings: Stories of Stewardship and Sustainability from the Next Generation," *Renewal: Students Caring for Creation* (2010), <http://renewingcreation.org/resources/840/the-green-awakenings-report-2010/>.

⁶Many efforts to improve campus sustainability are restricted primarily to aspects not directly related to land management; for example, the STARS (Sustainability Tracking Assessment and Rating System) program on North American campuses developed by AASHE (The Association for the Advancement of Sustainability in Higher Education). See <https://stars.aashe.org/>; the STARS rating system does include a "Grounds Category" that rates institutions on "integrated pest management," "native plants," "wildlife habitat," participation in the "Tree Campus USA" program, "snow and ice removal," and "compost." However, this category could be expanded considerably to incorporate additional aspects of land stewardship, and only a single criterion addresses large land holdings, that is, "wildlife habitat."

⁷Robert N. Muller and David S. Maehr, "Are Universities Leaders in the Stewardship of Conservation Lands?" *BioScience* 50, no. 8 (2000): 707–12.

⁸*Ibid.* A number of case studies illustrating policies and practices on US campuses are presented in Muller and Maehr. They reported that, despite the gift of a 5,866-acre parcel of land to the University of California at Santa Barbara with a "no sale" clause in 1967, the university managed to overturn this clause in 1990 and entertain proposals to subdivide the land to fund other university enterprises. However, pressure from the local conservation community and conservation-minded faculty resulted in the entire parcel being preserved for conservation. They also reported the acquisition by the University of Florida of 2,043 acres of land containing a mature second-growth stand of long-leaf pine that was home to the federally endangered red-cockaded woodpecker. Despite the endangered status of the bird, logging of the parcel to support university revenues continued, and the woodpecker was extirpated from the site by 1983. In a third case study, Muller and Maehr narrated a sequence of events surrounding a 14,786-acre parcel of land acquired by the University of Kentucky. Despite the conservation value of the land, timber was removed and coal mining was advocated to increase university revenues. And in the five specific case studies that they described, no clear policies or management plans have emerged

regarding land conservation; they maintain that this is a consistent theme among US institutions.

⁹For example, see K. Hailey, "Building a Sustainable Institution," *University Manager* (Fall 2008): 35–40.

¹⁰Michael M'Gonigle and Justine Starke, *Planet U: Sustaining the World, Reinventing the University* (Gabriola Island, BC: New Society Publishers, 2006).

¹¹Bernard Ramm, *The Christian College in the Twentieth Century* (Grand Rapids, MI: Eerdmans, 1963); Arthur F. Holmes, *Building the Christian Academy* (Grand Rapids, MI: Eerdmans, 2001).

¹²Muller and Maehr, "Are Universities Leaders in the Stewardship of Conservation Lands?"

¹³Ben Lowe, *Green Revolution: Coming Together to Care for Creation* (Downers Grove, IL: InterVarsity Press, 2009); Matthew K. Heun, David Warners, and Henry E. DeVries II, "Campus Carbon Neutrality as an Interdisciplinary Pedagogical Tool," *Perspectives on Science and Christian Faith* 61, no. 2 (2009): 85–98; J. Matthew Sleeth, *Serve God, Save the Planet* (White River Junction, VT: Chelsea Green, 2006); Steven Bouma-Prediger, *For the Beauty of the Earth: A Christian Vision for Creation Care* (Grand Rapids, MI: Baker, 2001).

¹⁴Two faith-based institutions included in the survey, Gustavus-Adolphus College and Pepperdine University, are not members of either the Au Sable Institute or the CCCU networks, but were included because of personal contacts.

¹⁵Questionnaire and a poster based on partial data was presented by The King's University College Environmental Studies Internship Reflections class (Themis-Marie Laffitte, Ben Peterson, Jonathan Bakker, Ike Asagwara) at the 61st Annual Meeting of the American Scientific Affiliation, Calvin College, 2006.

¹⁶See Norregaard and Juskus, *Green Awakenings*, for an extensive review of student-led sustainability activities on CCCU campuses. <http://renewingcreation.org/resources/green-awakenings-report/>.

¹⁷Muller and Maehr, "Are Universities Leaders in the Stewardship of Conservation Lands?"

¹⁸For example, see Tracy Stobbe, G. Cornelis van Kooten, and Geerte Cotteleer, "Externalities and Valuation of Farmland in the Urban Fringe," Farm Level Policy Brief, Agriculture and Agri-Food Canada, May 2007, <http://www.learnnetwork.ualberta.ca/en/FarmLevel/Publications/PolicyBriefs.aspx>.

¹⁹Peggy Barlett and Geoffrey W. Chase, eds., *Sustainability on Campus: Stories and Strategies for Change* (Cambridge, MA: Massachusetts Institute of Technology, 2004); Anthony D. Cortese and Amy S. Hattan, "Education for Sustainability as the Mission of Higher Education," *International Journal of Sustainability in Higher Education* 3, no. 1 (2010): 48–52; Tara Wright, "University Presidents' Conceptualizations of Sustainability in Higher Education," *International Journal of Sustainability in Higher Education* 11, no. 1 (2009): 61–73; Leith Sharp, "Higher Education: The Quest for the Sustainable Campus," *Sustainability: Science, Practice, and Policy* 5, no. 1 (2009): 1–8.

²⁰Loren Wilkinson, ed., *Earthkeeping: Christian Stewardship of Natural Resources* (Grand Rapids, MI: Eerdmans, 1980).

²¹Loren Wilkinson, ed., *Earthkeeping in the Nineties: Stewardship of Creation* (Grand Rapids, MI: Eerdmans, 1991).

²²Richard Wright, "Tearing Down the Green: Environmental Backlash in the Evangelical Sub-Culture," *Perspectives on Science and Christian Faith* 47, no. 2 (1995): 80–91.

²³At this time (December 2011), six CCCU institutions are enrolled in STARS.

²⁴Land management practices have been well documented at Merry Lea since Goshen first acquired the land in 1980, and more detailed information can be found online at <http://merrylea.goshen.edu/>.

²⁵At least two other campuses (Goshen College and Lipscomb University) have since added environment- and sustainability-related graduate programs.

²⁶Emily K. Gonzales and David R. Clements, "Plant Community Biomass Shifts in Response to Mowing and Fencing in Invaded Oak Meadows with Nonnative Grasses and Abundant Ungulates," *Restoration Ecology* 18, no. 5 (2010): 753–61.

²⁷Karen M. M. Steensma, Patrick L. Lilley, Heather M. Zandberg, "Life History and Habitat Requirements of the Oregon Forestsnail, *Allogona townsendiana* (Mollusca, Gastropoda, Pulmonata), in a British Columbia Population," *Invertebrate Biology* 128, no. 3 (2009): 232–42; Amanda B. Edworthy, Karen M. M. Steensma, Heather M. Zandberg, Patrick L. Lilley, "Dispersal, Home-Range Size, and Habitat Use of an Endangered Land Snail, the Oregon Forestsnail (*Allogona townsendiana*)," *Canadian Journal of Zoology* 90 (2012): 875–83.

²⁸Alicia Marshall, "Populations of *Erynnis propertius* at Selected Sites on Salt Spring Island, British Columbia," *Garry Oak Ecosystem Recovery Team Research Colloquium 2008 Proceedings* (2008): 13–4.

²⁹Aldo Leopold, *A Sand County Almanac, and Sketches Here and There; with Other Essays from Round River* (New York: Oxford University Press, 1948, 1966).

³⁰Holmes, *Building the Christian Academy*, 102–3; Walter R. Hearn, *Being a Christian in Science* (Downers Grove, IL: InterVarsity Press, 1997), 51.

³¹Heun, Warners, and DeVries, "Campus Carbon Neutrality as an Interdisciplinary Pedagogical Tool."

³²For example, at Gordon College (Dorothy Boorse, personal communication); at Trinity Western University there have been recent reductions in land management staff capacity.

³³<http://twu.ca/sites/ecosystem/species/default.html>.

³⁴Wes Jackson, *Consulting the Genius of the Place* (Berkeley, CA: Counterpoint, 2010), ix.

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Oscar González

Communication

Engaging the Evangelicals of Peru in Creation Care

Oscar González

Peru is a country that has great biodiversity and huge environmental problems. It also has a growing population of evangelicals, some in rural communities close to important conservation areas. In this communication, I describe how I encourage evangelical groups to participate in creation care, providing both reasons and paths for creation care and responses to opposition.

The Challenge

Peru has one of the highest species densities in the world. Its complex geography includes coastal deserts, the Andean mountains, and the Amazon rainforest. It is the fifth country in the world in terms of biodiversity richness, with up to 1,840 bird species and 17,000 flora species, and it harbors 13% of the Amazon rainforest.¹ However, this country is also part of the underdeveloped world: 40% of the population is considered to be poor. Poverty forces people to over-exploit natural resources, leading to land damage, pollution, and species extinction. According to the National Census of 2007, the majority of Peruvians are Roman Catholic (81.5%), with a percentage of evangelical Protestants (12.5%) that has almost doubled since 1993.² As many of these Catholic and evangelical communities live close to important natural areas, their participation in the conservation process is vital.

Evangelical Christians in particular are gaining political clout in the country, rising in power in rural areas where the system of living in community in small towns is quite strong.³ Evangelical

churches are tightly woven, and they usually help each other in their community. In some areas of the country, evangelicals are in the majority, and in these areas, even the authorities are evangelical.⁴ Many of these areas are also close to ecosystems that are protected.

The evangelical communities have sometimes clashed with the national authorities that manage protected areas.⁵ Not all evangelicals are aware of or convinced of the current challenges to the environment. For an individual or group to act, it is necessary to look not only to knowledge, but also to the belief system as a moral trigger. If nature conservation is what one's ethics or religion requires, then the individual or group can be convinced and moved to action.⁶

In Christianity, God is the Creator and Sustainer of nature. God gave it to human beings, who are part of the creation, to administrate it. Christianity, therefore, can be a consistent source for environmental ethics.⁷ Conservationists have begun to acknowledge this value of religions as a key source of ethics toward nature for people all over the world. The World Wildlife Fund and Conservation International promoted outreach with some religious leaders and involved them in the conservation of sacred spaces that can preserve ecosystems.⁸

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Edward O. Wilson, in his book *The Creation*, calls evangelical church leaders to join scientists and conservationists, recognizing the power of the pastors in guiding their people toward a better way of life, which also implies a healthy environment.⁹

Christianity and Creation Care

Christian communities may disregard nature conservation due to having a wrong idea, that the natural world is bad and opposed to spiritual matters. This view can be tragically combined with a misinterpretation of Gen. 1:26–28¹⁰ as a commandment to extract and deplete everything that is in nature. Herein lies, according to Lynn White, the “root of our environmental crisis.”¹¹ His thesis has been thoughtfully considered and critiqued in this journal. Others as well have rebutted White, showing that the Bible does not justify the destruction of nature.¹² The mandate “to subdue the earth” has to be seen in the context of the task that God also gave to the first man (following the Genesis story), to “till and care for the garden.” Theologians have developed the doctrine of “creation care,” reinterpreting this verse. The verb translated as “subdue” in Gen. 1:28 comes from the Hebrew verb “*shamar*,” which means, in a broader sense, “to keep and care for.”¹³

When they study the Bible, most modern-day Catholics, mainline Protestants, Orthodox Christians, and evangelicals are able to agree that God is the Creator and that humans should take care of the earth.¹⁴ The Bible implies stewardship of the earth; this can be seen in several biblical texts that refer to nature. Caring for creation was implied before Christ, in the Jewish laws to administer the use of the land, plants, and animals.¹⁵ Not only have theologians sponsored creation care, but many scientists that are evangelicals also stand for this doctrine.¹⁶ Creation care is a doctrine of common ground between different Christian traditions.

Creation care or responsible stewardship of creation recognizes that conservation of nature is a commandment for Christians. God created human beings and made them responsible for managing the rest of the creation. In this view, human beings are not the owner of the creation but rather stewards who must be accountable for how they manage the

land and its creatures. Thus, biodiversity conservation could be seen as creation care in action. Creation care argues that the Bible says that God creates and sustains life on the planet, that humanity is created in God’s image and is charged to care for the rest of his creatures, and that everything that was created is good. According to this line of theological thought, when creation care is neglected, environmental problems will come as a consequence of that sin. However, restoration of a healthy relationship between humanity and the environment is possible if there is repentance.¹⁷

Opposition to Creation Care

In the Peruvian context, there are certain doctrinal positions that, in some cases, make the evangelical communities decide not to embrace the creation care doctrine.

A. Liberation Theology and Social Justice

In Latin America, liberation theology, which originated in Peru,¹⁸ was popular in the mid-twentieth century. In some countries, such as El Salvador, this religious position cost many their lives.¹⁹ It appeared at a time when socialist and communist movements started to confront the social order, and progressive Catholics embraced it. Eventually, the preferential option for the poor became part of the Roman Catholic Church’s official doctrine. However, the poor keep destroying the natural resources that they need. There has not been an emphasis on a sustainable use of nature within this doctrine. Its agenda is to get political power to do justice in the name of the poor, but it is not clear how the poor should manage their environment to come out of poverty. Although, in and of itself, it is considered a challenge to an evangelical position because the emphasis is not on salvation by Jesus Christ, but on getting social justice,²⁰ some pastors who are sympathetic to liberation theology think that environmental problems may be a justification to get into local politics.²¹

B. Prosperity Gospel

This doctrine, although its roots are in evangelical movements, is rejected as heresy by mainline evangelicals.²² It claims that God’s will is that Christians

Communication

Engaging the Evangelicals of Peru in Creation Care

should be rich and that poverty is a sin and a symbol of lack of faith. People are pressured to give money to their churches so that they will be blessed later.²³ For people that adhere to this view, nature is not considered important, only a resource to be depleted. Here it is possible that there are cases of corruption by mismanagement of money. It is better to avoid these groups if there is evidence that they think in this way; they would not care about nature conservation.

C. Spiritualizing the Material World

Present in some Pentecostal and charismatic groups, this view proffers an extreme dualism of matter and spirit, therefore nature, as part of the nonspiritual world, is not valuable for them. Other positions that adhere to spiritualizing the material world include the denial of climate change and other scientific predictions,²⁴ and force a duality of science against religion. They may reject creation care because it sounds “scientific” or “not creationist.” Due to the fact that some New Age movements support nature conservation, these evangelicals cannot tell New Age environmentalists apart from Christians or other people that support creation care.²⁵ With people who think like this, it is necessary to explain that creation care comes from the Bible, not from any alien doctrine, and is independent of any position related to origins.

D. Deep Ecology in Shamanist Culture

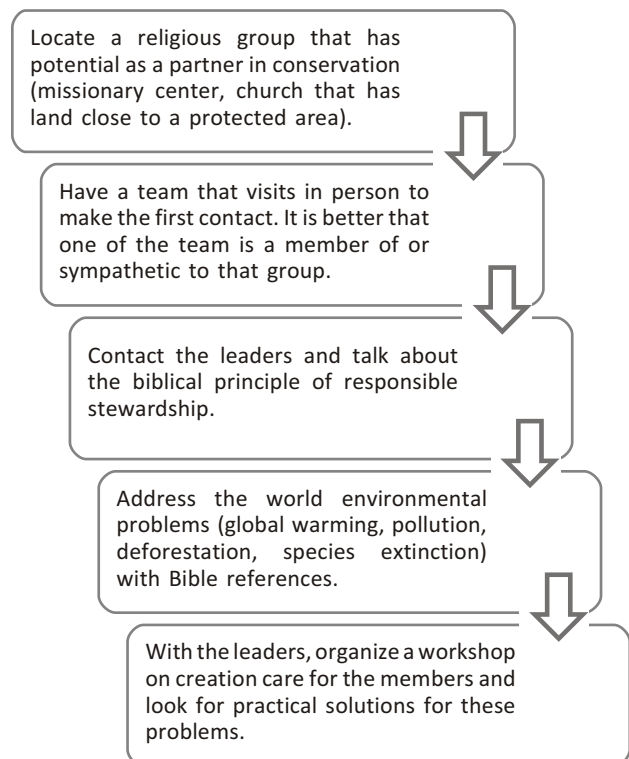
Before the Spaniards came to Peru, the Incas and other cultures that were subdued by them adored the sun, stars, and land. The land was the goddess to whom they had to pay homage.²⁶ Some people are restoring these ancient beliefs and therefore have a mystical approach to the land. There are Andean communities that have mixed these ancient religious practices with Catholic traditions as part of the “popular religion.”²⁷ Evangelicals who have come out of this context in the Andes may think that creation care is a way to worship the goddess of the land. But worshipping the land does not necessarily imply its conservation. Local communities that practice these mixed rituals have destroyed native forests and overgrazed native pastures.

Approach to Evangelical Communities and Institutions

I have been promoting creation care in Peru since 1994, when I collaborated to publish a book with a group of Peruvian evangelicals gathered by the National Council of Peruvian evangelicals (at that time the only association that represented the main evangelical denominations in Peru). The book explained the theoretical framework of why a Christian should preserve the environment.²⁸ Since then, very few attempts have been made to approach churches to involve them in conservation.²⁹ Until 2003, there was not any national or international group pursuing this.³⁰

To establish a link between a Christian community or institution and a natural protected area with wildlife or a specific natural place in an urban zone, I recommend a helpful process based on my experience as an environmental educator and conservation biologist in Peru (figure 1).

Figure 1. Process to approach religious groups based on the creation care principle.



This approach has been used in different cities and towns throughout the country between 2004 and 2009, when I visited thirteen evangelical groups and one governmental institution (table 1) for various reasons, but mainly to do particular research in the specific environment where the city was located (for example, Oxapampa, to study the montane rainforest). However, I also used the opportunity to approach groups to talk about creation care to con-

serve the native environment where the community is located. I approached the majority of them using the process of figure 1. Several groups welcomed the idea of creation care and the response of some members or the leader of the group was to start a conservation plan such as courses, field trips, or participation in reforestation projects. However, some of them were indifferent and one denied any responsibility for creation care.

Table 1. Presentations on Creation Care to Christian Groups and Institutions in Peru

Year	City and Environment of Interest	Churches and / or Institutions	People Reached (approx.)	Response of the Group Following Presentation
2004	Lima (coastal wetlands)	Christian and Missionary Alliance	120	Field trip to a protected wetland
2004	Lima (coastal wetlands)	Lutheran Church “Cristo Rey”	60	Proposal of field trip with children
2005	Lima (coastal wetlands)	Education College “Diego Thompson”	250	No response
2006	Lima (coastal wetlands)	Light Educational Ministries	0	Presentation denied
2006	Juanjui (lowland rainforest)	Christian and Missionary Alliance	40	Youth of the church involved in the conservation program of Rio Abiseo National Park
2006	Lima (coastal wetlands)	Theological Seminary of the Christian and Missionary Alliance	150	New course in the seminary: “Ecology and Christianity”
2007	Lima (coastal wetlands)	Theological Seminary of the Presbyterian Church	15	No response
2007	Oxapampa (montane rainforest)	Christian and Missionary Alliance	35	Proposal of field trip with children to Yanachaga National Park
2008	Lima (coastal wetlands)	Faculty of Theology of the Alliance Church	25	No response
2008	Ica (dry mesquite forest)	<i>Iglesia Apostólica Profética de Jesucristo</i> (Guadalupe)	72	Youth trained to do a reforestation program
2008	Ica (dry mesquite forest)	<i>Iglesia Cristo Redentor</i> (Yaurilla)	15	Youth trained to do a reforestation program
2008	Ica (dry mesquite forest)	<i>Iglesia El Aposento Alto</i> (La Venta)	62	Youth trained to do a reforestation program
2008	Tarapoto (lowland rainforest)	Institute of Natural Resources, course for park rangers of the Peruvian National Park system	45	Strategy to reach churches that impact in protected land of the Peruvian National Park system
2009	Ayacucho (high Andean ecosystems)	Bible United Society	50	Booklet “Called for Caring God’s Creation”

Communication

Engaging the Evangelicals of Peru in Creation Care

Positive Outcomes of Introducing Creation Care

Although there is still some opposition, several creation care initiatives are now being carried out by evangelical churches. Institutions such as The Evangelical Environmental Network³¹ are working to raise environmental awareness in evangelical churches worldwide. In Peru, even though I have met with some prejudices and indifference, nongovernmental associations such as A Rocha Peru, affiliated with A Rocha International,³² have been working since 2004 to approach evangelical churches and to encourage their taking part in creation care. This opens a door to cooperation between evangelical churches and conservation organizations. This is very important because within the nonreligious community of conservationists, there are people reluctant to work with Christians. Evangelicals are seen as intolerant, ignorant, and deniers of scientific principles such as evolution.³³ The dualism of science and religion is a myth that too often is believed by both sides.

Outcomes of creation care have been more than just a sermon. In some places it has meant the creation of church conservation committees, which look into the sustainability of the church building and the environment around it. A pastor that is aware of creation care may incorporate nature appreciation into worship services, looking at some Psalms that describe the beauty of creation.³⁴ The church that believes that creation care is an integral part of its ministry will educate children and adults in conservation, in Sunday school, or at other study meetings. Later, there will be personal commitments of church members to get involved in conservation activities.



Youth of the CMA church visiting a wetland in the coast of Lima

The positive results of creation care in the stewardship of the Chesapeake Bay (USA)³⁵ might in some ways be duplicated in Peru and other Latin American countries. The positive outcomes of creation care were suggested in a joint publication to Christian leaders, stressing that nature conservation is part of the church's mission.³⁶ Theological seminars for pastoral training have been formed for creation care through invited lectures and even courses, and some evangelical churches of different denominations have instituted creation care training and activities (see table 1).

The introduction of the creation care doctrine to evangelical churches in Peru helps them to more closely follow the implications of the gospel, such as cooperating in conservation projects. ¶

Acknowledgment

I am thankful to Stella Tippin who helped in the English version of this document.

Notes

¹Detailed information is given in <http://www.biodiversitya-z.org/areas/26> and in R. A. Mittermeier, P. R. Gil, and C. G. Mittermeier, *Megadiversity: Earth's Biologically Wealthiest Nations* (Monterrey, Mexico: Conservation International, Cemex, 1997).

²Precise statistics about social parameters of poverty, religious affiliation, and other topics in Peru were taken from data published in *Instituto Nacional de Estadística e Informática* (INEI). *Sistema de indicadores de pobreza: Peru en cifras* (Lima: INEI, 2008).

³Tomas Gutierrez, *Evangelicos, democracia y sociedad* (Lima: Editorial Linea Andina, 2005).

⁴Dario Lopez and Victor Arroyo, *Tejiendo un nuevo rostro publico: Evangélicos, sociedad y política en el Peru contemporáneo* (Lima: Instituto de Ciencias Políticas "Nueva Humanidad" and Ediciones Puma, 2010).

⁵Once, a chief of a national park in the Amazon forest wanted my participation as a speaker in a training course to their rangers on how to deal with evangelical groups, explaining creation care to them. He said that when the rangers approached these religious communities asking them not to log and not to hunt in the protected area, they responded: "God gave us this land for our benefit! We have the right to subdue it!"

⁶Conservation biology textbooks do agree that morality systems and religious values could be a positive influence on conservation action. See C. Anne Claus, Kai M. A. Chan, and Terre Satterfield, "The Roles of People in Conservation," in Navjot S. Sodhi and Paul Ehrlich, *Conservation Biology for All* (Oxford: Oxford University Press, 2010), 262–339; and Fred

- Van Dyke, *Conservation Biology: Foundations, Concepts, Applications* (New York: McGraw Hill, 2003), chap. 3.
- ⁷K. O'Brien, *An Ethics of Biodiversity: Christianity, Ecology and the Variety of Life* (Washington, DC: Georgetown University Press, 2010).
- ⁸See <http://www.arcworld.org/>.
- ⁹Edward O. Wilson, *The Creation: An Appeal to Save Life on Earth* (New York: W. W. Norton & Company, 2006).
- ¹⁰Genesis 1:26–28 says:
Then God said, "Let us make mankind in our image, in our likeness, so that they may rule over the fish in the sea and the birds in the sky, over the livestock and all the wild animals and over all the creatures that move along the ground." So God created mankind in his own image, in the image of God he created them; male and female he created them. God blessed them and said to them, "Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish in the sea and the birds in the sky and over every living creature that moves on the ground."
- ¹¹Lynn White, "The Historical Roots of our Ecologic Crisis," *Science* 155, no. 3767 (1967): 1203–7.
- ¹²Some prominent responses are done by Robert Booth Fowler, *The Greening of Protestant Thought* (Chapel Hill: University of North Carolina Press, 1995) and Raymond J. Berry, ed., *The Care of Creation* (Leicester, UK: Inter-Varsity Press, 2000).
- ¹³The Evangelical Environmental Network gives a very good source for the concept and application of creation care. See www.creationcare.org.
- ¹⁴Good sources are the books of E. Breuilly and M. Palmer, *Christianity and Ecology* (London: WWF, Cassell Publishing, 1992); D. T. Hessel and R. R. Ruether, *Christianity and Ecology: Seeking the Well-Being of Earth and Humans* (Cambridge, MA: Harvard University Press for the Harvard University Center for the Study of World Religions, 2000); and Celia Deane-Drummond, *Eco-theology* (London: Darton, Longman and Todd, 2008).
- ¹⁵A version of the Bible which has highlighted (in green) the references to nature, and has comments by respected Christian leaders of different denominations on why Christians should conserve it, is the "Green Bible" by Harper Bibles (New York: HarperCollins, 2008).
- ¹⁶Ghilleen T. Prance, *Earth under Threat* (Glasgow: Wild Goose, 1996); and Calvin B. DeWitt, "Preparing the Way for Action," *Perspectives on Science and Christian Faith* 46, no. 2 (1994): 80–9.
- ¹⁷Some Bible verses to back up the creation care doctrine are Isa. 45:12; Gen. 1:27; Gen. 2:15; Gen. 1:31; Exod. 23:10–11, Isa. 24:5–6; Jer. 23:10; Gen. 3:17–18; and 2 Chron. 7:14. A very good modern interpretation for these verses in the environmental context is given by Calvin B. DeWitt, *Caring for Creation: Responsible Stewardship of God's Handiwork* (Grand Rapids, MI: Baker Books and the Center for Public Justice, 1998).
- ¹⁸Gustavo Gutierrez, a Roman Catholic priest, considered that the founder of liberation theology is Peruvian. A book that explains his views is G. Gutierrez, *A Theology of Liberation: History, Politics and Salvation* (New York: Orbis, 1971).
- ¹⁹Anna Peterson, *Seeds of the Kingdom: Utopian Communities in the Americas* (Oxford: Oxford University Press, 2005). Emilio A. Nuñez is an evangelical theologian from El Salvador who gives a balanced critique for liberation theology, accusing it of not being rooted in the Bible but in the social context, and who also alerts evangelicals to not forget the social problems of their particular context. Emilio A. Nuñez, *Teología de la liberación* (San Jose, Costa Rica: Caribe, 1986).
- ²⁰A classic work on the relationship between the evangelical faith and liberation theology in Latin America is given by Samuel Escobar, *La fe evangélica y las teologías de la liberación* (El Paso, TX: Casa Bautista de Publicaciones, 1987).
- ²¹A series of essays on how evangelicals related to local politics in the Latin American context is explained by Pablo Alberto Deiros, ed., *Los evangélicos y el poder político en America Latina* (Grand Rapids, MI: Nueva Creacion, 1986).
- ²²An analysis of the prosperity theology from the Latin American view is given by Martin Ocaña, *Los banqueros de Dios: Una aproximación Evangélica a la teología de la prosperidad* (Lima: Ediciones Puma, 2002).
- ²³Hank Hanegraaff, *Cristianismo en crisis* (Miami, FL: Unilit, 1993) also comments on the bad influence of prosperity theology.
- ²⁴E. C. Beisner, *Where Garden Meets Wilderness: Evangelical Entry into the Environmental Debate* (Grand Rapids, MI: Acton Institute for the Study of Religion and Liberty / W. B. Eerdmans, 1997).
- ²⁵Ernest Lucas, "A Short Introduction to the New Age Movement," *Science and Christian Belief* 4 (1992): 3–11 gives a concise explanation of the New Age movement and a Christian response to this movement.
- ²⁶Two good sources that explain in detail the relationship of Andean communities with the land and how their religious and cultural perspectives are involved are Fausto O. Sarmiento, Guillermo Rodríguez, and Alejandro Argumedo, "Cultural Landscapes of the Andes: Indigenous and *Colonio* Culture, Traditional Knowledge, and Ethno-ecological Heritage," in *The Protected Landscape Approach: Linking Nature, Culture, and Community*, ed. Jessica Brown, Nora Mitchell, and Michael Beresford (Cambridge: IUCN The World Conservation Union, 2005); and Daniel W. Gade, *Nature and Culture in the Andes* (Madison, WI: The University of Wisconsin Press, 1999).
- ²⁷"Popular religion" (*religiosidad popular*) is a mixture and syncretism that some Roman Catholic communities have done to preserve ancient beliefs. Rodolfo Blank, *Teología y misión en America Latina* (Saint Louis, MO: Editorial Concordia, 1996). A case study on how an Andean community holds to this religious syncretism is well explained in Terry P. Smith, "Coca and the Mountain: Observations into the Worldview of the Quechua of Pano," *Notes on Anthropology and Intercultural Community Work* 22 (1996): 1–21.
- ²⁸Oscar Perez, ed., *El sermón ecológico: Un encuentro de la fe Cristiana con la crisis ambiental* (Lima: CONEP-APEP-VM, 1994). I have a chapter in this book, "La Biblia, un tratado sobre la naturaleza" [The Bible, a treatise on nature].
- ²⁹One university professor of chemistry published a book explaining the global environmental problems and encouraged Christians to embrace creation care: Juan C. Arroyo, *Guardianes de la tierra: Los Cristianos y el medio ambiente* (Lima: Editorial Puma, 1995). Later I justified the

Communication

Engaging the Evangelicals of Peru in Creation Care

utility of creation care in biodiversity conservation in a paper published in the journal of the Peruvian Association of Ecology: Oscar González, "La conservación de la naturaleza según el principio bíblico de la mayordomía responsable," *Ecologia (Peru)* 1 (1998): 95–7.

³⁰The organizations that were formed in Peru to promote creation care were the *Instituto para la Conservación de la Naturaleza "Nueva Creación"* founded in 2003 and A Rocha Peru, founded in 2004. I was a founding member of both organizations.

³¹See www.creationcare.org.

³²www.arocha.org.

³³Mark A. Noll, *The Scandal of the Evangelical Mind* (Grand Rapids, MI: Eerdmans, 1994). It is interesting that in an old book on Christian philosophy, Warren Young declares that there is an urgent need to develop Christian scholars, and he gives one example concerning the critics of evolution. He states that several evangelicals have written nonsense, criticizing this theory, and only Christians with adequate knowledge in the sciences should give opinions on this

topic. Warren C. Young, *A Christian Approach to Philosophy* (Wheaton, IL: Van Kampen Press, 1954). However, evangelical theologians that write for a Latin American audience keep quoting the out-of-date books of creationists Henry Morris and Duane Gish as scientific evidence against evolution. Richard B. Ramsay, *Integridad intelectual: Un llamado al Cristiano a pensar y vivir integralmente* (Terrasa: Editorial CLIE, 2005).

³⁴Check Psalms 8 and 104.

³⁵<http://whenheavenmeetsearth.org/>.

³⁶Pedro Arana, Victor Ferrer, and Oscar Gonzalez, *Llamados al cuidado de la creación: La función mayordomica de la iglesia* (Lima: Sociedades Biblicas Unidas, 2009). This was a booklet produced by two theologians and a biologist as part of a series of pamphlets on current topics and moral issues addressed to all Christian churches, sponsored by the United Bible Society of Peru.

ASA Members: Submit comments and questions on this communication at www.asa3.org → FORUMS → PSCF DISCUSSION.

ASA Annual Meeting Field Trips

Friday, July 19, 2013

Mammoth Cave National Park



Explore how the surface and cave tie together, eat an early lunch, possibly have time to visit the gift shop, and then go in the cave to learn about the geology, biology, and history of the cave. Participants

need to wear comfortable walking shoes and bring a jacket or sweatshirt since the cave temperature is about 55°F. Do not wear any shoes that have been in another cave or mine since 2005. All participants are required to walk the length of an artificial turf mat to remove spores and dirt after exiting the Cave.

Belmont Mansion



Listed as one of Nashville's top twenty tourist attractions, Belmont Mansion is the largest house museum in Tennessee and one of the few nineteenth-century homes whose history revolves around the life of a woman, Adelia

Hayes Franklin Acklen Cheatham. Belmont Mansion, located on Belmont University campus, was placed on the National Register of Historic Places in 1971. Its meticulous restoration and unique role in the history of Nashville and the South draw visitors eager to hear its story.

Discover Nashville



Spend a morning uncovering the beauty of Nashville. An experienced tour guide will blow you away with incredible stories of Music City, which is rich with history. Enjoy a driving tour of attractions such as Honky Tonk Row,

the State Capitol, Bicentennial Mall and Farmers Market, The Parthenon, world famous Music Row, and Studio B, where Elvis recorded the majority of his hit records. Then spend time inside the Historic Ryman Auditorium, considered the "Mother Church of Country Music," and visit The Country Music Hall of Fame and Museum, for a self-guided tour of this \$37 million interactive musical experience.

Parthenon



The Parthenon stands proudly as the centerpiece of Centennial Park, Nashville's premier urban park. The re-creation of the 42-foot statue Athena is the focus of the Parthenon just as it was in ancient Greece.

The building and the Athena statue are both full-scale replicas of the Athenian originals. The Parthenon also serves as the city of Nashville's art museum. The focus of the Parthenon's permanent collection is a group of 63 paintings by nineteenth- and twentieth-century American artists donated by James M. Cowan.

Register at www.asa3.org



BETWEEN HEAVEN AND EARTH: Christian Perspectives on Environmental Protection by Fred Van Dyke. Santa Barbara, CA: Praeger, 2010. 247 pages. Hardcover; \$44.95. ISBN: 9780313375361.

Conservation biologist Fred Van Dyke does not want his latest book viewed as yet another general entry into the crowded field of literature on creation care, written by and for Christians. Especially in the first two chapters, he begins by addressing his colleagues in the conservation biology community. He urges them, and others working in conservation and environmental issues, to consider the robust environmental ethic and conservation practice drawn from and part of the Christian tradition, as well as a Christian activism that breaks with the ethical paralysis of current conservation biology and environmental science. Yet, Van Dyke thinks that Christians should also read this book because they will come away with new knowledge, not found in other Christian writings on environmental issues. Principal new insights include an unbroken Christian conservation tradition from the very beginning of the Christian church as well as a compelling and distinctive form of Christian environmental activism.

The prerequisites for addressing these two very different intended audiences do not match up very well. Conservation and environmental scientists are largely unfamiliar with the surveys of biblical exegesis about the nonhuman creation, of environmental theology, of the debates about the roots of environmental problems, and of the church's relationship to environmental matters (chaps. 3–6). Yet these have been recurrent topics in the nearly half century of Christian environmental literature and really do not need further reiteration for a Christian audience of environmental advocates. This fact points to a basic dilemma of the book: is the intended primary audience the actual audience? Sales figures will not help here, but given the clear Christian faith-based content of much of the book, as well as the title, I think the hoped-for more secular conservation and environmental readership will largely stay away. Van Dyke wants to throw this community a lifeline but, given the book's content and voice, it is one they will not likely reach for. A more systematic treatment of environmental ethics and activism per se, which, while based on Christian confessions, theology, assumptions and ultimacies, but one that leaves these largely implicit, would likely be more successful in capturing their serious attention and consideration. The writings of Holmes Rolston III,

environmental philosopher and ethicist who is admired and referenced by Van Dyke, would fall into this category.

If I am right that Christian readers are still the main audience for *Between Heaven and Earth*, what subject matter in this book enlarges their knowledge and charts new directions for Christian perspectives on environment? The middle chapters (3–6), as shown, cover familiar terrain. But the opening chapters (1 and 2) and the closing ones (7–10) break important new ground. As a guide to environmental living, action, and management, environmental ethics (both normative and applied) is today a necessary turn and natural successive next step for Christians writing on environmental issues. Though not an ethicist, as a conservation biologist Van Dyke is well positioned and qualified to take Christian environmentalism in this direction.

In chapter one, he surveys the intellectual tradition in conservation and environmental science and concludes that they are fields without hope, locked into Enlightenment objectivism that excludes ethical judgments and management decisions. He argues for an "ethically overt" (p. 11) conservation science and endorses, from among other candidates for this purpose, the Christian tradition of creation stewardship, based on Christian theology, traditions, and practices. This is a courageous recommendation. Most environmental professionals, if they are open to ethics at all, have been conditioned to entirely exclude this worldview as an ethical solution but, rather, see it as the cause of the world's environmental plight. Chapter two is an informative and eye-opening journey through various contemporary schools of environmental ethics. Each school, Van Dyke argues, runs aground as a full-fledged and fully functional ethic for environmental action because it fails to deal with each and every necessary fundamental question about human relationships to the nonhuman world. Van Dyke wants to demonstrate that a Christian conservation ethic does answer all these questions and therefore is truly comprehensive (chap. 9).

Four chapters follow that, for Christian readers, are a more or less standard account and review of biblical environmental commentary, environmental theology, and ecclesiology, but which for secular environmental professionals constitute the evidence that must demonstrate Van Dyke's assertion. Important for both readerships is his claim of, and evidence for, a continuous tradition of conservation within Christianity. I think this is overstated and without sufficient evidence. The thinkers and

Book Reviews

practices Van Dyke registers and describes are no doubt lone forerunners of present-day Christian conservation efforts, but to weave them into a persisting and integrated cultural tradition of conservation is, I believe, historically untenable. A geographically broader and continuing Christian environmental ethic, one with far greater cultural engagement, is linked to the prevailing, although deeply flawed, nature-grace dualism in medieval and early modern Christian Europe. Clearing forests, draining wetlands and burning grasslands, and then replacing these with the preferred fields, pastures, orchards, villages, and gardens were seen as adding grace (God's gift, humanity's task) to (fallen, disordered) nature, to civilizing, and even finishing it.

Christian environmental education, organizations, leadership, conservation projects, media, and lobbying efforts all come on to the scene post-Earth Day, 1970, the beginning of the modern environmental movement. Chapters seven and eight take important steps to itemize, tell the stories, characterize, and connect together all these different forms of Christian environmental activism. Van Dyke himself was recently appointed Executive Director of the Au Sable Institute of Environmental Studies, a college-level, Christian environmental education enterprise. All such efforts are the beginnings of a truly sustained Christian tradition of environmental conservation. No doubt, there are other stories, undertakings, trailblazers, and associations that have to be added in order to fashion a global history of Christian creation care. Such an account is of great value to Christian environmentalism, establishing a tradition from which others may draw encouragement, common purposes, best practices, expertise, and cultural appropriateness.

With telling examples, the distinctiveness and place of Christian conservation efforts are highlighted throughout these chapters. Slowly, faith-based organizations have become accepted partners among government, NGOs, and international conservation efforts. Christian environmental organizations, Van Dyke underscores, bring necessary distinctive approaches to conservation. Most important is a primary regard for people in their actual relationships to the nonhuman environment, something commonly overlooked by the more technical, policy, and environment-only solutions of mainline organizations. Environmental problems are fallings-out, dysfunctional and alienated relationships among people and the natural world. Environmental conservation restores these relationships into ones of care and fit. It should be pointed out, however, that when it comes to environmental issues, a Christian

ethic is not the only one that treats people and nature together. The biblical warrant for this among Christians is the alienation among humanity, nature, and God and the reconciliation of these three in Jesus Christ. Albeit from a functionalist perspective, environmental anthropologists and cultural ecologists have also long worked with a holistic people-nature paradigm to study and advocate for action on environmental issues.

Environmental activism by Christians has as its goal the recognition and acceptance of an alternate set of environmental values. Nature's intrinsic and instrumental values are both part of a creation that God sees as good. Van Dyke adds aesthetic value in between these two as a third category, a human relationship to nature that can act on behalf of intrinsic worth and does not belong to instrumental value. Aesthetic value bundles the study, enjoyment, contemplation, and appreciation of the beauty of the nonhuman world. Normally, these are regarded as ways in which nature is valuable to people: scientific, recreational, and aesthetic values. Rather than distinguishing a category of value that serves as the motor for a Christian environmental ethic, I much prefer that duties to the natural world be integrated into every type of human interaction with the nonhuman environment.

Between Heaven and Earth makes important contributions to Christian environmental ethics and to the recent history of Christian environmental activism.

Reviewed by Henk Aay, *Professor of Geography and Environmental Studies, Emeritus, Calvin College, Grand Rapids, MI 49546.*

THE HOCKEY STICK AND THE CLIMATE WARS: Dispatches from the Front Lines by Michael E. Mann. New York: Columbia University Press, 2012. 395 pages, notes, index. Hardcover; \$28.95. ISBN: 9780231152549.

Nonspecialists, especially those unfamiliar with peer-reviewed literature and the practice of science, sometimes find reliable information about climate change hard to come by. Michael Mann's *The Hockey Stick and the Climate Wars: Dispatches from the Front Lines* gives a remarkably readable antidote to this problem. If you read only one book on climate change, this one is hard to beat. Since Mann has made important contributions to climate science, and those contributions brought on attempts to assassinate his character, his personal story provides an engaging, easy-to-read context to learn about (1) the science, which he has a gift for describing, and (2) how the often seamier side of the politics

of climate change makes it difficult for laypeople to recognize reliable information on the subject.

Mann became a public figure when he published, with Raymond Bradley and Malcolm Hughes two papers which reconstructed the earth's spatial temperature history for the past millennium. The papers were a step forward in method and in precision, providing yearly resolution of historic temperatures where previous studies had only decadal resolution, but more importantly, quantitative uncertainties. As examples of the reconstruction's resolution, it confirmed anecdotal accounts of a large El Nino event in 1791, and showed that 1816, "the year without summer," was a year that was cold in Eurasia and North America (where our reports come from), but warmer than usual in the Middle East and Labrador (p. 48). The year without summer was largely a local event.

Mann would have remained off the public stage had he and his co-authors not decided to find the annual average Northern Hemisphere temperatures (in Mann's words, "the least scientifically interesting thing one could possibly do"). The result, when plotted, resembles a hockey stick where temperature fluctuates within a relatively narrow range for a thousand years (the handle) followed by a rapid increase (the blade), beginning at the start of the industrial revolution. Even with the large uncertainties in historical temperatures, 1990, 1995, and 1997 were the warmest in a thousand years. The temperatures of those three years have been surpassed consistently since the paper's 1998 publication.¹

Outside the scientific community, Mann's paper became controversial because of its prominence in the Intergovernmental Panel on Climate Change's (IPCC's) Third Assessment Report (2001) and the fact that the temperature history challenged a key contention of climate skeptics.² Many skeptics contend, based on British scientist Hubert Lamb's work between 1960 and 1982 (p. 34), that the earth was warmer during the so-called Medieval Warm Period (MWP) than now (climate scientists now prefer the label Medieval Climate Anomaly).³ Such a view gives succor to those who believe that our current situation is not unusual compared to historic climate fluctuations. In fact, Mann et al.'s reconstruction revealed the MWP. The warmest 100-year period prior to the twentieth century in the reconstruction was 1084–1183, right in the middle of the MWP. But their reconstruction (and subsequent ones) showed that its temperatures were still cooler than the warmest years in the 1990s.

It is important to note that our understanding of the impacts of greenhouse gas increases on climate does not depend on the hockey stick construction. Thus the reconstruction cannot prove or disprove the cause of current warming.⁴ Nevertheless, Mann became a target of skeptics' harassment and character assaults. Peculiarly, the assaults have persisted for fourteen years even as temperatures have continued to rise and at least eleven subsequent independent studies (some using completely different data and different methods) have confirmed the conclusion of Mann et al. concerning modern temperatures being unprecedented.⁵

The harassment included political intimidation from powerful people such as Senator James Inhofe, US Representative Joe Barton (who famously apologized to British Petroleum for the treatment it received in the wake of the Deepwater Horizon oil spill), and most recently, the state of Virginia Attorney General Ken Cuccinelli, who demanded that the University of Virginia turn over essentially every e-mail, record, or document related to Mann during his time at the University of Virginia (p. 237). Inhofe, who claimed from the Senate floor that climate change was "the single greatest hoax ever perpetrated on the American public," threatened investigation in intimidating letters to Mann and others. Barton, as chair of the House Energy and Commerce Committee, demanded extensive materials, including "all financial support you have received related to your research, including, but not limited to all private, state, and federal assistance, grants, contracts (including subgrants or subcontracts), or other financial awards or honoraria," and demanded "the location of all data archives relating to each published study for which you are author or co-author ... such supporting documentation as computer source code, validation information, and other ancillary information," among many other requests in what was clearly an effort to burden and intimidate Mann and others.

Apart from the riveting political and personal story, the book deftly covers a surprisingly broad range of scientific subjects, ranging from basic physics of greenhouse gases, to principal component analysis (PCA), the mathematical method used in the hockey stick papers. Mann demonstrates a nice sense of how much is needed to engage readers with the concepts and results. Dealing with the arcane subject of PCA would seem a quixotic challenge in a book for laypersons, but Mann accomplishes it quite nicely with a very simple example (p. 130ff).

Book Reviews

Those who want to expend a little effort can understand the method and the essence of the flaw in the technical challenge Mann et al. received from climate skeptic Stephen McIntyre (p. 137). Its inclusion is helpful because the skeptic literature often cites McIntyre, with little sense of what he or Mann has done. Later in the book, Mann cites a useful paper from National Center for Atmospheric Research researchers, which reproduced the hockey stick after accepting McIntyre's potentially valid points (eliminating key data sets as McIntyre had done was not valid) and showed that McIntyre's reconstruction failed the statistical tests of Mann et al. for validity (p. 138).

Particularly useful is Mann's description of the "scientific give-and-take" with other scientists resulting from the hockey stick publications (p. 99ff). The give-and-take is a stark contrast to public rhetoric from activists. Mann describes climate scientists' criticisms, what he learned from them, and how they were answered. People often perceive scientific papers as naked events, with no sense of the history and nuances of the papers' development, the foundation on which the papers are built, nor the interplay between the scientists and the subsequent scientific papers they inspire, critical or otherwise. For such, the book offers an intriguing look into science's culture.

Most scientific responses involved details that, if true, would not impact the overall results. For example, one publication that reconstructed historic temperatures from ice cores (scientists analyze isotopic ratios in gas trapped in bubbles to infer historic temperatures), argued that the actual temperature during the "Little Ice Age" (about 1600s to 1800s) was 0.5°C lower than tree-ring-based reconstructions (a significant part of the hockey stick papers' reconstruction). Mann and his co-authors responded that some of the differences could have been due to different seasonality or differing regional emphases between various reconstructions. This dialogue apparently persisted in the scientific literature for some time (p. 100).

Another interesting example is an extended discussion of paleoclimatologist Wallace Broecker's argument that the increase in temperatures Mann et al. observed was associated with the warm phase of an approximately 1,500-year temperature oscillation cycle, that the MWP was also a warm phase from the oscillation, and that the MWP was actually warmer than today, contrary to the hockey stick reconstruction (pp. 101–3). The source of Broecker's

postulated oscillation is changes in the ocean "conveyor belt," the thermo-haline circulation and complex interactions between this circulation and wind-driven circulations, both of which transport energy from tropical to northern latitudes. Broecker argued that limited long-term historical temperature data made millennial oscillations difficult to detect. The interaction is interesting. Mann opines that Broecker's theory has at least "a grain of truth," but that evidence for a prominent role for the conveyor belt in generating millennial cycles is tenuous.

One aspect that makes the scientific discussion useful is that it makes the idea of a scientific conspiracy concerning climate change implausible. There are real arguments, but neither side gives any hope for those who doubt climate change. For example, Broecker, the man who might give comfort to skeptics with his claim that the MWP was warmer than today, stated that human activity was "poking" an "angry beast" with "sticks." Indeed, it seems that the hope of the climate skeptics seems to be to avoid the details that the scientific community discusses because arguments about details indicate the strength of the evidence for the general pattern of human-caused climate change.

In summary, *The Hockey Stick and the Climate Wars* is one of those books you wish everyone would read. Such an outcome would dramatically elevate climate change discussion.

Notes

¹As of 2011, with the exception of 1998, the ten warmest years have occurred since 2001. Mann et al.'s hottest years are no longer in the top ten and will soon be out of the top 20!

²Since then, Mann has also featured prominently in emails hacked from East Anglia University's Climate Research Unit, which he recounts in chapter 14, "Climategate: The Real Story." For a good independent assessment of key issues raised by skeptics concerning the emails, see <http://www.yaleclimatemediaforum.org/2009/12/cru-emails-whats-really-there/>.

³Raymond S. Bradley, *Global Warming and Political Intimidation: How Politicians Cracked Down on Scientists As the Earth Heated Up* (Amherst, MA: University of Massachusetts Press, 2011), 19. (Bradley was one of Mann's co-authors).

⁴With that said, however, if the MWP were warmer than present, it would be observational support for the idea of long-term oscillations in Earth's temperature (see comments involving Wallace Broecker below).

⁵S. Solomon et al., *IPCC 2007a: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge: Cambridge University Press, 2007), section 6.6.1.

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HISTORY OF SCIENCE

GALILEO'S MUSE: Renaissance Mathematics and the Arts by Mark A. Peterson. Cambridge, MA: Harvard University Press, 2011. vi + 336 pages, index. Hardcover; \$28.95. ISBN: 9780674059726.

A standard yarn told by science teachers about the Scientific Revolution is that it was born from the union of experimentation and quantification. This new approach to natural philosophy is typically credited to the heroic efforts and monumental accomplishments of Kepler, Galileo, and Newton, done in the face of reactionary opposition from dogmatic philosophers and narrow-minded theologians. Galileo's transitional role in this narrative is twofold: (1) he is the one who stood up to the church on behalf of science with his advocacy of Copernican astronomy; and (2) he is the one whose scientific approach turned away from Aristotelian forms of causal explanation toward the functional (quantitative) descriptions of modern physics.

This nutshell description contains nuggets of truth, though readers of this journal will likely know ways in which it should be trimmed, qualified, and even rebutted. Historians have long argued over how to contextualize and conceptualize the contributions of seventeenth-century scientists. The present book, modestly priced and carefully edited, makes a fresh and important contribution to our understanding of Galileo, one of the most fascinating and seminal characters of this time period.

Peterson's earlier research focused on connections between mathematics and art in the Renaissance era. With this book, he has moved forward to explore ways in which this sort of material influenced Galileo's scientific work. Historians have, for the most part, investigated possible relationships between Galileo's theories and precedents in medieval natural philosophy, but not in the humanities. Peterson's alternative line of attack is intriguing and breaks new ground. Given that his primary preparation is not in history of science, he is a bit careful in how he formulates his conclusions, but this does not deter him from offering unconventional views on the subject. One nevertheless senses that Peterson strives to "live in" the characters and trends he is writing about. Moreover, his technical training in physics more than qualifies him to evaluate those aspects of Galileo's thought that he focuses upon—Galileo's mechanics and kinematics in his *magnum opus*, *Two*

New Sciences, published in 1638, a few years before his death.

While many think of the clash between science and religion whenever Galileo's name is mentioned, that episode receives scant attention here. In fact, Peterson postpones raising this issue until the *Epilogue*, where he offers his assessment that the conflict's importance in Galileo's life and legacy is overblown and distracts from recognizing Galileo's true significance to science. Galileo certainly had a strong interest in astronomy, but it was not a professional one, and the evidence that he initially thought best-demonstrated the Copernican stance on the earth's movement (the tides) he later came to associate with the action of the moon. Galileo's main and lasting contribution to science per se was terrestrial; in his landmark time-squared analysis of falling bodies, he showed how fruitful the combination of experiment and mathematics could be.

Peterson organizes his book into four main parts. In the first part (chapters 1 and 2), after sketching the humanist milieu in which Galileo lived and was educated, he explores the classical Greek and Roman heritage in mathematics available then. The second part consists of four largely independent subparts, each given two chapters: poetry, painting, music, and architecture. Comprising over half of the book, this part examines the various Renaissance arts that had been prominent in the centuries just preceding Galileo. Peterson points out ways in which mathematics entered into these arts and explains how they functioned in Galileo's life and education. After considering aspects of Renaissance mathematics related to the arts, the third part spends one chapter looking at mathematics proper (algebra, geometry, trigonometry) during this time period. The last part finally zeroes in on Galileo's understanding and use of mathematics for his work in science, linking it to the book's previous discussions. As an addendum, Peterson analyzes a thirty-four-page oration given by a student and close follower of Galileo in 1627 upon assuming the mathematics professorship at Pisa. This chapter tantalizingly suggests that the ideas and perhaps even the words themselves are due to Galileo, thus providing us with an additional window on Galileo's view of mathematics, the arts, and their relevance to doing science.

Looking at the sort of mathematics used in *Two New Sciences*, it quickly becomes clear that Galileo is not drawing upon contemporaneous developments in mathematics proper—there is no algebra, no trigonometry, and no incipient calculus. The mathematics

Book Reviews

Galileo draws upon heavily involves ratio and proportion, a topic Galileo had been interested in from his earliest study of Euclidean geometry and also the most prominent part of mathematics used by Renaissance artists in painting (perspective), music (scales and tuning), and architecture (harmonious balance of components). The missing art in this list is poetry, which housed little or no mathematical thinking. Peterson argues, however, that Galileo's flawed mathematical analysis of Dante's inferno in *The Divine Comedy*, presented in two serious but whimsical Florentine lectures connected with his appointment as professor of mathematics at Pisa in 1589, may have become a behind-the-scenes stimulus for his eventually correct work on the strength of materials, the first of Galileo's *Two New Sciences*.

But perhaps even more important to Galileo's way of using mathematics was the Renaissance artisans' attitude toward and outlook on mathematics. While mainstream humanists and educators and even Kepler held a view of mathematics that was rooted in more speculative Platonic philosophy and Aristotelian/Ptolemaic practice, Galileo tacitly adopted a more down-to-earth approach. Mathematical features of the world were not dictated by natural philosophy; they needed to be teased out of and made to fit with the way things actually behave, on earth as well as in the heavens. Galileo (and Peterson, to a large extent) attributes this more humble but commanding role for mathematics to Pythagoras and his true followers, allegedly including Archimedes. One might debate whether grounding this modern perspective on mathematization in these ancients is tenable, but it is clear that the changed view of mathematics emerging in Galileo's work and thinking went against the dominant classical viewpoint of his time and signals a new and wide-ranging utility for mathematics in natural science.

Readers may wish to challenge some aspects of Peterson's presentation for accuracy or interpretation, and one can always quibble about how much influence a changed outlook actually had on the derivation of a new result, but *Galileo's Muse* is a provocative and rewarding book. Its thesis is well argued and offers original insights on a topic that has been mined for decades. Peterson's work deserves a spot on the shelf of every academic library and should be read by anyone interested in the Scientific Revolution more generally, or in the nature of Galileo's place and work therein in particular.

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NATURAL SCIENCE

THE ROCKS DON'T LIE: A Geologist Investigates Noah's Flood by David R. Montgomery. New York: W. W. Norton and Company, 2012. 320 pages. Hardcover; \$26.95. ISBN: 9780393082395.

As a professor of geomorphology at the University of Washington, David Montgomery specializes in the interpretation of landforms. He is interested in the development of topography and the influence of geomorphological processes, such as flooding, upon ecological systems and human societies. Along the way he became intrigued by folklore about large floods from cultures all over the world. Might there be, he wondered, some basis in geological fact behind such tales? *The Rocks Don't Lie* recounts Montgomery's personal encounter with geological and other lines of evidence that might lie behind the most famous flood story of them all—the biblical flood associated with Noah.

Montgomery tells us that Noah's flood and other biblical stories were treated, in Sunday School, as parables "to be read more for their moral message than their literal words." Implicit in his comment is that the historical content of biblical stories was viewed as relatively unimportant. He was satisfied that "Jesus taught how to live a good life and that science revealed how the world worked." An encounter in his thirties with a devotee of young-earth creationism, however, stirred Montgomery to begin exploring why people accepted the idea of a global deluge. In 1998 he read *Noah's Flood: The New Scientific Discoveries about the Event that Changed History*, a book in which Bill Ryan and Walter Pitman of Lamont-Doherty Earth Observatory espoused the idea that rapid infilling of the Black Sea basin at the end of the ice age might have been the trigger behind the biblical flood story. Montgomery began to realize that the flood story of Noah might have a geologically detectable basis.

Such experiences prompted Montgomery to investigate the history of ideas about the nature, extent, and impact of the biblical flood. Why did early Christians generally accept a global flood? What interpretive strategies did later Christians adopt to adjust to geological evidence that counters a global flood? How have scientific knowledge, Christian faith, folklore, and philosophy interacted throughout the past two millennia? In his search for answers to questions such as these, Montgomery

acknowledged his dependence on the work of Martin Rudwick (*Bursting the Limits of Time*), Ronald Numbers (*The Creationists*), Dorothy Vitaliano (*Legends of the Earth*), Norman Cohn (*Noah's Flood*), Arthur McCalla (*The Creationist Debate*), and my own book (*The Biblical Flood*). Nevertheless, his book is no mere rehash of the work of these authors. Montgomery has also read original and additional secondary sources and reworked the material into his own compelling narrative. *The Rocks Don't Lie* is a readable, engaging, informative, and at times humorous historical review that addresses the questions above for a general audience. The author has made things more palatable for the lay reader by including extremely few endnotes. He has incorporated a bibliography.

I would like to single out four features of this book in particular that appealed to me. The first was the personal element. Integrated with the sketches of major individuals and episodes in the history of geology are several narrations of Montgomery's own field experiences that shaped his thinking about the possibility of gigantic floods. The main text begins with a brief account of his experience mapping ancient terraces along the valley of the Tsangpo River in Tibet. From the field evidence, he inferred the former existence of a large lake and was stunned to learn later that the locals already had their own tales of an ancient lake in the area.

Chapter two is introduced by reference to Montgomery's hike from the bottom to the top of the Grand Canyon. En route, he observed the features of the stratigraphy that tell the story of a long, complex history. Once at the top, he visited the National Park Service gift shop where he discovered a creationist book that attributed the geology of the canyon to Noah's flood! "Reading about earth history is one thing; to see and feel it for oneself is another," he mused.

A photograph of part of the spectacular rock exposure at Siccar Point, southeast of Edinburgh along Scotland's North Sea coast, graces the cover of the book. In chapter six, Montgomery recounts his visit to Siccar Point to see for himself the world's most famous outcrop. It was at Siccar Point that James Hutton discovered in 1788 what has become the classic example of an angular unconformity—an ancient erosion surface located between a stack of approximately horizontal sedimentary rock beds that lie above a set of much more steeply dipping sedimentary rock layers. At this outcrop, Hutton recognized incontrovertible evidence for at least two episodes of sedimentation, each of which was

followed by a "revolution" that involved burial and hardening of the sediment layers; tilting, uplift, and erosion of the beds; and subsequent deposition of more sediments on the eroded surface and deep burial, tilting, and so on. "Here," Montgomery wrote, "in front of me, were the rocks that helped inspire geology's core concept of deep time ... Over lunch I read the story in the rocks, laid out plain as day." I can attest that no geologist can visit this magnificent exposure without experiencing a thrill and without feeling the same excitement that Hutton himself must have felt upon first seeing these rocks.

Chapter eleven tells the story of a decades-long attempt by J. Harlen Bretz to persuade fellow geologists that the bizarre landscape of eastern Washington's Channeled Scablands had been formed by catastrophic flooding on a grand scale. Montgomery explains that he had been teaching about landforms at the University of Washington for at least a decade before he ever saw the deep canyons of the Scablands on the other side of the state. One day he was asked by departmental colleagues to help lead a field trip for students to the Scablands. Professing lack of acquaintance with Scabland geology, he asked if he might just tag along to learn about this unique terrain. Much to his surprise he was listed as a field trip leader on the trip announcement. He learned about the Scablands in a hurry!

Other personal experiences included study of the Pasig-Potrero River a couple of years after the great eruption of Mount Pinatubo in the Philippines (chapter seven) and a visit to the Creation Museum in Petersburg, Kentucky (chapter ten).

A second feature that I appreciated was Montgomery's treatment of folklore in relation to geology. The first half of the book features the speculations, hypotheses, and discoveries about the earth by Da Vinci, Descartes, Kircher, Steno, Burnet, Woodward, Halley, Whiston, Scheuchzer, Buffon, Cuvier, Hutton, Kirwan, Playfair, Smith, Buckland, Fleming, Sedgwick, Lyell, Agassiz, and others, most of whom contributed in one way or another to an emerging understanding that the earth is extremely ancient and devoid of compelling evidence for a global flood. The book also reviews the thinking of modern creationism. This material is already familiar to most geologists. But in chapters eight and nine, beginning with George Smith's decipherment of the Gilgamesh flood epic, Montgomery takes us farther into folklore than many of us have gone by highlighting the significant differences in legends from different parts of the world and situated in different geological contexts.

Book Reviews

In the third place, I appreciated the fact that, after reviewing the discoveries of the abundant evidence discrediting a global flood and even the continent-scale floods postulated by Buckland, Sedgwick, and others, Montgomery did not proceed to dismiss the possibility of a historical Noah's flood entirely. In fact, he acknowledged that physical evidence for such a flood might exist. He looked with favor on the Ryan-Pitman hypothesis of a rapid infilling of the Black Sea at the end of the ice age as a geologically reasonable cause of the biblical deluge. Nor did he exclude the possibility of a Mesopotamian flood.

The fourth aspect of the book that I welcomed was Montgomery's balance in treating other people. His tone throughout was conciliatory. Although inconsistent that geological evidence has discredited the global deluge hypothesis beloved by young-earth creationists, Montgomery avoided the disdain and condescension often directed toward young-earth creationists. He struck me as charitable and respectful toward those with whom he disagreed and recognized that most people are attempting to make sense of the world in the best way that they can.

A further evidence of Montgomery's balance is that he was critical of the geological community for its blindness to the possibility of very large-scale floods. Geologists of the early twentieth century were so beholden to an extreme gradualist approach to geology that they were unable to appreciate the evidence in western Montana, northern Idaho, and eastern Washington for the Lake Missoula-Channeled Scabland floods proposed by Bretz and Joseph Pardee. It was refreshing to be reminded that young-earth creationists are not the only ones who can be so committed to a certain approach to earth history that they are unable to process evidence to the contrary. Geologists and other scientists (indeed, all of us) can do the same. What is encouraging is that the geological profession finally engaged in some serious self-correction and is now comfortable with the inclusion of large catastrophic events in the narrative of geological history. Perhaps one day young-earth creationism will rise above its insistence on a global deluge and make peace with the overwhelming geological evidence for large localized floods as a component of the earth's long, complex terrestrial history.

Montgomery does not tell us his stand on the religious question. He neither labels himself a Christian nor denies that he is one. He expresses openness toward religion and is sympathetic toward those who exercise religious faith. He does not appreciate the hostile attitude displayed by some atheists

toward those who have religious convictions. In his preface Montgomery wrote that "along the way, scientists were as apt to be blinded by faith in conventional wisdom as Christians proved adept at reinterpreting biblical stories to account for scientific findings. The historical relationship between science and religion was far more fluid, far more cross-pollenating than I ever thought—or was taught at Sunday school or in college."

I highly recommend *The Rocks Don't Lie*. The author gives the reader a clear picture of the course of the history of geology and makes it plain why geologists today do not accept the idea of a global flood. At the same time, he is kind to those who are still intrigued by the concept.

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PHILOSOPHY & THEOLOGY

THE SPIRIT IN CREATION AND NEW CREATION: Science and Theology in Western and Orthodox Realms by Michael Welker, ed. Grand Rapids, MI: Eerdmans, 2012. 202 + xvi pages. Paperback; \$32.00. ISBN: 9780802866929.

This collection of short essays (fifteen essays in only two-hundred pages) results from a dialogue held in the fall of 2009 at the *Internationales Wissenschaftsforum* at the University of Heidelberg, a conference supported by the John Templeton Foundation. The contributors are European (East and West) and North American. Theological perspectives represent Orthodox, Catholic, and Protestant perspectives. Scientific areas of expertise include physics, biology, math, and psychology. One also finds two essays by social scientists.

This is a book that betrays its title. The main title might indicate that it contains a discussion of the doctrine of the Holy Spirit in relation to contemporary science. Most of the essays do touch on pneumatology. However, some contain a focus on the human spirit, e.g., Michael Welker in chapter ten, or spirituality in general, e.g., Vladimir Katasonov's chapter, described below. José Casanova's chapter, "Human Religious Evolution and Unfinished Creation," only briefly mentions a general "spirit of creation" on the last page of his essay (p. 202).

The subtitle of this book might lead one to think that all of the essays address the convergence of science and theology. However, only a limited number

of the essays engage this convergence in a significant manner. The first of four sections in the book, subtitled “scientific perspectives,” includes all of the essays that are most direct in bringing science and theology into conversation. To begin Section One, John Polkinghorne explains how physics has moved away from a merely mechanistic view of the world. Though physical systems can be described according to their parts, Polkinghorne offers the concept of “information” as a way of explaining the “dynamical pattern” (p. 7)—and even causal role—of a total physical system. With this, he proposes that the Spirit acts as a hidden top-down cause by inputting active “information” into “the cloudiness of intrinsic unpredictability” (p. 9) in the physical world.

Denis Alexander (chapter two) finds resonances between pneumatology and evolutionary history. His observations on unity and diversity and of order and disorder through both the work of the Spirit and evolutionary history are helpful. However, his attempt to link the emergence of personhood out of impersonal matter in evolution to the progressive revelation of the Spirit is problematic in that it implies that the Spirit emerged from being impersonal in the Old Testament to personal in the New Testament.

In chapter three, Jeffrey Schloss argues that scientific observations regarding the preconditions of life, the nature of life, and the history of evolution are concordant with the biblical portrayal of the Spirit as one who animates, preserves, and brings purpose to life. Although only part of the chapter focuses on evolution, his argument that God has a purpose for evolution (rather than evolution itself being purposeful) and that evolution is directional and progressive well complement the previous chapter.

In the fourth chapter, Vladimir Katasonov outlines a history of the idea of infinity in mathematics (eventually focusing on Russian thinkers) and the close relationship it has had with mysticism and religion (especially the Orthodox name-worshipping spiritual tradition). Nearing the end of the essay, Katasonov proposes that “the name Infinity is a form of God’s icon in mathematics” (p. 62) and that the Divine Name confirms the existence of an actual infinity.

Outside of the first section in the book, there are two essays that take the approach of the social sciences. In the eleventh chapter, Renos K. Papadopoulos emphasizes that those who suffer as a result of significant human conflict or natural disaster do

not all respond with “trauma.” Rather, they respond in a variety of ways (often simultaneously), ranging from psychiatric disorders, to having a new zest for life. Papadopoulos relates an ascetic Orthodox saying to these experiences, which describes how people can remain mindful of their “hell” while keeping hope and remaining open to transformation by the Spirit.

In the final chapter, José Casanova, also a social scientist, highlights how the “application of evolutionary theory to the study of socio-cultural development has been contaminated ideologically again and again” (p. 194) and outlines three phases of human globalization. He concludes by noting challenges from scientific developments including the need to re-sacralize nature in light of the ecological crisis and the challenge of a potential post-Darwinian deism in the light of breakthroughs in biogenetics and other areas where humans could become participants in a new phase of human evolution.

Outside of the above-mentioned essays, few of the essays in this book deal to any great extent with contemporary science. For example, it is not until the last paragraph that Vladimir Shmaliy’s essay, “The Spirit or/and Spirits in Creation?,” makes mention of dialogue with science—and here he only comes to the limited conclusion that “creative dialog is possible between science and religion about the mystery of life and its source—the Holy Spirit” (p. 94). A number of the other essays make brief mention of evolution or neuroscience, but they do not contain the engagement with science that one might have expected.

The lack of engagement with science throughout this book, however, does not indicate that there is nothing of significant value in these essays. If one has an interest in pneumatology, there is much to be gained here. For example, in chapter nine Friederike Nüssel (drawing on Pannenberg) proposes that there is no gap between the Spirit’s work in creation and new creation once the Spirit’s creative activity is understood as enlivening and overcoming corruption. One also finds Frank Macchia (drawing on his *Justified in the Spirit*) arguing in chapter 14 that justification is a pneumatological reality that includes not just divine pardon but the transformation of life which one participates in by faith (he also relates this to “the border of theology and science,” p. 191).

One particular strength of this book is that it contains a number of excellent essays addressing Orthodox theology. For example, while some theologians have been optimistic regarding the Spirit’s

Book Reviews

work in non-Christian religions based on the presence of the Holy Spirit in creation, Vladimir Shmaliy (sixth chapter) notes the Orthodox “guarded attitude to extra-ecclesial spirituality” and their emphasis on the need to discern spirits (p. 91). Another excellent chapter coming from the Orthodox tradition is found in chapter seven, where Sergey Horujy documents how and why the Orthodox tradition (especially the Hesychast tradition) has been more reserved regarding natural theology than their Western church counterparts. All in all, *The Spirit in Creation and New Creation* was well worth reading, and not only for the reasons that the title (and subtitle) suggest.

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WHAT THE HEAVENS DECLARE: Science in the Light of Creation by Lydia Jaeger. Translated by Jonathan Vaughn. Eugene, OR: Cascade Books, 2012. xxiv + 199 pages. Paperback; \$25.00. ISBN: 978-1610970341.

How should Christians understand the “laws of nature?” French philosopher Jaeger examines the natural order from an interdisciplinary perspective, including philosophy of science, philosophy, and theology. She offers some interesting ideas on the subject and challenges some contemporary views on science and creation. However, readers without a philosophy background may find *What the Heavens Declare* a challenging read.

Jaeger uses the term “creationism” in a general sense: “The world is created without specifying the manner of creation” (p. xv). Her aim is to

bring the structure of the Christian worldview to bear on the question of natural order and to construct a notion of laws of nature that fits the Christian faith’s framework for thinking and living. (p. xxiv)

Science, in fact, began as an examination of the world created by God. Jaeger notes that no viewpoints are neutral, and aligns herself with neo-Kantian continental philosophy and the Augustinian tradition with its assumption of “a radical difference between the Creator and the creation” (p. xxi). This asymmetry between the dependent creation and the independent Creator is emphasized throughout the book; chapter 1 especially claims this to be the starting point of scripture and a Christian worldview. Jaeger affirms creation *ex nihilo*, following Augustine (unfortunately without critique or discussion of alternate views), the freedom of creation, the mystery of divine immanence

and transcendence, and redemption as the restoration of creation. She argues against dualism, viewing evil as privation, and against the plenitude principle (the idea of unrealized potential) because it undermines the contingency of creation.

In Chapter 2, Jaeger reinforces the idea of the distinction between God and creation, and argues against any hierarchy of being. She affirms creation as a Trinitarian act, and the *imago Dei* as primarily a relational concept. With respect to science, the idea of laws of nature gradually replaced the philosophical categories of substantial forms. However, this is insufficient as God creates the laws: “all natural things are subject to the same divine law” (p. 39).

Jaeger discusses the order of the created world in chapter 3. Order and structure are evident in biblical creation texts and creation *ex nihilo* confirms “God’s perfect control over all parts of reality” (p. 66). Creation also relates to covenant (e.g., Jer. 33:25–26), which affirms the stability of the natural order along with divine freedom. However, creation as divine decree can be the basis for scientific investigation. Jaeger is clearly against reductionism, noting that different aspects of the world have different structuring principles and that plurality originated with creation. Furthermore, because of the God/world duality, we cannot understand everything; indeed, quests for unified theories are arrogant. Jaeger believes creationism is both more unified and more diversified than the philosophical idea of analogy of being, and provides “justification for the universality of the lawful order as a regulating principle in science” (p. 85). She discusses quantum theory (unfortunately with little interaction with opposing viewpoints), noting that events at the quantum level obey mathematical formulae, and insisting that God is in control of random events (novelty can arise through divine willing, not necessarily through chance).

In chapter 4, Jaeger examines the relational nature of knowledge. Reality is informed by the divine word and humans are reinterpreters of the natural order. However, because of sin and subjectivity, humans can only partially understand reality. Science does not give us privileged access to reality, but only captures certain aspects of it. Knowledge is derivative, situated within space and time, and is “both realistic and relational, objective and personal” (p. 115). There is tension between the knower and the world to be known (curiously, Jaeger does not discuss critical realism). Humans are part of the created order but transcend it to be in relationship

with God. They are free in terms of their submission to the divine order of creation.

In her final chapter, Jaeger attempts to explain the natural order and to clarify how creationism helps us understand the world. She critiques Swinburne's probabilistic natural theology, John Foster's natural theology, pantheism's impersonal nature, scientism's claim to explain everything, and empiricism's refusal to explain anything. The last three avow that the world is the ultimate reality, and reject its transcendent foundation. Creationism claims we are justified in forming theories regarding the genuine created order and, since the lawfulness of the world indicates a Creator, we need religious explanations for the world. We should look beyond observations to that "which confers *consistency, coherence, and meaning* on nature's laws" (p. 157). Creationism views humankind as the ambassador, not the master in the world. Kant and his followers go beyond empiricism and scientism, putting a limit on the claims of reason, endorsing the necessity of science, and affirming the contingent order. However, Jaeger, contra Kant, believes it is possible to know God; incomprehensibility is not the same as unintelligibility.

In concluding, Jaeger reemphasizes the radical difference between Creator and creature. The natural order points beyond itself and is dependent on God for its existence. Creation is multifaceted but not hierarchical; it contains determined structures but is not deterministic or reductionistic. She reaffirms realism—its relational nature, its transcendental foundation, and the possibility of knowing it.

We should put to work the full range of human activities in order to encounter the breathtaking wealth of this world in which we live. (p. 171)

This book contributes to the philosophy of science with respect to creation and offers a nuanced view of the relationship between science and the natural order of creation. I appreciate Jaeger's insistence on the contingency of creation and the responsibility of humans in understanding it. The author repetitively asserts Calvinistic assumptions with respect to divine sovereignty and control, and, although she is to be commended for being upfront regarding her position, I wonder if this is sufficient to explain her frequent neglect of opposing views and alternate biblical exegesis. *What the Heavens Declare* could be improved through an appreciation of the diversity of Christian perspectives on creationism.

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GOD AND THE FOLLY OF FAITH: The Incompatibility of Science and Religion by Victor Stenger. Amherst, NY: Prometheus Books, 2012. 409 pages. Paperback; \$20.00. ISBN: 9781616145996.

Victor Stenger, adjunct professor of philosophy at the University of Colorado, is a self-identified "new atheist." *God and the Folly of Faith* is his latest contribution to this movement. The book claims science and religion have been at war since the stone-age and remain so today. The book denounces Christian faith as a danger to science.

The foreword to the book sets the tone. Dan Barker, a pastor-turned-atheist, recalls a story of a girl who died from untreated diabetes because her parents believed in prayer healing and refused her medical attention. Barker argues the parents were taking the Bible at its word. After quoting purportedly relevant scripture verses, Barker states the "Bible is very explicit that faith will heal the sick" (p. 16) and then asks, "if the Bible is true, then why did Kara die?" (p. 17). His response is that the "obvious answer is the Bible is wrong" (p. 18).

While science collects data and forms, testable theories and models, Barker and Stenger believe "when religion does that at all, it always fails the test" (p. 20). Stenger argues, "The god that most people worship is in principle detectable and should have been detectable by now" (p. 21). But Stenger is unable to discern any activity of God, whether in the universe, in scripture, or in Jesus. Stenger concludes that for God to remain unseen requires God to have deliberately hidden himself, implying an unkind and unjust God. The circular reasoning here is very apparent.

Stenger claims the world is worse off as a result of (Christian) faith. He calls for new atheists to "act for the sake of the betterment of humankind and the future of our planet" (p. 21). Stenger rejoices that young people are increasingly abandoning religion. He has hope that in "another generation, America will have joined Europe and the rest of the developed world in casting off the rusty chains of ancient superstitions that stand as an impediment to science and progress" (p. 23).

If science did not work, Stenger argues, we would not do it. In contrast, he claims, "relying on faith, religion has brought us inquisitions, holy wars, and intolerance." He believes "religion does not work, but we still do it" because it has the properties of a virus (p. 25). Stenger fails to realize, by his own reasoning, that religion may exist because it works in ways he fails to understand.

Book Reviews

Stenger holds that “science is the systematic study of observations made of the natural world,” while “in contrast all major religions teach that humans possess an additional ‘inner sense’ that allows access to the supernatural” (p. 26). As a materialist, Stenger believes such teachings are false. He claims that there is no evidence of prophetic fulfillment and no evidence that feelings of contact with the supernatural correspond to anything beyond normal physiology.

Throughout the book, Stenger criticizes “God-of-the-gaps” reasoning. Stenger believes science will eventually fill the holes, rendering faith needless. But if the supernatural exists, he claims we should be able to observe its effects in the physical world by scientific means.

Stenger acknowledges problems that science has brought about in the world, but places the blame on “disgraceful examples of scientists working for oil, tobacco, and pharmaceuticals” and ignorant churches who believe their lies. Stenger says “we can solve the problems [of] misuse of science only by better use of science and more rational behavior” (p. 27). Stenger fails to recognize here that specifying a “better” use of science requires judgments beyond science.

According to Stenger, while liberal theologians accept discoveries of science, the theologies of all ages still promote a worldview antithetical to science. Stenger claims that by believing that God is somehow involved in evolution, even moderate Christians “do not fully accept Darwinian evolution” (p. 29). He says not a single Christian fully accepts evolution, because Darwinian evolution implies all life is accidental and unplanned. Theistic evolution is, for Stenger, another version of Intelligent Design. Stenger contradicts himself by calling Kenneth Miller “one of the most effective spokespersons in support of Darwinian evolution” with an intricate knowledge of the science, while also recognizing Miller as a devote Catholic. Stenger tries to escape a contradiction by defining Miller as a deist rather than as a theist and stating that it is really theists he is complaining about and not deists.

For Stenger, observation is the sole valid source of all knowledge, including science. In contrast, he sees the source of knowledge in theology as primarily faith, plus only some reason and observations allowed. For Stenger, “fundamentalist Christian beliefs” of virgin birth, miracles, revelation, prophecies, and resurrection are in conflict with his defini-

tion of science and, thus, must be wrong. Stenger demands that

those who rely on observation and reason to provide an understanding of the world must stop viewing as harmless those who rely instead on superstition and the mythologies in ancient text ... For the sake of the future of humanity, we must fight to expunge the fantasies of faith from human thinking. (p. 30)

He warns of dangers from the triad of religion, anti-science, and extreme conservatism and its ties to “greedy corporate executives and politicians who exploit anti-science.”

Stenger admits that anti-science exists on the liberal end also, but claims it is more benign because the “extreme Left possess little power in America today, while conservatives wield huge resources that give them influence far exceeding their actual numbers” (p. 30). One wonders here about Stenger’s grasp of the actual state of political affairs in the US.

Stenger’s book is his “call for scientists and other rationalists to join together to put a stop to those who insist they have some sacred right to decide what kind of society the rest of us must live in.” He writes that his group must do this “for the sake of the future of the planet and the betterment of humankind” (p. 30).

In chapters 1–3, Stenger narrates a history of conflict between science and religion from the time of cave people through the age of Enlightenment. In chapters 4–11, he argues that the materialist, reductionist paradigm offers better answers to the set of issues often raised by theists: the nature of reality; origin of the universe; fine-tuning; the argument by design; evolution; quantum consciousness and a holistic universe; reductionism and emergence; information theology; the nature of mind, free will, and consciousness; the origin of morality; and modern theology.

Stenger intersperses his opinions with denigrating comments about scripture, theologians, and Jesus. He believes that “the Bible is so filled with violence, contradictions, and downright errors that it provides no reliable source for the nature of reality or morality” (p. 78). He holds that “the New Testament is hardly the handbook for righteous behavior that Christians think it is. Jesus was not exactly a paragon of morality” (p. 254). “The faithful in the pews are kept in the dark about theology by their pastors” (p. 224). For Stenger, religion and especially Christianity “is a virus ... of the mind that acts in the way a biological virus acts in living organisms” (p. 124).

Stenger believes religion is like a parasite humans would be better off without (p. 290).

Stenger returns to his “call-to-arms” for new atheists. He fears that Christians dominate the US government at all levels, and therefore that religion is “too destructive a force in society to just sit back and allow it to spread unopposed” (p. 299). Stenger warns the new atheists that the stakes are high. He fears that the Christian Right is trying to replace democracy with theocracy. He acknowledges that most scientists would scoff at that notion, but says they need to look at the data. He claims that many books have been written of these “dangers,” including a “secretive Christian group known as ‘The Family’” (Focus on the Family?) that arranges Washington prayer breakfasts. Stenger believes that “scientists have to stop sitting back and start stepping up to challenge religion.” For him, “their welfare, and indeed the survival of our species, is at stake” (p. 301). As examples, Stenger believes that an anti-science Christian movement was the main opposition to studies of the dangers of secondhand smoke and the greenhouse effect.

Stenger concludes the book with his exhortation that the new atheists “need to focus attention on one goal ... which has to be achieved someday if humanity is to survive: the eradication of foolish faith from the face of this planet” (p. 322).

The book is a disappointment as an examination of aspects of the science/religion debate. Stenger’s understandings of scripture and the manner God can interact with creation is naïve. Going beyond the overarching bias in the book and its circular reasoning, there is little new material that has not been more deeply developed in other books. The discussions in the initial and final chapters are especially vitriolic, while often concurrently trivial. It is at best worth reading to better understand the mindset of the “new atheists” and why they are so bothered by religion, Christian faith in particular.

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TIME IN ETERNITY: Pannenberg, Physics, and Eschatology in Creative Mutual Interaction by Robert J. Russell. Notre Dame, IN: University of Notre Dame Press, 2012. 440 pages, index. Paperback; \$49.00. ISBN: 9780268040598.

It is commonplace in current religion-and-science conferences and literature for religion scholars to take science seriously. What would happen if scien-

tists took theological ideas as a starting point for work within their own discipline and were guided in their research by what they learned? That scientists have been influenced in their approach to natural knowledge by their theism is well documented historically. But what about today? One of the world’s foremost scientist-theologians, Robert J. Russell, exemplifies this possibility in a long-awaited, major monograph here under review. Russell is well known as the founder and director of the Center for Theology and the Natural Sciences and is the Ian G. Barbour Professor of Theology and Science. The book under review is an outstanding example of what Russell (and to be honest the present writer) have been promoting for some decades: mutuality between theology and science as academic disciplines.

Let me say at once that this is an impressive, technical monograph. Russell demonstrates a range of deep learning not only in the mathematics of relativity theory, but also in the philosophy of time, theology, physics, and the mathematics of infinity, including set theory. This is not a book for beginners, or even for the seasoned student. Just understanding the major argument of the book may take several readings, along with significant background knowledge on the part of the reader. That said, this is a fascinating study that will reward the serious student who engages the ideas, argument, and proposals Russell puts forward.

At the core of this proposal is an acceptance, central to the Christian faith, of the bodily resurrection of Jesus from the dead as a *real spacetime event*. It is not just a matter of preaching, or message, or story, but something real and bodily. Russell takes up Wolfhart Pannenberg’s defense of the bodily resurrection, along with Pannenberg’s notion that this act of God is an act “from the future,” that is, a “proleptic” eschatological act (a term Pannenberg borrows from literary criticism). Indeed, the book under review both expounds in a clear, convincing and learned way the theology of Pannenberg, and draws upon his theology to develop a physical-mathematical interpretation of time and space, eternity, and omnipresence in the light of contemporary physics.

After an introduction summarizing the book, Russell sets out a number of appendices that provide background perspectives for the book’s overall argument. This includes both a setting out of his general program for creative mutual interaction (CMI) in theology and science and a defense of the resurrection of Jesus following the lines of Pannenberg’s

Book Reviews

thought, as well as other topics. What is important about his scheme of CMI is that he includes not only rational influences from science to theology, but also from theology to science. The purpose of this work as a whole is to provide an extended example of this mutual interaction between physics and theology. Russell has chosen the theme of time as his topic and finds Pannenberg's work on time and eternity the most persuasive contemporary theological work on the subject from a Christian systematic theologian (p. 28). Part One of the book (chaps. 1–4) reinterprets and translates Pannenberg's theology of time and eternity in terminology more at home in mathematical physics. Russell does a fine job of both expounding Pannenberg's views and of making sense of them scientifically. In fact, I think that the author actually improves upon Pannenberg at several key points.

As Russell rightly notes, Pannenberg's views on God's infinite being, including divine eternity and omnipresence, are based upon Hegel's notion of the infinite. That notion, in which a true infinite being must include the finite within itself and transcend both somehow, is logically flawed and metaphysically dubious. It is to be regretted that Pannenberg followed this theory in his theology (see further W. L. Craig, "Pantheists in Spite of Themselves: God and Infinity in Contemporary Theology," in *For Faith and Clarity*, ed. J. K. Beilby [Grand Rapids, MI: Baker Academic, 2006], 135–56). Now Russell replaces Hegel's view of the infinite with Cantor's Absolute Infinite, developed in his set-theoretical conception of infinite and transfinite in mathematics. This "translating" of Pannenberg's theology into more scientific language is, in fact, an improvement, not just a translation. While the idea of infinite being is not the only example of such clarification-as-translation, it is perhaps the most obvious and central one.

Having translated Pannenberg's eschatology and doctrine of God into scientific terms, and along the way explained many of the characteristics of contemporary spacetime physics based upon the special theory of relativity (STR), Russell then sets about seeing the ways in which such theological concepts could influence further scientific discovery, as well as the interpretation of accepted theories in physics. Pannenberg argues that God acts "from the future," and also that eternity is in some ways present to Christians now. What is more, in his view, God's eternity contains and somehow heals or overcomes the loss of reality in the past-present-future movement of time (temporal process or "flow") as we know it. Russell translates these ideas in spacetime physics, arguing for a relational view of process-facts like present, past and future, which then allows

him to argue that given STR, process facts are *relational* terms relative to light-cones. An event present for one observer can be future for another, etc. Events in the future are not simply future, on this view, but future-for-Q (which allows some to be "present-for-R" in another frame of reference).

Perhaps we are ready now to state the thesis of this book, or at least part of it, in this quotation from p. 279:

In essence, I described a way to correlate the divine attributes of eternity and omnipresence by identifying particular events in time for a given observer with particular events in space for that observer in a relativistically invariant way. These spacelike events then constitute the global present for that observer, and in turn the events to which God is omnipresent.

God's infinite Being includes the whole of spacetime within Godself. On this basis it makes coherent sense to say that God acts in the present (or in the past, as at the resurrection of Jesus) *from the eschatological future*. This is because, for this theology, all times are eternally co-present to God's infinite Being.

Now Pannenberg famously wants to have his cake and eat it too, by holding that God's eternity includes all of temporal reality—past, present, and future—and still holding to a dynamic view of temporal process within creation (what is often called an "A" theory of time) in which past episodes of history are not fully real (they used to be, but are not now), and future episodes are not fully open, not having reality yet. Here Pannenberg is similar to Barth, who likewise insists on both. Such a view may be attractive; whether it is coherent has generally been the problem.

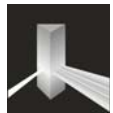
Russell has a creative proposal for overcoming this problem, by developing what he calls a "flowing time" interpretation of spacetime. He explicitly rejects the stasis or "B-theory" of time, in which process facts are not objectively about the cosmos, but are mind-dependent. On stasis theories, real, objective time consists in a structure of before and after, rather than in process facts such as presentness or futurity. So Russell allows that the present as defined within a specific inertial frame of reference ("light cone") actually defines reality, *but only for those in that frame at that time*. This leads to a causal invariance that is not global across spacetime itself. Russell boldly accepts this ontological fracturing of spacetime, calling it "inhomogeneous temporal ontology" (p. 303). He then holds that because the causal future (for an observer in a given light-cone)

is open, and the causal past is closed (again, relative to that frame) this is just a “flowing time” theory.

While this is a detailed and learned work, Russell makes it clear that his proposals are open to further discussion and development. So I will close this review with just two of the many questions which raised themselves to my mind after studying this book. First, does the view he calls “flowing time” simply collapse temporality into a causal structure? As a philosopher of time, I find that process-facts make causal asymmetry ontologically *possible* in the actual world, but do not *reduce down* to causal asymmetry. So I wonder if what Russell calls “flowing time” is actually a theory of dynamic temporal process. In other words, Russell may be developing a type of stasis or B-theory of time after all. Second, is Russell’s inhomogeneous temporal ontology consistent with the *general* theory of relativity and the uniform expansion of the cosmos since the Big Bang?

This is a solid work of scholarship that provides a creative and important contribution. The amount of learning, understanding, and depth of research in both theology and physics is impressive. Future scholars interested in God, time, and eternity, or looking for a solid example of theology and science in mutual interaction, will want to study it carefully.

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PHYSICS

A UNIVERSE FROM NOTHING: Why There Is Something Rather than Nothing by Lawrence M. Krauss. New York: Free Press, 2012. xix + 204 pages, preface, illustrations, index, author information. Hardcover; \$24.99. ISBN: 9781451624458.

If the title and subtitle of Krauss’s book do not tell you that he intends to challenge basic religious beliefs, the announcement on the cover of an afterword by Richard Dawkins should. A major thrust of this presentation of modern cosmology is indeed an attempt to debunk ideas that the existence of the universe requires God. Religious believers should not, however, conclude that it is simply a bad book. Krauss’s argument has major flaws, but there are aspects of it that theologically serious people should take to heart. Beyond that, this work by one who has done extensive research in particle physics and cosmology and has written several popularizations of science will help to bring readers to the current frontiers of cosmological research.

We can begin with theologically unproblematic matters. The observations that established the basic big bang model of cosmology—the relation between galactic distances and redshifts, the microwave background radiation, and the abundances of the light elements—are, of course, sketched here, together with the theoretical framework of Einstein’s general relativity. But Krauss does not dwell on these now-classic aspects of the field. Instead, he focuses on recent observational discoveries and theoretical speculations that go beyond them. Detailed observations of the microwave background enable us to see slight thermal fluctuations that would grow into clusters of galaxies, and the sizes of these regions lead to the inference that space (not space-time) is flat. The motions of galaxies and clusters of galaxies force us to accept an idea long suspected by some astronomers, that the amount of dark matter, detectable only by its gravitational effects, is several times larger than the amount of matter that we can see. And observations of distant supernovae have finally established the cosmic distance scale with precision and determined the time elapsed since expansion began 13.72 billion years.

None of those results were a tremendous surprise. What did startle many cosmologists was the further discovery that cosmic expansion is speeding up, a consequence of the negative gravitational effect of dark energy. The cosmological term that Einstein introduced into his field equations in 1917, and later rejected, seems to account for this. Krauss is justifiably proud of the fact that he and a colleague argued for what he calls the “crazy” idea that space is flat and that expansion is speeding up a few years before there was observational confirmation. A nonzero cosmological term was, however, not quite as “heretical” a claim as he suggests. There had always been relativity theorists who thought that this term should not just be equated to zero, but had to be determined by observations. Eddington, in particular, insisted that it would not be zero. In any case, there is a big problem here. As Krauss points out in his discussion of the quantum vacuum in chapter 4, the energy associated with the vacuum ought to be a monstrous 120 orders of magnitude larger than the dark energy that we infer from observations! Clearly, we are missing something important, and there is plenty of room for further work.

One implication of accelerating expansion is presented in chapter 7, “Our Miserable Future.” The repulsion due to dark energy does not break up gravitationally bound systems like our local cluster of galaxies, but as time goes on, all other clusters will be swept away from us at increasing speeds, eventu-

Book Reviews

ally passing beyond our “horizon.” In two trillion years, our local cluster will be alone in empty space and the kinds of evidence that have pushed us to develop big bang cosmology will not be available to astronomers of that distant epoch. They might never be able to learn that they lived in an expanding universe.

Now we need to look at the questionable aspects of the book. When you open it, the first thing you read is a quotation by Neil deGrasse Tyson that begins, “Nothing is not nothing. Nothing is something.” The “nothing,” from which Krauss describes the contents of the universe arising, is the quantum vacuum in space-time, fluctuating quantum fields of which particles like electrons and photons are modes. Evanescent virtual particles continually pop into and out of existence. Under certain conditions, most interestingly in connection with gravitation, these transient entities can become real particles. The negative energy of their gravitational energy can cancel their rest and kinetic energies, so that real particles can emerge in a state of zero energy.

So far, so good, but now comes the problem. Krauss seems to think that the classical doctrine of “creation out of nothing” (*creatio ex nihilo*) meant simply creation out of empty space, so that he has explained this scientifically. But the *nihil* is no-thing, an absence of anything at all—space, time, fields, particles, strings, etc. Krauss accuses philosophers and theologians of changing their definition of “nothing,” but he is the one who is playing a word game, saying that nothing is something but that is really nothing.

He does, however, move beyond the relatively simple model of fields in a pre-existing space-time. In general relativity or quantum extensions of it, space-time is not simply a passive arena for the interaction of particles and fields but is itself dynamic, affecting and being affected by those entities. In the context of theories of inflation and multiverses, Krauss points out that it may be possible to explain how space-time comes into being. But this still leaves the origin of gravitation (that is, the dynamic character of space-time) and the fields associated with particles unexplained. And when in chapter 11 he argues that the laws of physics require no explanation because in the hypothetical multiverse there are universes obeying perhaps any conceivable set of laws, we have to wonder if anything at all is being explained.

So while the book presents a good picture of the current state of theoretical and observational

cosmology, the philosophical and theological arguments are badly flawed. The afterword by Dawkins adds nothing to this except premature gloating.

I hope, though, that Christians will be encouraged by Krauss’s arguments to think about the real implications of modern cosmology for their beliefs. The God who demands acknowledgment of his existence by being “necessary” for various features of the universe is not the one of whom it is said, “Truly, you are a God who hides himself” (Isa. 45:15, NRSV). While science has not explained *creatio ex nihilo*, it seems that the Creator has arranged things so that scientific investigation could come as close as is logically possible to that goal. The God of the philosophers would not have done that, but the God revealed in the event of the cross apparently has.

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RELIGION & BIBLICAL STUDIES

THE EVOLUTION OF ADAM: What the Bible Does and Doesn’t Say about Human Origins by Peter Enns. Grand Rapids, MI: Brazos Press, 2012. xx + 172 pages. Paperback; \$17.99. ISBN: 9781587433153.

Peter Enns wrote this book to persuade Christians that “the biblical authors tell a very different story of human origins than does science” (p. ix). He argues that a modern critical approach to the origin of the biblical books supports the scientific conclusion that justifies a Christian’s abandonment of any notion of the biblical Adam as an actual person.

Enns’s book comes with strong commendations from people familiar to the ASA: Ted Davis, Denis Lamoureux, and Karl Giberson. Unsurprisingly, I find this book’s case to be severely flawed, though this brief review will not allow me to detail all of my critique.

The introduction sets out Enns’s perspective unambiguously. First,

The most faithful, Christian reading of sacred Scripture is one that recognizes Scripture as a product of the times in which it was written and/or the events took place—not merely so, but unalterably so. (p. xi)

Second,

If evolution is correct, one can no longer accept, in any true sense of the word ‘historical,’ the instantaneous and special creation of humanity described in Genesis, specifically 1:26–31 and 2:7, 22.” (p. xiv)

He dismisses all efforts to reconcile Genesis with “evolution” as producing a “hybrid” Adam who is “utterly foreign to the biblical portrait” (pp. xiv–xv, xvii).

In chapters 1–4 (“Genesis: An ancient story of Israelite self-definition”), Enns claims that scholarly study of the origin and purpose of Genesis should keep us from attaching much “historicity” to its creation stories:

The Pentateuch was not authored out of whole cloth by a second-millennium Moses but is the end product of a complex literary process – written, oral, or both – that did not come to a close until the postexilic period. This summary statement, with only the rarest exception, is a virtual scholarly consensus after one and a half centuries of debate. (p. 23, italics his)

Further, the widely acknowledged parallels between the early chapters of Genesis and the mythical tales from other peoples in the ancient Near East show that the purpose of Genesis is to define Israel and her God over against these tales. And since these other tales are “clearly mythical” (p. 37) and therefore unhistorical, why should we treat Genesis any differently?

He goes on to suggest, “Some elements of the [Genesis] story suggest that it is not about universal human origins but Israel’s origin” (p. 65), offering a chart to show how the “Adam story mirrors Israel’s story from exodus to exile” (p. 66). In such a reading, Adam as an actual person is a *misreading*, since he is really “proto-Israel.”

In chapters 5–7 (“Understanding Paul’s Adam”), Enns addresses an obvious difficulty, namely that Paul presented Adam as historical, the first man. Enns’s argument, that Paul’s Adam cannot result from a “straight exegesis” (p. 81) of Genesis, will be familiar to those who have read Enns’s other writings: “What is missing from the Old Testament is any indication that Adam’s disobedience is the cause of universal sin, death, and condemnation, as Paul seems to argue” (p. 82); he contends that this is true both of Genesis and of the whole Old Testament.

Paul “was a first-century Jew, and his approach to biblical interpretation reflects the assumptions and conventions held by other Jewish interpreters at the time” (p. 95). Even though, however, “we” can no longer accept Paul’s take on Adam as the first man (because of both science and historical criticism), “death and sin are still universal realities that mark the human condition” (p. 124).

The final section presents nine theses:

1. Literalism [in reading Genesis] is not an option.

2. Scientific and biblical models of human origins are, strictly speaking, incompatible because they speak a different language. They cannot be reconciled, and there is no “Adam” to be found in an evolutionary scheme.
3. The Adam story in Genesis reflects its ancient Near Eastern setting and should be read that way.
4. There are two creation stories in Genesis; the Adam story is probably the older and was subsumed under Genesis 1 after the exile in order to tell Israel’s story.
5. The Israel-centered focus of the Adam story can also be seen in its similarity to Proverbs: the story of Adam is about failure to fear God and attain wise maturity.
6. God’s solution through the resurrection of Christ reveals the deep, foundational plight of the human condition, and Paul expresses that fact in the biblical idiom available to him.
7. A proper view of inspiration will embrace the fact that God speaks by means of the cultural idiom of the authors – whether it be the author of Genesis in describing origins or how Paul would later come to understand Genesis. Both reflect the setting and the limitations of the cultural moment.
8. The root of the conflict for many Christians is not scientific or even theological, but group identity and fear of losing what it offers.
9. A true rapprochement between evolution and Christianity requires a synthesis, not simply adding evolution to existing theological formulations.

It is difficult to review this book in short compass. Enns covers a lot of ground, his topics are controversial, and I disagree frequently with his judgments. Even more challenging is how hard it is to find extended arguments for Enns’s positions. He tells us that the post-exilic date for the final form of the Pentateuch (and for most of the OT) is the consensus opinion of scholars at research universities; and he gives a standard list of factors that move historical critical scholars in this direction. But other than a nod in the direction of the traditionalists (p. 25, note 22, referring only to Umberto Cassuto [d. 1951] and William H. Green [d. 1900]), he never actually engages the traditionalist counter-arguments.

The presence of a consensus, to which he frequently refers, is not a valid argument. Assuming that the consensus actually exists, one needs to know how it came about, and with what combination of

Book Reviews

persuasion, inculcation, indoctrination, and coercion it is enforced. Further, consensus changes: the contemporary consensus has replaced an older one, and may itself be replaced. Further, I do not know if acceptance of *some* historical critical conclusions entails historical skepticism about Adam and Eve; certainly Enns has not argued the point.

Additionally, surely some acknowledgment of worldview factors would be appropriate when addressing the consensus of scholars in research universities. Is there any link between ideology, method, and conclusions? Enns seems to proceed as if this consensus is value neutral—and perhaps it is (much as I doubt it)—but he should *show* it.

Enns's readings of biblical materials are often simplistic. He shows no awareness of the developments in literary readings of biblical materials—even if he rejects these—with the resulting attention to literary style, and the Bible writers' preference for showing over telling. He also, in common with many in the critical camp, assumes a naïve literalism in reading texts, and equates that with truthfulness. Again, he owes us a discussion of *why* he rejects the notion of rhetoric, phenomenological language, and related concepts. But this assumption is what enables him to dismiss any correlation of biblical Adam with historical-scientific research.

Enns is convinced that “evolution” and “a biblical Adam” are incompatible. But what definition does he assume for those terms? Enns is clear about the second and vague about the first. I cannot tell whether he has a particular notion of what “evolution” is, or if it is a general term for “the results of the modern sciences regarding the antiquity of the cosmos and earth, and the development of life over a long period,” or some combination. Hence the book lacks any discussion of what kinds of evolution he has in mind, or of whether the advocates of evolution all mean the same thing, or whether we laity have any right to evaluate the proffered theories.

Enns's estimate of “biblical Adam” comes from a literalistic reading of Genesis:

The biblical writers assumed that the earth is flat, was made by God in relatively recent history (about 4,000 years before Jesus) just as it looks now, and that it is a fixed point in the cosmos over which the sun actually rises and sets. (p. xiii)

It is the traditionalists' confidence that the biblical story of Adam is intended both to be *referential* (about real persons and events) and *rhetorically artistic*; together with a respect for science, this has motivated them to come up with historical-scientific scenarios

by which to picture Adam and Eve and their progeny. They have challenged naturalistic extrapolations from the scientific theories, much as they have differed somewhat in their judgments of where the naturalism comes in. Affirming the actual resurrection of Jesus, Enns is personally a Christian and not a naturalist; but if he can swallow that camel, why strain out the gnats by approving a naturalistic account of the Bible and of biological origins?

Enns acknowledges that Paul's argument assumes a historical Adam, but does not engage the other New Testament texts that assume this: e.g., the imagery in Rev. 22:1–5 (where God will ultimately remove the effects of the Fall) gets a mention (p. 74), without saying whether it should affect our thinking; and he leaves out Jesus in Matt. 19:3–9, who insists that “from the beginning it was not so.”

In this book, there is no place for any apologetic questions of whether humankind is a *natural* product of evolution or something special, or of whether there is a humankind at all, and of how sin came into the world, of why our souls abhor sin and dysfunction as “not the way it's supposed to be” and yearn for healing—all of which the traditional notions of Adam sought to explain.

This book strengthened and clarified my own thinking when I disagreed. Indeed, I came away even more confident in traditional views of Adam and Eve as our specially created first parents through whom sin and evil came into human experience. If evolutionary theories are opposed to that, then those theories must adapt to accommodate the entire range of evidence.

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RELIGION & SCIENCE

SCIENCE IN A DEMOCRATIC SOCIETY by Philip Kitcher. Amherst, NY: Prometheus Books, 2011. 270 pages. Hardcover; \$28.00. ISBN: 9781616144074.

Philip Kitcher is worried. In his latest book, *Science in a Democratic Society*, Kitcher wants to show that there is too much ambivalence about the authority due to natural scientists, and often this is exemplified in controversial science-related public issues, such as genetically modified plants, global warming, or claims about evolution (p. 15). Initially, Kitcher places blame for these problems on “the sweeping

declarations of enthusiastic scientists" (p. 16), scientists who cling to the Enlightenment legacy "that all questions of a specific type can be addressed by future research, or even that all important issues can eventually find scientific resolution," a view Kitcher labels "scientism" (p. 17).

But it turns out that "Scientism" is not the real problem. The loss of the public authority of science is primarily the result of growing belief in an alternative story in which

institutionalized science is dominated by people with biases that oppose the ideas of the folk. Behind the elite universities and the honorary societies [so this view holds] is a subversive agenda, one intent on rooting out popular convictions and values. (p. 19)

If the reader is unsure what group embraces such a story, the reference in the next sentence to "teachers at the Bible colleges" clears things up. Kitcher believes that this never-specified group of Bible believers (he offers not one example of a specific Bible-believing person or idea or institution or work anywhere in the book—a major shortcoming) has uncritically accepted a limited view of the nature of a democratic society, a view which encourages people to think that their democratic freedoms of thought and expression justify their believing as they wish, even in the face of scientific evidence to the contrary. Kitcher notes that the over-enthusiastic scientistic scientists inadvertently encourage this view, since such scientists are still in thrall to the empty ideal of a value-free science. Their blindness to the role of values in their science only encourages the alternative story told by Bible believers.

Kitcher, who is the John Dewey Professor of Philosophy at Columbia University, has what at first appears to be an unlikely way out of this dilemma. He recognizes that *both* of these views of science are naïve. In a modern society such as ours, where science impacts (or could impact) more people than ever before, there needs to be an improved way for scientists and citizens to relate one to another, or, in Kitcher's words, integrate "expertise with democratic values" (p. 11).

Kitcher's goal is to avoid the distortion of thinking that there are experts in the public good or the ultimate expert, God. His alternative is a notion of "authoritative conversation, in which *all* participate on *equal* terms ..." (pp. 49–50). This will, of necessity, involve judgments of ethical value, something made too little of by Scientism and too much of by religious believers. For Kitcher, "there are ... no ethical

experts, only the authority of the conversation" (p. 57).

Kitcher is realistic enough to acknowledge that this is an ideal, but he believes that aiming for this ideal is our best hope for citizens and scientists to find common purpose, provided that religious claims are inadmissible. Such claims, says Kitcher, fail because they do not meet "the cognitive conditions on mutual engagement" (p. 60). For Kitcher, the condition means that claims can only be validated empirically. Since religious claims, according to Kitcher, offer no such evidence, their truth claims are therefore based on a "chimeric epistemology" (p. 157). Kitcher characterizes this approach to knowing as willfully and ignorantly believing X without offering any reasons for the belief. Kitcher playfully summarizes his epistemology with a simple rule: "There will be no spooks" (p. 41).

For an author with Kitcher's breadth of reading and understanding of important thinkers such as Thomas Kuhn (with whom Kitcher studied), such claims as this (and they are liberally sprinkled throughout the book) are breathtakingly naïve. Given Kitcher's insistence on the sole validity of evidence-based claims, his virtually complete absence of evidence for these claims is astonishing. For example, I could not detect one single footnote to, or any publication listed in his bibliography by, those unnamed people criticized by Kitcher. Again, Kitcher uncritically adopts an "evolution of ethics and religion" view without apparently having seriously considered the well-developed positions of many anthropologists, historians, and biblical scholars to the effect that religion and ethics have numerous features that cannot be explained by pragmatic evolutionary criteria alone. Especially egregious for a philosopher, he makes no reference to the respectable body of philosophy of science done by Christian scholars such as Del Ratzsch, not to mention the discussion of rationality and belief in God by Alvin Plantinga in his *Warrant* series. The work of the ASA (including this publication) also apparently escapes Kitcher's notice.

Lest this seem too monochromatic a judgment of the work of such a distinguished scholar as Kitcher, consider the following assertion regarding religious believers:

To assert their ungrounded commitment to a particular standard, and to claim that others should abide by policies flowing from it, even when these others repudiate the commitment, would be a dramatic failure of mutual engagement. Ideal deliberation would thus endorse the conclusion that

Book Reviews

methods of certifying claims as part of public knowledge must be thoroughly and completely secular. Public reason can allow discussants to put forward claims that accord with religious beliefs, but *defense* of those claims must be free of any reliance on the tenets of a religious tradition. (p. 161)

Many readers of this journal will immediately recognize what Kitcher misses—that a statement such as this is grounded on assumptions that can only be believed rather than proven. As such, they are beliefs about ultimate, nondependent reality, which are therefore *de facto* religious beliefs.

I would have preferred, as I wrote this review, to have foregrounded Kitcher's case for the impossibility of value-free science. His generous desire to give all citizens, scientists or not, secular or not (or at least their representatives) some way to have a conversation about how to better engage in supporting science for the public good deserved more attention. In the latter half of his nine chapters, Kitcher offers some interesting (albeit brief and very optimistic) analyses of what this could look like. His brief historically rooted exploration of how modern science came to see itself as semi-autonomous is worthy of more attention.

Such would have been my preference. But his standard modern pragmatic secularism (upon which Kitcher's analysis and solution depend) showed him to be so culpably ignorant of the very ideas about which he seemed so deeply concerned, and he so cavalierly ignored his own values of supporting claims with evidence, that this reviewer must judge the book more for its deficiencies than its promise.

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SOCIAL SCIENCE

THE PHYSICAL NATURE OF CHRISTIAN LIFE: Neuroscience, Psychology, and the Church by Warren S. Brown and Brad D. Strawn. New York: Cambridge University Press, 2012. xii + 178 pages. Paperback; \$27.99. ISBN: 9780521734219.

How would the church, the Body of Christ, be impacted if Christians fully embraced their own embodiment as persons? Brown and Strawn look at the implications for spiritual formation and pastoral care of leaving behind anthropological dualism in favor of a theology and practice stressing the person as physical, social and communal.

Neuroscientist Warren Brown is professor of psychology at Fuller Seminary where he mentored Brad Strawn who is now VP for Spiritual Development at Southern Nazarene University. Brown has been influenced by nonreductive physicalism as articulated by Donald MacKay and Malcolm Jeeves, scientists whose writings are familiar to many in ASA. In previous articles and books, Brown has argued on the basis of neuroscientific, psychological, and biblical evidence in favor of this Christian physicalist perspective over the traditional dualistic view, which espouses separation of physical body and immaterial soul. The present book moves beyond those arguments to consider the formative and transformative nature of social relationships on our ever-developing physical brains.

In the first of three sections, the authors argue that the biblical and scientific view of persons is that of a unitary physical, mental, spiritual being embedded within social relationships. Our uniqueness as humans consists in our rationality, relationality, morality, and religiousness, all of which have been linked by neuroscience with our physical brains. Without question, social neuroscience is the fastest-growing area within neuroscience. Using data from fMRI and brain disorders, Brown and Strawn show the connection between our brains and thoughts, including our social pain, empathy, and development of trust. Various neurological disorders can radically disrupt language, the ability to imagine other minds, forethought, and empathy. During the last decade, neuroscience and philosophy have both recognized the role of emotions as a major and useful guide in moral decision making. Although the connection between religious experience and brain activity has been naively discussed in popular and even some scientific literature, it is clear that brain activity is altered during prayer, meditation, and glossolalia. Indeed various religions over the millennia have used brain-altering drugs or practices to induce religious experience. The brain plays a role, but Brown and Strawn point out this role is not associated with one neural area or pattern, and religious experience is conditioned by memory, social context, and beliefs.

Brown and Strawn further describe how persons are formed by complex interactions with the social environment. This open and self-organizational nature of the mind is seen most strikingly in childhood, but continues into old age. The ability to share attention, to imitate others, to develop language and a concept of self, and to be emotionally attuned to others all develop first in the cradle of interpersonal

attachment and can be disrupted by neural disorders or failures of nurturance. Relationships, however, continue to shape us over the entire lifespan because dendritic structure continues to remain plastic throughout life. The authors argue that the church needs to reconsider not only religious development of children, but also the reality of social embeddedness in lifelong spiritual growth. For enduring spiritual transformation to occur, conversion must be followed by progressive development, which in normal human life is facilitated by social relationships.

In the second section, the authors explicate the roles that attachment, imitation, and narrative play in childhood development and the further roles they might play in the spiritual formation of adults. In complex dynamical systems theory, it is at the point when a system becomes destabilized and is unable to successfully interact with the environment that reorganization and emergence of new systems most readily occur. The authors compare these events, referred to as catastrophes in systems theory, to conversion and ongoing experiences of spiritual transformation. Already in the 1950s, British psychologist John Bowlby showed that secure attachment in childhood leads to flexible healthy interpersonal behavior, but we now recognize that secure relationships can also bring healing and reorganization of behavior to adults. Psychological data show that both children and adults unconsciously imitate not only behaviors of others, but also their desires, motives, goals, and attitudes. Brown and Strawn relate the mimetic theory of René Gerard to this phenomenon to show how we shape each other through reciprocal imitation. Psychological research also suggests that people adopt narratives or scripts as children in order to organize their social relations, and that healing can be facilitated by adoption of more coherent narratives. The authors invoke Alasdair MacIntyre's view that persons flourish only in the context of their interdependence. The development of wisdom and virtue requires feedback and error correction from others, they argue, more than disembodied mysticism

The third section deals specifically with church bodies, the need of bodies for churches, and practical considerations of embodied spirituality. Mastery of behavior requires more than focus on the inner "me." Learning how one impacts other people allows development of self-observation and new behaviors. Caring, committed long-term relationships can disaffirm people's anticipation of rejection and allow development of new attachment styles.

A new template for behavior can form as a result of corrective recapitulation of early family groups. In the right kind of church community, people can serve as role models, reciprocal partners for growth, and mirrors which allow us to discover our identity. Unfortunately most church groups, as Brown and Strawn point out, are focused on more superficial social interaction and/or Bible study and not characterized by longer-term covenants of caring and commitment to correctively speak into each other's lives. A common involvement in ministry together allows development of new outward-oriented attitudes toward service.

In churches where the emphasis is on passive "experience" rather than service, a sort of Gnostic subjectivism can too easily develop. Brown and Strawn advocate active physical participation in worship and liturgy, in particular the physical, participatory, communal activity of the Eucharist. There are additional implications for how congregations deal with various physical, emotional, and mental disabilities. The embedded view sees salvation and sanctification as the turning of the whole person to Christ in transformation of the entirety of life and behavior. Because people change in and through relationship, Christian formation takes place with and is emergent from the ongoing life of the interactive community as Christ operates through his body.

I highly recommend this book for leaders and lay members of congregations, as well as students at Christian colleges. The relevant research is presented in readable form, and should be easily accessible at a beginning undergraduate level. The authors not only extend the understanding of the present neuroscientific and psychological understanding of human beings, but integrate it with practical wisdom for church organization.

References within the text are covered in footnotes, and there is an adequate index. In spite of the number of citations provided, the role of relationship in moral development is one area which might have included more reference to other work.

Reviewed by Judith Toronchuk, Trinity Western University, Langley, BC V2Y 1Y1. ☞



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Letters

"Hard" and "Soft" Methodological Naturalism

I very much enjoyed Kathryn Applegate's article ("A Defense of Methodological Naturalism," *PSCF* 65, no. 1 [2013]: 37–45) defending methodological naturalism (MN). I share her enthusiasm that MN can help to shed light on the mechanism of God's handiwork in nature, as opposed to previous intimations that MN is somehow inconsistent with God's creative agency. I do not think that MN is the methodological extension of metaphysical naturalism. Indeed, if atheism were true, it would undercut both our reason and our ability to do science in the first place!

One issue that I was hoping Applegate would address, but that did not appear in her article, was the contrast between "hard" and "soft" MN. This is a distinction first made by English philosopher Peter S. Williams, and is one that I find very helpful. In short, the difference is this: "hard" MN precludes intelligent causation from science, whereas "soft" MN precludes explicitly supernatural causation from science, while still allowing for explanations to be framed in terms of intelligence. Williams argues that "soft" MN should be permissible in science—and, indeed, *is* permissible in science, given such widely recognized fields of investigation as forensics, archaeology, and SETI. I cannot help but feel that he is on to something.

Although Applegate does not directly address the distinction between "hard" and "soft" MN, she does brush the issue tangentially. She writes, "By practicing methodological naturalism, one does not deny the presence of design or teleology in the created order but simply removes it from the purview of science" (p. 43). Here, Applegate appears to advocate some form of "hard" MN, whereby appeal to intelligence is disallowed a priori. That is certainly her prerogative, although I wonder whether she truly believes that none of the aforementioned disciplines are scientific in nature because they, too, invoke intelligent causes.

To be clear, I remain unconvinced by the recent Intelligent Design movement, particularly as it purports to explain the origin of biological diversity. However, I do find the "hard" version of MN to be problematic, and I think that we limit ourselves needlessly by adhering to it for Applegate's fear of "demeaning God."

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Clarifying "Hard" and "Soft" Methodological Naturalism

I am grateful for Jordan Mallon's question regarding the distinction between "hard" and "soft" methodological naturalism (MN), the former being that which precludes *all* intelligent causation, the latter precluding only supernatural causation. I agree that hard MN is problematic. In my article I wrote that "these fields [archaeology, forensics, SETI] do abide by the traditional definition of methodological naturalism, *which only excludes supernatural explanation, not all intelligent causes*" (p. 40, emphasis added). The version of MN I hoped to defend in my article ("A Defense of Methodological Naturalism," *PSCF* 65, no. 1 [2013]: 37–45)—what I called "traditional" MN—is indeed "weak" MN.

Mallon questioned whether I meant to exclude *all* intelligent causation when I wrote, "By practicing methodological naturalism, one does not deny the presence of design or teleology in the created order but simply removes it from the purview of science" (p. 43). I am happy to concede that my wording could have been more careful: make that "*supernatural* design or teleology." My intent was that nonscientific avenues for thinking about design and teleology (e.g., biblical ones) are likely to be more fruitful, in many cases.

Kathryn Applegate
ASA Member

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Editorial

Accurate 73 James C. Peterson

Articles

Do the Polls Show That Science Leads to Atheism?	75	Eugene A. Curry
In Defense of Uniformitarianism	79	Bruce L. Gordon
Background Beliefs, Ideology, and Science	87	Jitse van der Meer
Stewarding the Gift of Land: Christian Campuses as Land Management Models	104	Karen M. M. Steensma, David R. Clements, John R. Wood, Randall Van Dragt, and Ben Lowe

Communication

Engaging the Evangelicals of Peru in Creation Care 116 Oscar González

Book Reviews

<i>Between Heaven and Earth: Christian Perspectives on Environmental Protection</i>	123	Fred Van Dyke
<i>The Hockey Stick and the Climate Wars: Dispatches from the Front Lines</i>	124	Michael E. Mann
<i>Galileo's Muse: Renaissance Mathematics and the Arts</i>	127	Mark A. Peterson
<i>The Rocks Don't Lie: A Geologist Investigates Noah's Flood</i>	128	David R. Montgomery
<i>The Spirit in Creation and New Creation: Science and Theology in Western and Orthodox Realms</i>	130	Michael Welker, ed.
<i>What the Heavens Declare: Science in the Light of Creation</i>	132	Lydia Jaeger
<i>God and the Folly of Faith: The Incompatibility of Science and Religion</i>	133	Victor Stenger
<i>Time in Eternity: Pannenberg, Physics, and Eschatology in Creative Mutual Interaction</i>	135	Robert J. Russell
<i>A Universe from Nothing: Why There Is Something Rather than Nothing</i>	137	Lawrence M. Krauss
<i>The Evolution of Adam: What the Bible Does and Doesn't Say about Human Origins</i>	138	Peter Enns
<i>Science in a Democratic Society</i>	140	Philip Kitcher
<i>The Physical Nature of Christian Life: Neuroscience, Psychology, and the Church</i>	142	Warren S. Brown and Brad D. Strawn

Letters

"Hard" and "Soft" Methodological Naturalism	144	Jordan Mallon
Clarifying "Hard" and "Soft" Methodological Naturalism	144	Kathryn Applegate