

# PERSPECTIVES on Science and Christian Faith

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

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

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3. Use endnotes for all references. Each note must have a unique number. Follow *The Chicago Style Manual* (14th ed., sections 15.1 to 15.426).
4. If possible, include graphics (electronic file preferred) that enhance the theme of the paper. Figures and diagrams not in electronic format should be clear, black and white, line ink drawings or glossy photographs suitable for direct reproduction. Provide captions separately.

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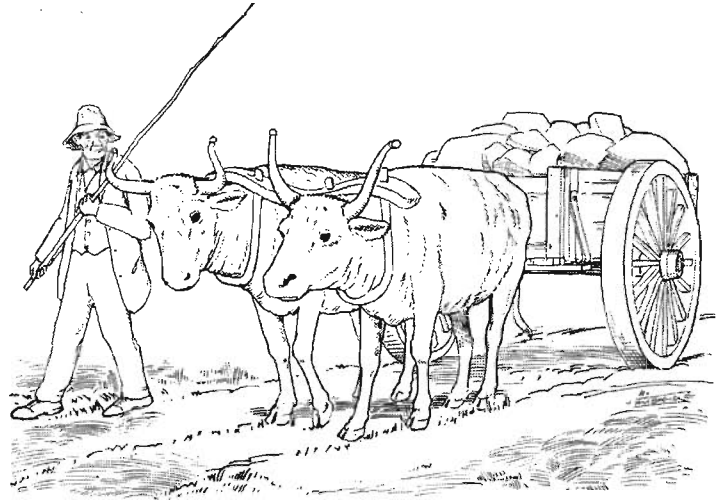
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# Prick of the Goad



In the book of Ecclesiastes, the Teacher writes: “The words of the wise are like goads, their collected sayings like firmly embedded nails—given by one Shepherd” (Eccl. 12:11, NIV). In the ancient world, “goads” were staffs embedded with sharp nails, used to “guide” animals along a path. The visual image of a long waving stick and occasional sensorimotor pricks were adequate reminders to keep a pair of domesticated and trained oxen pulling their load along a pathway. In a similar fashion, wise words not only bring pleasure and pain but also shepherd us along appropriate paths.

The scientific enterprise progresses in proportion to the published word of its practitioners and interpreters. An important aspect of science is the dialogue that results from reflecting on the ideas and insights of others. Consequently in this issue, we feature a dialogue format to “goad” us along as we ponder the very nature of our scientific endeavor.

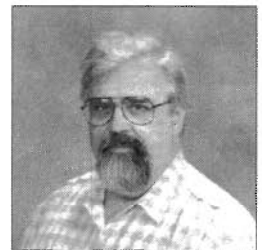
The focus of this issue of *PSCF* is the nature of science. Is naturalism an appropriate way to explore the handiwork of the Creator? Walter Thorson, a retired physical chemistry professor, argues that a redefined “naturalism” guides scientists to fulfill the Creator’s intentions. God’s proclamation, “cultivate and keep the garden,” gives the descendents of Adam both motivation and legitimacy to engage in scientific inquiry and discovery.

The four peer reviewers of Thorson’s initial manuscripts, while critical at some

points, were lavish with appreciation for Thorson’s insights. Following a reviewer’s suggestion, the editor invited a group of philosophers, theologians, and scientists to write short responses to Thorson’s ideas. In the pages that follow Thorson’s two-part article, twelve respondents give both affirmations and critical objections to varied aspects of “naturalism’s” role. Concluding the dialogue section of this issue, Thorson responds to the respondents by acknowledging their contributions and by challenging some of their assumptions. Depending upon reader interest and involvement, the dialogue may continue in subsequent *PSCF* issues via contributions to the Letters to the Editor section.

Following the dialogue section, we feature a regular paper by Donald Yerxa who gives us a historical perspective on the early events that ushered in the Intelligent Design movement. The listings of financial donors to ASA and peer reviewers of submitted manuscripts to *PSCF* highlight our attempt to acknowledge the contributions of many persons, who have repeatedly demonstrated their commitment and loyalty to our society and our journal. We thank them. Finally, we conclude the issue with sixteen book reviews in various categories, seven letters that continue dialogue on ideas raised by articles published in prior *PSCF* issues, and an index to the preceding three volumes of our journal. ♦

Yours for “goadly” reading,  
**Roman J. Miller**  
Editor



*In this issue,  
we feature a  
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## Dialogue: Article

*Legitimacy and Scope of "Naturalism" in Science*

*Part I: Theological Basis for a "Naturalistic" Science*

# Legitimacy and Scope of "Naturalism" in Science

## Part I: Theological Basis for a "Naturalistic" Science



*For theological reasons, "naturalism" is an appropriate presupposition of science.*

*The crucial reason for naturalism in science is theological – God's transcendence with respect to creation. "Naturalism" limits science to the "creaturely" domain – and gives it legitimacy as a discourse distinct from theology. Adam naming the creatures forms the biblical paradigm for science: reason is a creaturely gift, not an autonomous power to subject God or divine agency in creation to our mundane scrutiny. Theological grounds for naturalism also affect its potential scientific meaning. Mechanistic assumptions adequate for physical science do not provide a final definition of "naturalism." Part II discusses important implications for biology in particular as a "naturalistic" science.*

**T**his first half of a two-part essay argues that for *theological reasons*, "naturalism" is an appropriate presupposition of science. It intentionally limits the scope of science to its proper "creaturely" domain, giving it legitimacy as a discourse distinct from theology. Such limited, "naturalistic" enterprises are necessarily sustained and informed by some broader, essentially religious/philosophical understanding. Adequacy of such a sustaining framework or world view is then a crucially important issue.

The crucial theological basis for scientific "naturalism" is God's sovereign transcendence with respect to creation. God and his agency in creation are mysterious, not subject to routine scrutiny by human reason; they are apprehended only by faith, involving the human will and attitude in

relation to God as personal. Correspondingly, human reason should not be understood as an autonomous power for knowing transcendent, divine realities; it is a "creaturely" gift, appropriate to the vocation and setting of human beings within creation. As a creative achievement of our reason, science finds its defining paradigm in that context. Theological reflection on creation is entirely legitimate, but must be clearly distinguished from the mundane study of creation with which science is concerned. "Naturalism" in science is thus a methodological policy, rooted in the understanding that God is transcendent—not an object of autonomous rational scrutiny as created things are.

Persistent use of quotation marks is meant to flag two difficulties in using the very controversial term "*naturalism*" for this theologically based approach. PSCF readers are well aware of the extended debate among Christian thinkers regarding the legitimacy of naturalism in science—a debate now more than ten years old, with entrenched positions on both sides. To use the "N-word" at all seems asking for trouble, especially since I shall argue for a position having points of agreement/disagreement with both sides of the debate.

**Walter R. Thorson**, was professor of chemistry at the University of Alberta (1968–1994). A theoretical chemist, he applied quantum mechanics to small molecule dynamics and atomic collisions, and was elected a Fellow of the American Physical Society in 1987. He has a deep interest in the philosophy of science and related issues in theology, and is author of several articles on these topics in PSCF and elsewhere. He is an ASA Fellow, and was adjunct professor of philosophy of science at Regent College in Vancouver, BC for many years. Walter and his wife Mary now live near Sandpoint, Idaho. They have two children and four grandchildren. To contact Walter, mail correspondence to: P.O. Box 12, Kootenai, ID 83840 or email him at [wmtorsn@bossig.com](mailto:wmtorsn@bossig.com)



The first difficulty is one of substance. I do *not* argue for the current *status quo* concerning what naturalism *means*. The “naturalism” presented here is radically different from the *philosophical* or *metaphysical naturalism* assumed in the “scientific world view.” That religious/philosophical viewpoint is better described as atheistic materialism. Christian thinkers correctly criticize its prejudicial influence as a tacit (and perhaps even dogmatic) bias in the contemporary scientific community. Theological justification for “naturalism” as a scientific presupposition must first make it clear that such religious/metaphysical dogmatism misses the essential point about what science means as a *limited* discourse about the world. But a theological understanding of “naturalism” also provides a basis for more open thinking about science and its explanatory paradigms. Following this up, Part II considers the scope of a theologically based “naturalism.” I argue there that a *mechanistic reductionism which sees nature in terms of physics alone* need not be the exclusive basis for scientific understanding, and that scientific problems are presented by living things for which it is not an adequate basis. New paradigms are needed which recognize that the central problems of biology and cognition *logically transcend* a merely mechanistic, physical account of the phenomena involved. These phenomena, though still “natural,” exhibit a logically distinct aspect or “level” of creation from the purely physical.

My second difficulty is semantic. For the most part, Christian debate over the legitimacy of naturalism in science tacitly shares the contemporary secularist, materialistic definition of the “N-word.” Therefore, even though the presuppositional framework presented here offers a fundamentally different meaning for the term, and even if Christian readers agreed that this framework provides a legitimate basis for science, they might still object to using the word *naturalism* for it. The objection has some merit, and if a suitable but different term “XYZ” were available, I would gladly use it. However, the currently accepted meaning of the word *naturalism* is really the result of a cultural and philosophical drift from an original presuppositional context for science very close to “XYZ.” I therefore believe that “*naturalism*” is both appropriate and economical to denote “XYZ,” at least for the time being. My persistent use of quotation marks signals this. Where *naturalism* appears without quotation marks, I allow for ambiguity in its meaning or for a generic, *status quo* usage.

Historically, Robert Boyle advocated naturalistic presuppositions in physical science (the “mechanical philosophy”) for reasons rather similar to those given here.<sup>1</sup> Boyle’s theological grounds for “naturalism” are relevant to us because in his day they gave science legitimacy as a separate discourse from theology. The limiting assumptions of “mechanical philosophy” offered a heuristic working proposal for *physical* science, and were *not* adopted to

provide a fixed paradigm of “nature” adequate for all future science. Cultural/philosophical drift away from this understanding came later, with the rise of Deism and the rationalism of the Enlightenment. Naturalism then became progressively identified with the specific idea of a mechanical, physical, and purely material world as a self-sufficient metaphysics—and progressively detached from the fundamentally theological context that gave it legitimacy.

## Naturalism in Science Requires Theological Foundations

### Science always has *some* religious context.

Modern culture thinks of science as an autonomous, self-justifying and self-sustaining enterprise. But this presupposes that the particular metaphysical idea of “nature” underlying physical science is an adequate view of the whole of reality. Sometimes people immersed in this reductionist world view even claim that belief in God subverts scientific inquiry by imposing on it the broader context of compatibility with theological understanding. Such claims reveal amazing ignorance of the roots of modern science in Judeo-Christian understanding of creation. They also ignore a more important point: the question is never *whether* people have a framework of religious beliefs, but *what those beliefs are*—and how they affect one’s approach to the world. Ideas promoted by science popularizers like Carl Sagan, Richard Dawkins or Richard Lewontin are rooted in their ultimately religious belief in a certain metaphysical view of “nature.”

However, modern philosophical naturalism really presumes an unlimited *human* autonomy, not merely an autonomous science. In the Bible, Cain symbolizes this claim to autonomous power independent of any relation to God, as he creates technology, culture, and an entire world “*away from the presence of the Lord*.”<sup>2</sup> The claim is based on the creative power of human reason: modern Cain recognizes as valid only that which he grasps and fashions with his own mind.

Postmodern philosophy is no real friend to Christianity because it denies any objective truth. Yet it has correctly understood that modernity’s real religion has always been the covert worship of reason as divine. In Western culture, long before the rise of modernity, Christian understanding found a religious basis for human enterprise in creation in the biblical notion of the *imago Dei*, God’s creation of humankind in his own image.<sup>3</sup> But the long-standing parallel idea that identifies this *imago Dei* with our *reason* owes much more to the influence of Greek philosophy on medieval thought than to the Bible. In contrast to this rationalistic bias in medieval thought, Calvin and some other Reformers followed the New Testament’s understanding of the image of God as *relational*—taking its



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## Dialogue: Article

### Legitimacy and Scope of "Naturalism" in Science

#### Part I: Theological Basis for a "Naturalistic" Science

primary meaning from the renewing personal relationship between God and humans mediated by God's grace, rather than being defined in any *a priori, metaphysical* terms. There is evidence that this shifted emphasis influenced the rise of modern science.<sup>4</sup>

Francis Bacon, for example, did not base his vision of the scientific enterprise on an inherent human autonomy derived from reason, but on the theological ground of a restored relationship to God in Christ. He argued polemically against rationalism in all its forms—and in favor of a basic humility toward the two books, nature and Scripture, which, he said, should result from a renewal of proper attitudes to their Author.<sup>5</sup> While there are deep flaws in Bacon's thinking which we should reject, especially his tendency to think of science as a domination or exploitation of nature, these steps toward a theological rather than a rationalistic basis for science were sound, and they in turn influenced pioneers like Robert Boyle in thinking scientifically about creation.

Yet today it is Cain's assertion of human autonomy based on reason that covertly underlies the modern notion of an autonomous science and the materialist metaphysical picture of nature it presupposes. This belief-context which frames modern secularist understanding of science is clearly a form of *religion*.

Recognizing the biblical portrait of Cain in modernity's spiritual intentions, some Christians may mistrust the creativity exhibited by the naturalistic approach of physical science to the world. However, the point of biblical commentary on Cain's culture is not to demonstrate the entire depravity of creative human enterprises, but their *radical ambiguity*.<sup>6</sup> The value of reason and its creativity, like all the gifts of God in creation, is conditional, and depends on maintaining a sustaining context in which humanity can live: "*not by bread alone, but by every word that proceeds from the mouth of God.*"<sup>7</sup>

These theological and historical issues are relevant to the current debate about naturalism as a presupposition of science. Some Christian critiques of the contemporary scientific establishment identify its *a*

*priori* assumption of naturalism as the main issue at stake, claiming that this simply reflects its underlying materialist religious beliefs. Debate has focused particularly on the problem of biological origins, especially for those who argue for "intelligent design" as an alternative *scientific hypothesis*. Such critics accurately point out that today the scientific community is not really neutral on underlying spiritual issues. If the "scientific establishment" also promotes a philosophical agenda deeply contradicting Christian understanding of creation, it is proper to criticize its dogmatic metaphysical naturalism as a form of religious belief. As a scientist, I have considerable trust and respect for the scientific tradition; but I also realize that human enterprise is radically ambiguous.

For the Christian, then, naturalism in science clearly requires a theological basis; otherwise its legitimacy is in question. Uncritical, tacit acceptance of scientific naturalism as it now stands merely concedes Cain's autonomous terms of reference for the enterprise.<sup>8</sup> I am especially concerned to show here that sound theological justification for "naturalism" in science is not *a posteriori*, i.e. after the fact; and also, that it does not imply mere acceptance of the *status quo* for a scientific paradigm of "nature." Instead, it radically renews our thinking about what such "*naturalism*" really means, and opens horizons to possible novel paradigms consistent with its broader terms of reference.

#### The theological issue cannot be side-stepped by a simple distinction between philosophical and methodological naturalism.

To avoid entanglement in theology, some people try to resolve these problems more pragmatically. Thoughtful people realize that the values, habits of mind, and intellectual passions which sustain scientific enterprise can be shared and promoted by persons with a wide variety of religious beliefs. For them, the argument that naturalism in science is a purely *methodological* presupposition is a way of expressing the generosity of mind needed to sustain a fragile enterprise in a fragmented culture. Christians may accept such a notion *in prin-*

ciple, seeing it as a proper admission of limits to the claims of science. But one person's methodological naturalism may be seen by another as philosophical in practice. This has been amply demonstrated in ongoing debate, both in the pages of *PSCF* and more generally.

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### *One person's methodological naturalism may be seen by another as philosophical in practice.*

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Phillip Johnson's widely read books may have initiated current debate on naturalism; they have certainly stimulated it.<sup>9</sup> His works have strongly attacked the tradition of scientific naturalism, arguing that it merely expresses the atheism prevalent in modern scientific culture. In a *PSCF* review critical of Johnson's *Darwin on Trial*, Owen Gingerich defended naturalism in science as purely methodological: he argued that science is a game with widely agreed-upon rules, one of which is that to qualify as *scientific*, an explanation is necessarily *naturalistic*.<sup>10</sup> However, to help define "naturalism," Gingerich used the adjectives *mechanistic* and *automatic*—terms I do not use, for reasons made clear in Part II. In effect, Gingerich's argument accepted the *status quo* for the meaning of "naturalism," i.e. the particular metaphysical view of nature as seen by physical science. But for critics like Johnson that view itself is part of the issue, since they question whether it is *theologically* appropriate. In a parallel and more philosophical *PSCF* critique of the same book, Nancey Murphy made another apology for methodological naturalism. She stated: "Isaac Newton and Robert Boyle, two of the scientists who led the move to exclude all natural theology from science (then called 'natural philosophy') did so for *theological* reasons."<sup>11</sup> While this indicated that "naturalism" was originally methodological rather than philosophical, Murphy did not make clear what these theological reasons were, or how they might affect what we understand by "naturalism."<sup>12</sup>

Critical opposition to naturalism (philosophical or methodological) is often more explicitly defined by claims, for example, that the agency of a creative intelligence as the source of informational complexity in living things must be considered to be a legitimate *scientific* hypothesis.<sup>13</sup> A pragmatic apology for naturalism as "purely methodological" cannot address these arguments on the necessary theological grounds, and failure to provide a theological basis for treating the issue simply allows the discussion to be framed in terms defined by current culture.

Of course I argue that "naturalism" is *methodological*, an assumption which limits and distinguishes scientific dis-

course from a wider, essentially theological context in which it is placed; but the theological ground which justifies this policy is really the issue.

### **"Rules for the game of science"**

In a *PSCF* article responding to critics of methodological naturalism, Dickerson appealed to the maxim "*If it isn't broken, don't fix it.*"<sup>14</sup> Why, he asked, is naturalism proper for physical science but inappropriate for biological science? Should we have been doing a fundamentally different sort of physical science all these years since Boyle and Newton, one which was *not* naturalistic in the way they intended? His point is relevant: The "naturalism" familiar to us in the presuppositions of physical science is entirely appropriate to the scope of that enterprise, and invoking miracles, intelligent design, and special divine intervention certainly would have hindered its progress. Many critics of "naturalism" seem to agree tacitly with this specific claim—for physical science. However, they argue that biology is really different and that in biology it is appropriate to suppose "intervention by an intelligent agent."

The idea of science as a game with rules does help, because it recognizes that science has some sustaining human context which transcends science itself: some limiting reference frame in which the validity of presuppositions like "naturalism" can be assessed. "*If it isn't broken, don't fix it*" is a conditional statement, based on a notion of achievement or success in some larger context. Participation in the game of science tacitly includes agreement to modify the rules if our conception of "meaning" or "progress" demands it. As Toulmin argued, it is essential to science that we do not indefinitely play games offering us no progress in explanatory power.<sup>15</sup> A decision that the rules of the game need to be changed is not itself a move within the game; yet the capacity for appropriate rule changes may sometimes have crucial importance to scientific progress. If "naturalism" is a sound rule for the game of science, its justification and definition will not come from within the narrowly limited world picture in use for current versions of the game itself, but from a deeper understanding of ourselves and those ends to which our science is appropriate.

For the Christian, that understanding is ultimately theological. The claims of the Christian religion are "legislated with universal intent," i.e. we assert they are a true account of the way things are.<sup>16</sup> This does not mean a Christian understanding of the scientific enterprise must be shared by everyone participating in science (even though such an understanding was widely accepted in its infancy). Whatever the historical origins of the modern scientific tradition were, the enterprise today is open to all who agree to accept its limited values, ideals, and obligations. As a scientist, I share some common ground with all



*There are roughly two theological arguments for naturalism in science. One places primary weight on some kind of theological/metaphysical doctrine of "Nature"; the other emphasizes the legitimate vocation of humanity in fulfilling the Creator's intentions.*

## Dialogue: Article

### *Legitimacy and Scope of "Naturalism" in Science* *Part I: Theological Basis for a "Naturalistic" Science*

scientists because of the agreed terms on which the enterprise is conducted. In part, this means that "naturalism," rightly understood, is a presupposition both appropriate and necessary to science. Those who see its deliberate exclusion of theological terms of reference as an error in the original framing of the rules of the game are overlooking the theological principles which make science legitimate, limiting its scope and meaning. Since, as a Christian, I ultimately see the world as the creation of God, these theological principles are essential. Thus, Part I of this essay is concerned with a sound theological basis for "naturalism" in science.

In Part II, I consider the scientific scope implicit in such a theologically grounded presuppositional framework. There, I shall differ with Dickerson's maxim, "*If it isn't broken, don't fix it,*" arguing that real progress in tackling major conceptual problems of biology may require new scientific paradigms. Though still "naturalistic" in the theological terms presented here, these are not limited to the reductionist, mechanistic terms of reference adequate for physical science.

#### **Theological grounds for distinguishing science from theology**

If creation is God's handiwork, how can a discourse about creation be distinguished from theology? In my own scientific work, God's absence as *an object of scientific discourse* never created discomfort or a sense of impropriety. In fact, I argue that a scientist must carefully *refrain* from making God such an object. But if we believe that God is the Author of that "book of nature" which science reads, how can such a policy be legitimate? What in the world of human discourse is *not* theology? I think this was also the central theological question resolved in Robert Boyle's decision to adopt "naturalism" in science. At least that is how I interpret his thinking, and some clues suggest it is a reasonable historical reading.<sup>17</sup> Today this question may seem contrived, but remember that in Boyle's day the imposing tradition and achievements of physical science *did not yet exist*. Boyle's decision to embark on the enterprise of a naturalistic "mechanical philosophy" was very bold, but it was not irreverent and certainly not atheistic.

There are roughly two theological arguments for naturalism in science. One places primary weight on some kind of theological/metaphysical doctrine of "Nature"; the other emphasizes the *legitimate vocation of humanity* in fulfilling the Creator's intentions. The second view stresses our role within creation and does not claim to offer a specific metaphysical account of what the natural world *is*. Of course, the distinction between these two approaches cannot be made too extreme, since neither fully excludes all aspects of the other. Nevertheless, the two emphases have different effects and tendencies. Boyle seems to have preferred the second approach—and so do I.

Boyle argued against the idea of Nature as a metaphysical entity having quasi-divine status or autonomous directive power. He was reacting especially to the teachings of Aristotle as they had influenced medieval thought about creation—for example, in the idea of Nature as a kind of sub-deity who rules here in God's place. He was aware how Aristotelian doctrine about forms and development in nature had controlled natural philosophy up to his own time, embedding a divine *telos* in all natural processes, and even supporting organismic models of physical phenomena which interpreted them as an embodiment of essentially divine principles.

It is ironic that today this religious notion of Nature to which Boyle objected so vigorously has crept back into the language of secular culture about creation. It shows up, not only in openly pantheistic views of the natural world, but in the unguarded language of agnostic scientists who try to form understanding of the world as something other than the creation of God. It is latent in the common notion many Christians share, that "laws of nature" describe how nature behaves *in the absence of divine agency*. In secular culture, positing Nature as the proper noun for the mystery behind creation is a widespread, practically uncontested usage. Religious ideas of nature fill the vacuum left when we deny God as the Author of creation.

Boyle thought this concept of Nature to be at best a "*vulgarly received notion*" (i.e. mere superstition), and at worst "*an impious blasphemy*" against the true, sovereign, and



living God. Consistent with this he favored a *voluntarist theology of creation* which argued that the dynamics of a changing universe should be understood theologically as the manifestation of divine sovereignty, divine establishment, divine intentions; there just *is not any* sub-deity ruling in God's place here. Our concept "*laws of nature*" is originally derived from this voluntarist view; as a nineteenth-century writer said, they are really just "*customs of God*."

This doesn't mean that the created universe or the order it manifests are not objectively real. Since antiquity, Christian theology has understood the relationship of God to creation in terms which clearly give it an authentic being distinct from God, while taking care to stress God's role as creator and conserver. There is wide scope in creation for a capacity to bring forth new levels of complexity and richness without implicating God in the machinery as a specific, "secondary cause."<sup>18</sup> An emphasis on God's transcendent sovereignty and the vocation of humanity in response to God's purposes does not deny creation's authentic being or the rich capacity for change and development with which the Creator has endowed it.<sup>19</sup>

However, such an emphasis still leads to a different approach, because it does not aim to offer any explicit metaphysical account of "nature." It is unwilling to justify scientific naturalism by extended *a priori* metaphysical claims about what creation is in itself, or how God is related to it in itself, apart from our participation. That is a wise policy! Our metaphysical views tend to be biased and severely limited by the *current* state of our scientific, creaturely knowledge. The essential point here is *epistemological*: No matter how extensive it may be, our knowledge of creation remains *our* knowledge—creaturely in its character, its limits, and its intentions. What nature's being really *is*, is fully known only to God. A metaphysical doctrine of nature is not needed to justify science and the "naturalism" proper to it.

## Theological Reasons for "Naturalism" in Science

### Divine Transcendence, Divine Purpose, and the Creation

The most important biblical doctrine for science is not the *order* or *rationality* of creation, but *the transcendence of God*. The Bible uniquely presents creation as the free, contingent expression of God's sovereign intentions. It is neither *a direct embodiment of*, nor *a necessary generation from*, the divine nature and being. Genesis carefully uses *distancing* terms: God *creates, forms, makes, speaks* creation into being; it is clearly distinct from God, who generously grants it an *authentic existence*. It is neither the dream nor the body of God.

Significantly, the Bible gives two distinct accounts of creation. They are complementary in certain ways, but

this complementarity should be understood in terms of priorities established by the first account. Genesis 1, which is like a literary and theological prologue to the Pentateuch (and indeed, to the entire Bible), presents a transcendent, determining perspective on creation. Even though this perspective is not accessible to us who live in creation, we need to know it exists. In Genesis 1, God is the only speaker and agent; there is no challenge to divine intentions and their fulfillment. The narrative ends with the seventh day which *has* no end, unlike the six preceding it; it is eternal day, the day of God's completed work and God's rest. In this perspective, divine purposes and actions are fulfilled and completed. But such a perspective cannot actually be a human one, set within space-time.

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*The most important [biblical truth regarding God and humans] is that God has chosen the relation of transcendence to creation as a direct result of his absolutely sovereign decision to be known as God in Jesus Christ.*

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It is the unique, transcendent view of creation as only God can see it, the "view from outside." Though its order of creation has correspondences in space-time, this order is not primarily *chronological*, but describes the unfolding logic of divine purpose. We learn that God has called a complete realm into existence and human beings have a unique meaning and role in it. God's sovereign purpose generously places creation in human hands, giving everything to us in gracious kindness; but the grant of dominion also implies human accountability to him. I do not think Genesis 1 is primarily concerned with the actual processes by which God created, though it suggests ordering principles we may correlate to these. The central theme is that *creation in all its fullness is the result of specific divine intentions – intentions essential to the identity and vocation of humanity*.

Key biblical truths regarding God and humans are implicit in this view of creation; they have a bearing on science. The most important is that God has chosen the relation of transcendence to creation as a direct result of his absolutely sovereign decision to be known as *God in Jesus Christ*. We do not know God himself through the knowledge of creation, although it bears witness to his power and transcendent nature as God. Nor do we know him (as Greek philosophy presupposed) on the basis of some similar divinity in our own nature, such as reason and its cognitive power. We can know God only on the ground of his gracious decision to be revealed and related



*The theological justification for scientific enterprise arises out of [the] vocation to cultivate and keep creation [Gen. 2:4b ff], which includes the power to know it and exercise responsible authority within and for it.*

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to us personally, in Jesus Christ. To bear witness to this fact is the essential aim of all the Scriptures.

Secondary, derivative truths follow: *Imago Dei*, the image of God, expressing the divine purpose in creating human beings, should not be misunderstood as some metaphysical essence or "stand-alone" quality of human beings in and by themselves. Instead, it refers to an identity with transcendent meaning, rooted in the divine purpose of personal relationship, to be realized/developed in a sustaining relationship to God—as the New Testament always teaches. In particular, the common idea that *imago Dei* should be identified with our *reason* and the power it gives us in creation is a dangerous misconception, really coming from Greek philosophy rather than the Bible. Its dangers are manifested in modern culture's idol of an autonomous reason and autonomous humanity, which have made science the basis for a claim to power and god-likeness without God—the claim *Cain* symbolizes.

#### **The second account of creation provides the "creaturely" context for science.**

The second narrative, Genesis 2:4bff, offers the complementary perspective from *within* creation. It has a clearly temporal setting and merges gradually into the ongoing story of humanity. In this account, human identity is linked to a vocation given humans by God: *to cultivate and to keep* the garden in which God has placed them. This vocation has deep theological meaning, and should not be dismissed as merely "ecological." Ultimately it points to the deep connection of servanthood and lordship expressed so perfectly in Jesus Christ, and links it to the purpose of God in creating humans. Because of the irrevocable calling and gifts granted to them by God, human beings are unique; but their uniqueness is not a basis for autonomy without accountability, as Cain presumed. We are responsible to the divine purposes or *dedication* which formed us.

The theological justification for scientific enterprise arises out of this vocation to cultivate and keep creation, which includes the power to know it and exercise responsible authority within and for it—a part of the

gardener's calling. This offers a quite different understanding from the traditional notion that science expresses dominion implicit in *imago Dei* (Gen. 1:26b). It emphasizes the biblical truth that our identity is not autonomously defined, but realized in relationship to God and his intentions.

In Genesis 2, God's intentions are supported by his endowment of human beings with unique gifts and powers to sustain human life and creativity, providing means by which our calling can be fulfilled. Specifically, creative powers of our rationality and its legitimate exercise—including the biblical paradigm for the meaning and legitimate scope of science—are presented in the story of Adam naming the living creatures.<sup>20</sup> It is very important that this incident is not the main point of the Genesis 2 narrative! The gift of rationality and the authority it gives us in creation is secondary; God's much greater gift is the potential for intimate personal communion between human beings, so that they are no longer *solitary individuals*. Exclaiming "*this at last is another like me,*" Adam finds in Eve one mysteriously and complementarily *other* to himself, yet equally bearing the divine image.

However, for a brief moment the gift of reason and its powers *is* the focus of the narrative: "*He brought them (the creatures) to the Adam to see what the Adam would call them; and whatever the Adam called each living creature, that was its name.*" Encouraged silently by the Lord's presence and sponsoring action, the human being has the wonderful task to name the creatures—and has the ability for it. For Semitic peoples, to know the name of something, even more to *give it a name*, was to possess a crucial privilege, knowledge, or authority in relation to it. Genesis 2 asserts that we have such authority and power within creation—linked to our vocation to cultivate and keep. The *contingency of creation*, the reason for the empirical methods of science, is implicit here; names for the creatures must be a response to examining them. Finally, while placing great value upon this enterprise by his presence and his interest in the outcome, *God delegates the enterprise entirely to us*. In this narrative, we can see the deep philosophical insight of the Bible. While we must understand that science is our own

creative work, it is an essential motivation of science that the order in creation it describes is objective. Creative scientists continually testify to this spiritual legitimacy of the enterprise by insisting that its truths are not invented, but *discovered*.

**"Naturalism" in science reflects essential limits to the "naming" power.**

In evident contrast to this, the Bible as a whole, and the Pentateuch in particular, consistently emphasizes that *God cannot be named by us in this way*.<sup>21</sup> God is not an object of scrutiny to our autonomous rational powers; and this inability is not a matter of degree, as if a divine mind were greater (even infinitely greater), but essentially of the same kind as our own. The inability to name God as we name created things is categorical: as transcendent, God is not related to created things either by *logical necessity* or *essential nature*. God cannot be subjected to mundane scrutiny at our will. His relationship to us and to all creation is a matter of his sovereign and free authority, and is properly described by terms such as *faithfulness, love, and grace*. We do have names for God, but these are the express tokens of his favor, not achievements of our creative powers. No one has argued this point more powerfully in modern times than the theologian Karl Barth.

What is true of God himself is also true of his mysterious agency in creation. Scientific study of the physical universe has revealed an awesome complexity and detail we can organize descriptively under the general concept of laws of nature. These in no way imply an *absence* of divine agency, replacing God by "Nature"; rather, they are a deliberately *non-theological* way of describing certain limited aspects of God's agency. People who argue for "intelligent design" in relation to the biological creation, however, often speak as though in that case we must somehow adopt a different stance—as though we should suppose that in biology, God's agency is a more discernible kind of "intervention" in some otherwise "natural" order, and is routinely open to detection and mundane scrutiny—so that in effect we can "fingerprint" God's acts within creation in some fashion not possible in the merely physical order.

There are clear cases in human experience where we are driven by the facts to speak, however incompetently, of divine "intervention"; we call such events *miracles*. But miracles too are mysterious, not subject to our rational and mundane scrutiny. Above all, as the Bible consistently shows, the encounter with God's direct agency in miracles always demands of the human beings involved a serious examination of their own wills and attitudes in relation to the divine purpose, i.e. it raises issues of faith in relation to God. Discussing this question, Austin Farrer argues convincingly that the "metaphysical joint" where divine agency intersects the created world is fundamentally

inscrutable.<sup>22</sup> God's agency is essentially mysterious at *every* level, both in the mundane order of creation and in the events we are constrained to call miracles; it cannot be subjected to scientific, rational analysis.

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*Science is an enterprise whose aim is to offer understanding and explanation of created things in the (limited) context of cultivating and keeping them. It is a response to what the natural world is, as manifested in certain kinds of mundane, controlled experience which are subject to our rational scrutiny; and it is also uniquely a result of human intelligence and its creative powers of naming.*

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The argument for "naturalism" as a presupposition of science is now evident. Science is an enterprise whose aim is to offer understanding and explanation of created things in the *(limited) context of cultivating and keeping them*. It is a *response* to what the natural world is, as manifested in certain kinds of mundane, controlled experience which are subject to our rational scrutiny; and it is also uniquely a result of human intelligence and its creative powers of naming. It is particularly *not* an attempt to understand, to explain or name God, or to detect God's agency in nature. It cannot address the unique nature of human identity, the relation of human beings to God, or even the full depth of human interpersonal relationships, since we are made *in God's image and likeness*. Such concerns are necessarily theological, transcending the task of naming the creatures and the stewardship role toward which it aims.

Exploring what is and is not within the scope of science, Michael B. Foster offers a further relevant insight. He acknowledges that it is the legitimate aim of science to clarify what can be mundanely known about creation by human reason, i.e. *to remove mystery from it*. However, he emphasizes the *limits* of science arising from this aim and its presuppositions about what lies within the human grasp.<sup>23</sup> In particular, *God, and those things which are God's*, such as true peace, reconciliation, and genuine unity and harmony, are beyond our mastery. Scientific knowledge and the mastery of creation it provides must be universally available on the basis of ordinary human life and thought. Thus, in science we are necessarily speaking of that which can be known and is accessible to us without change in ourselves or our personal condition: that is,



*"Naturalism" is really a theologically based policy aiming to discuss creation in terms of reference defined by creaturely things themselves. It deliberately refrains from claims to name God or detect God's agency by our own powers.*

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without repentance. The Bible teaches that knowledge of God or of God's agency is not accessible to us on such terms.

#### **Theological terms of reference for "naturalism" invite open discussion regarding its scope within creation.**

I have argued here that "naturalism" is really a theologically based policy aiming to discuss creation in terms of reference defined by creaturely things themselves. It deliberately refrains from claims to name God or detect God's agency by our own powers. While such discussion is therefore limited in scope, within its own terms of reference it remains indefinitely open for the exercise of our synthetic rational powers in studying what has been created. The terms of reference established for *physical science* even by the severely limited paradigm of a mechanistic, purely material world have proved remarkably broad, and we have not yet finished exhausting their possible implications.

However, the theological grounds given for "naturalism" also open the potential for "naturalistic" thinking about creation which is not necessarily constrained by the specific working assumptions of physical science. Negative Christian critiques of Darwinist claims that the merely physical, mechanistic order is sufficient to explain the biological creation do have scientific merit. But I believe the proper positive response is to offer "naturalistic" alternatives to such dogmatically constricted thinking. In the second half of this essay, I consider the open scientific scope of "naturalism." In particular, I shall argue for possible new paradigms of biological science; these appeal to the idea of a contingent order which, though still "natural" and seamlessly compatible with the physical order, is logically disjoint, not derivable from or reducible to it. ◇

in particular, cf. E. M. Klaaren, *Religious Origins of Modern Science* (Grand Rapids, MI: Eerdmans, 1977); chaps. 2, 4, 5, & 6.

<sup>2</sup> Genesis 4:8–24. A valuable theological commentary on the significance of Cain to continuing secular culture is given by Jacques Ellul in *The Meaning of the City*, esp. chaps. 1, 5. (Grand Rapids, MI: Eerdmans, 1970).

<sup>3</sup> Genesis 1:26–28.

<sup>4</sup> For some helpful discussion of Calvin's influence on thinking about various matters relating to science, see T. F. Torrance, *Theology in Reconstruction*, esp. chap. 1, sections 4, 5, & 6. (London: SCM Press, 1965; paper ed. Grand Rapids, MI: Eerdmans, 1975). See also T. F. Torrance, *The Hermeneutics of John Calvin* (Edinburgh, UK: Scottish Academic Press, 1988).

<sup>5</sup> See Hooykaas, op. cit., Ref. 1, chap. II, Section B.

<sup>6</sup> This point about ambiguity of fallen human creativity is well developed by Ellul in *The Meaning of the City* (op. cit., Ref. 2).

<sup>7</sup> Matthew 4:4.

<sup>8</sup> While I do not agree with his implicit rejection of naturalism in science, this point about conceding autonomy to science by uncritical acceptance of naturalism is made clear by Alvin Plantinga, "When Faith and Reason Clash: Evolution and the Bible," *Christian Scholar's Review* 21 (1991): 80.

<sup>9</sup> Phillip E. Johnson, *Darwin on Trial* (Downers Grove, IL: Inter-Varsity Press, 1991); —, *Defeating Darwinism by Opening Minds* (Inter-Varsity Press, 1997); —, *Reason in the Balance: The Case against Naturalism in Science, Law and Education* (IVP, 1998); —, *The Wedge of Truth: Splitting the Foundations of Naturalism* (IVP, 2000).

<sup>10</sup> Owen Gingerich, "Review of *Darwin on Trial*," *Perspectives on Science and Christian Faith* (this journal, abbreviated hereafter as PSCF) 44 (June 1992): 140; cf. also, "Further Reflections on *Darwin on Trial*," PSCF 44 (December 1992): 249.

<sup>11</sup> Nancey Murphy, "Phillip Johnson on Trial: A Critique of His Critique of Darwin," PSCF 45 (March 1993): 26.

<sup>12</sup> Murphy's use of the term *methodologically atheistic* to define or clarify *naturalistic* is not very satisfactory from the standpoint of this essay. Comments in her article could appear to suggest that the decision of Newton and Boyle for naturalism in science might have had better alternatives, though I do not think that was intended. I argue that the assumption of naturalism, properly understood, is essential to the *theological* legitimacy of science, and that Newton, Boyle, and their contemporaries were correct in making it; hence the framework supporting science is explicitly *not* atheistic.

<sup>13</sup> See, for example, J. P. Moreland, ed., *The Creation Hypothesis: Scientific Evidence of an Intelligent Designer* (Downers Grove, IL: Inter-Varsity Press, 1994); cf. also J. P. Moreland, "Conceptual Problems and the Scientific Status of Creation Science," PSCF 46 (March 1994): 2; for further commentary, cf. Stephen C. Meyer, "The Use and Abuse of Philosophy of Science: A Response to Moreland," PSCF 46 (March 1994): 14.

<sup>14</sup> R. Dickerson, "The Game of Science: Reflections after Arguing with some Rather Overwrought People," PSCF 44 (June 1992): 137.

#### Notes

<sup>1</sup> (a) Cf. R. Hooykaas, *Religion and the Rise of Modern Science* (Edinburgh, UK: Scottish Academic Press, 1973; paper ed., Grand Rapids, MI: Wm. B. Eerdmans Publishing Company, 1980). See esp. chap. I, section E; chap. II, section D. (b) For a more detailed and careful study of Boyle's views

<sup>15</sup>Stephen Toulmin, *Foresight and Understanding: An Enquiry into the Aims of Science* (New York: Harper and Row, Harper Torchbooks, 1963; first published, Indiana Univ. Press, 1961).

<sup>16</sup>The phrase "legislated with universal intent" was widely used by Michael Polanyi to stress that while truth claims are finally expressions of personal, responsible commitment by the speaker, they place emphasis on the universal validity for others of what is claimed. Cf. Michael Polanyi, *Personal Knowledge: Toward a Post-critical Philosophy*, esp. Part III and Part II, chap. 6; (first published London, UK: Routledge and Kegan Paul, 1958; paper ed., New York: Harper Torchbooks, Harper & Row, Inc., 1977; and later printings) In using Polanyi's phrase here, I want to draw attention to the fact that merely because others do not share a Christian understanding of the way the world is does not make such understanding irrelevant to the actual situation of science—or any other pluralistically shared cultural enterprise. Christians should not suppose that science is illegitimate unless everyone practicing it has Christian presuppositions; but they should also not suppose that a Christian understanding of the proper basis for science is irrelevant to the future of science, simply because Christians are now a minority in scientific culture. Some Christian critics of science too quickly adopt these extreme views.

<sup>17</sup>Cf. Eugene M. Klaaren, *Religious Origins of Modern Science*, op. cit., Ref. 1 (b); esp. chaps. 4 & 5.

<sup>18</sup>Ernan McMullin, "Evolution and Special Creation," *Zygon* 28 (September 1993): 299.

<sup>19</sup>Howard J. Van Till, "Evolutionary Science and the Forgotten Doctrine of Creation's Functional Integrity," *Christian Scholar's Review* 21 (1991): 80.

<sup>20</sup>Genesis 2:18ff.

<sup>21</sup>This point is emphatic in the Pentateuch. In an intimate encounter with God [Genesis 32:22–32] Jacob is told he cannot know God's name "since it is wonderful"; Moses' request to know it [Exodus 3:1–15] is answered by an enigma—"I Am what I Am"; and, in these and other cases (e.g., Abraham) where God names himself to those who meet him, it is a mark of divine favor or privilege. The specific sense of awe in which Jewish tradition has always held the divine name *JHWH* directly reflects this same understanding. Further, the Old Testament identifies attempts to name God, or to give an identity to the divine being in terms of created things, as *idolatry*. The critique of idolatry is twofold: First, such gods as we fashion cannot deliver us from our own crisis; second, the direct result of such misuse of our creative skills and reason is *spiritual emptiness* (*feeding on ashes*) and *intellectual blindness* [cf. Isaiah 44:9–20]. Claims that we can rationally test or "detect" God's specific involvement in the processes of creation must be approached with deep reservation, given this biblical teaching.

<sup>22</sup>Austin Farrer, *Faith and Speculation: An Essay in Philosophical Theology* (originally published, London, UK: A.&C.Black Ltd., 1967; paper ed., Edinburgh, UK: T. & T. Clark Ltd., 1988). Farrer's work was a Christian response to the *genre* of works in speculative (and mostly atheistic) philosophical theology popular in the 1950s and '60s.

<sup>23</sup>Michael B. Foster, *Mystery and Philosophy* (London, UK: SCM Press Ltd., 1957, in series "The Library of Philosophy and Theology"; reprinted by permission from SCM Press, 1980, by Greenwood Press, a division of Congressional Information Service, Inc., 88 Post Road West, Westport, CT 06881).

## Books Received and Available for Review

This is a partial list of the books available for review. Please contact the book review editor if you would like to review one of them or receive a copy of the complete list. Richard Ruble, Book Review Editor, *Perspectives on Science and Christian Faith*, 212 Western Hills Drive, Siloam Springs, AR 72761. richard@tcainternet.com

Joe Ator, *Darwinism and the Creation Science Movement*, Star Bible Publications, 88 pages, 2000

Gregory Boyd, *Satan and the Problem of Evil: Constructing a Trinitarian Warfare Theodicy*, IVP, 456 pages, 2001

Michael Carroll, *Dinosaurs: Exploring the Scientific Mysteries of God's Creation*, Cook Communications, 50 pages, 2001

Ben Carter, *How Darwinism Fails to Provide an Adequate Account of the World*, University Press of America, 183 pages, 2001

T. J. Chamberlain, *Realized Religion: Research on the Relationship Between Religion and Health*, Templeton Foundation Press, 235 pages, 2001

Richard Coleman, *Competing Truths: Theology and Science as Sibling Rivals*, Trinity Press, 322 pages, 2001

Celia Deane-Drummond, *Creation Through Wisdom: Theology and the New Biology*, T & T Clark, 265 pages, 2000

Jim Denney, *Answers to Satisfy the Soul: Clear, Straight Answers to 20 of Life's Most Perplexing Questions*, Quill Driver Books, 275 pages, 2001

W. B. Drees, *Creation: From Nothing Until Now*, Routledge, 115 pages, 2002

Timothy Freke & Peter Gandy, *Jesus and the Lost Goddess: The Secret Teachings of the Original Christians*, Crown Pub. Co., 322 pages, 2001

Robert C. Fuller, *Spiritual But Not Religious*, Oxford Univ. Press, 210 pages, 2001

Henning Genz, *Nothingness: The Science of Empty Space*, Perseus Publishing, 340 pages, 2001

Adrian Gilbert, *Signs in the Sky: The Astrological And Archaeological Evidence for the Birth of a New Age*, Three Rivers Press, 328 pages, 2001

Tim Goldsmith & W. Zimmerman, *Biology, Evolution and Human Nature*, Wiley And Sons, 370 pages, 2001

Martin Gorst, *Measuring Eternity: The Search for the Beginning of Time*, Random House, 338 pages, 2001

James E. Huchingson, *Pandemonium Tremendum: Chaos and Mystery in the Life of God*, The Pilgrim Press, 230 pages, 2001

Gordon Kane, *Supersymmetry: Unveiling the Ultimate Laws of Nature*, Perseus Publishing, 200 pages, 2000

R. S. Kramer, *Religions of Star Trek*, Westview Press, 250 pages, 2002

David Loye, *Darwin's Lost Theory of Love: A Healing Vision for the New Century*, iUniverse, com, 308 pages, 2000

John MacArthur, *The Battle for the Beginning: Creation, Evolution and the Bible*, Word, 235 pages, 2001

John Mason, *The Human Family and the Creator-God*, Vantage Press, 250 pages, 2000

Arthur Peacocke, *Paths From Science Towards God*, Oneworld Publications, 200 pages, 2001

Andrew Porter, *By the Waters of Naturalism: Theology Perplexed Among the Sciences*, Wipf and Stock Publishers, 136 pages, 2001

Mark Richardson & Gordy Slack, *Faith in Science: Scientists Search for Truth*, Routledge, 200 pages, 2001.





## Dialogue: Article

Legitimacy and Scope of "Naturalism" in Science  
Part II: Scope for New Scientific Paradigm

# Legitimacy and Scope of "Naturalism" in Science

## Part II: Scope for New Scientific Paradigms

*Part I presented a theological basis for naturalism in science. As an intentionally limited discourse, science is sustained in a subsidiary context of religious/philosophical beliefs, whose adequacy and scope affects its creative horizons. I argue that biological systems cannot be adequately understood in terms of the materialist, mechanist, and reductionist assumptions appropriate to physical science, but require broader naturalistic explanatory paradigms. An organizational logic concerned with certain types of function or achievement is manifest in biological organisms, which is distinct from the principles of physics. Examples are given showing how tacit use of this logic influences current biological research.*

*[The paradigm for science found in Genesis 2] provides no basis for the idolatrous claim to unlimited dominion and power based on reason, which is at the heart of modern secularism.*

Part I gave important theological reasons for scientific naturalism:<sup>1</sup> it is a methodological policy limiting the scope of science, understanding that God is transcendent with respect to creation. We do not find a biblical paradigm for science and human rational creativity in the *imago Dei* of Genesis 1, but in the creaturely context of Genesis 2—the story of Adam naming the creatures. Reason is a creaturely gift, related to our vocation to cultivate and keep creation as stewards accountable to God. In naming creation, we should use *creaturely terms of reference*, recognizing that we cannot name God himself by our own rational powers. God and his mysterious agency in creation are not subject to mundane scrutiny; knowledge of God depends entirely on God's sovereign and gracious choice to be known personally—as the Scriptures consistently teach.

Such "naturalism" is not, therefore, a methodological atheism which excludes God from his creation. Recognizing the legitimacy of our rational powers within creation, it identifies their limits. Finding the paradigm for science in Genesis 2 also reminds us that, from the divine point of view, true authority is shown in *servanthood*. It provides no basis for the idolatrous

claim to unlimited dominion and power based on reason, which is at the heart of modern secularism.

Theological grounds for "naturalism" insist on a clear distinction between a naturalistic scientific discourse and a much richer, contextual framework of religious/philosophical belief necessary to sustain it. But in contemporary secular culture, the naturalistic paradigm of a mechanistic, purely material world *also* has been adopted as an exclusive religious and philosophical belief system, i.e., as the contextual framework sustaining and informing science. Christian critiques of such *philosophical* naturalism correctly argue it is inappropriate and inadequate for that task.

However, arguments for or against naturalism will remain mostly academic unless there are potential consequences for science itself. I argue here that "naturalism" as defined in Part I has a much greater *scientific scope* than the *status quo* meaning allows, *for biology in particular*. Extreme Darwinism's claim that life can be explained by natural selection, random mutations, and lots of time is not really based on scientifically convincing evidence. It is based on a *a priori* belief in a closed metaphysical view of

"nature" that is materialist, mechanist and reductionist—belief having the status of religious dogma, as "the scientific world view."

Of course this view is the naturalistic paradigm of the world physics describes, and its severely limited scope is appropriate for that purpose. It is significant that most Christian critiques of naturalism in science tacitly agree on its adequacy for physical science. For that particular enterprise, *it is not broken, and does not need fixing.*

Is there something which is broken, and which therefore needs fixing, in current scientific thinking about biology or biological origins? Christian critiques of Darwinism, which advocate the idea of "intelligent design" as a scientific approach to biological origins, certainly argue that this is the case.<sup>2</sup> However, these critiques also reject "naturalism" in science, since they argue that a specific external agency is scientifically detectable in the design and function of living things.

The argument presented here agrees with these critiques that something is lacking in current thinking about biology; but it differs strongly from them by maintaining that this does *not* mean we should introduce an "intelligent agent" as a scientific surrogate for divine agency in creation. Instead, we need a new "naturalistic" biological science which is more than the application of physical science to biosystems.

## Biology and the Presuppositions of Science

**Historically, a *mechanistic* definition of "naturalism" was heuristic, not essential.**

Robert Boyle's adoption of naturalism in science was motivated by theological concerns like those argued in Part I. He wished to mark off a limited discourse about nature in creaturely, internal terms of reference, distinguishing it from broader discourses which necessarily have theological reference. This theological and philosophical move is the most important element in Boyle's approach to science.<sup>3</sup> The particular presuppositions of *mechanism*, *reductionism*, and *determinate causation* peculiar to the "mechanical philosophy" were a secondary choice, *heuristically* adopted for the specific enterprise of physical science. Their adequacy as a paradigm for physics has been demonstrated by its success over more than three hundred years. In assessing this history, we should admire Boyle for his boldness and astute judgment concerning the open possibilities in physical science, not fault him as the father of a methodological atheism. Criticizing the mechanistic paradigm because it was later made a basis for atheistic belief really misses the point.<sup>4</sup>

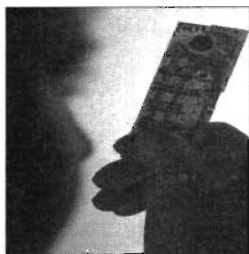
A second look at Boyle's approach can give us useful new insight. Using the clock as an example of both design and mechanistic behavior, Boyle specifically illustrated the idea of a discourse with terms of reference limited to certain kinds of meanings. He also tried in this way to identify subject matters lying within or beyond such terms of reference. "Mechanical philosophy" formed the germ of what we call physical science. The notion of the machine as an embodiment of natural laws and causal, determinate connections has been very relevant to the history of modern science; we shall argue that it has still more to offer from a second, rather different viewpoint.

Boyle believed that adequate explanation for the behavior and development of living things lay beyond the scope of scientific discourse—an opinion mostly shared by his contemporaries. Scientists of Boyle's day recognized that mechanical descriptions are relevant to biological systems—consider, for example, Harvey's work on blood circulation—but a mechanical account was seen as peripheral to *proper* explanations of their form and behavior, which remained essentially teleological (and therefore also *theological*).<sup>5</sup> Terms of reference established for the Boyle Lectures (to the Royal Society) proposed that lecturers show evidences from their work for a divine design in nature; Boyle's belief that biological organisms could not be explained by purely mechanistic theory certainly had some bearing on this, and also on the eighteenth century flowering of a scientifically unfruitful "natural theology," which tried to *explain* biological systems as examples of divine purpose and design.<sup>6</sup>

However, the conclusion that biology could not be a fully "naturalistic" science did not derive from Boyle's primary idea of science as a discourse limited by creaturely terms of reference. *It resulted from the secondary, heuristic identification of such limits with the working terms of reference established specifically for physical science.* While these have proved remarkably durable and fruitful, we should not assume they define the character of all scientific explanation for an indefinite future. "Naturalism" able to sustain a true *bio-logical* science may require broader paradigms of scientific meaning.

### Is the account of biology given by physical science an adequate explanation?

The success of physical science has blinded us to what it does not and cannot comprehend within its explanatory paradigms. In scientific thinking, we easily miss the distinction between the idea of mechanism in the context of a functional system in which it plays some role, and the reductionist idea that mechanism gives a *fully adequate account* of that system. The question of adequacy does not arise if we seek only to describe the mechanistic structure itself, without also seeking rationalization for the entire system's existence and complex organization. Such a



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purely mechanistic study of biological systems has necessarily been the initial task of modern biology; studying the physics and chemistry of living things is a first step toward true understanding.

However, *the question*, whether a purely mechanistic description offers an adequate explanation for living things, *also cannot arise if we decide in advance to legislate it out of existence*. Just such legislative decision is hidden in tacit, reductionist assumptions that mechanical structure and physical laws are necessarily sufficient to account for the form and function appearing in biosystems. Such assumptions are central to extreme Darwinism.

The laws of physics appear to provide a valid, coherent structural and mechanical account of the world—including biological systems. I do not think that we lack some unknown but essential principle of physics needed to account for the physical and chemical processes occurring in biosystems, or that the study of biological behavior will turn up mysterious violations of currently understood physical principles. Fifty years of molecular biology/biophysics provide convincing evidence to the contrary: Biological systems do behave according to the mechanistic laws of physics. Within the limits of measurement, and conceptual limits to what "complete specification of the state of a physical system" means (and also leaving aside such matters as whether quantum uncertainty or chaotic dynamic instability play key roles in brain behavior, for instance), a purely physical description of biosystems is comprehensive within its terms of reference, showing no hint of mysterious "gaps." The mechanical account *works*, and we even know the physical/chemical structure of the human body in increasing detail, down to the molecular level. In some cases, as the human genome project is showing, we can even link disease or dysfunction to variant molecular species and events they cause.

But does a purely mechanistic description really explain what is essential to biology: namely, its complex functional entities and their unique behavior? I suggest that it does not, and that current research supports this conclusion.

### **Michael Polanyi, the open presuppositions of science, and the question of a distinct "bio-logic"**

The idea of a "bio-logical" science distinct from the *physical science of biological systems* challenges the entrenched materialist, reductionist, and mechanist legislative assumptions I referred to earlier—which define science *a priori* as physical science. It forces us to ask the *epistemological* question, "Can we define explicitly what the presuppositions of science are?" In *Personal Knowledge*, his major work on the philosophy and epistemology of science, Michael Polanyi argued that the presuppositions of science cannot be fully specified.<sup>7</sup> The operating assumptions which motivate current scientific inquiry, shape its legitimate subject matter and explanatory paradigms, and establish its specific methodology cannot be fully stated in advance of the enterprise itself. They are always partially tacit subsidiaries to it. Only after the achievements of a new science become manifest can we begin to make the underlying presuppositions supporting it more explicit. Polanyi argues further that whenever scientific enterprise is active, an inarticulate, tacit component necessarily remains in our participation as personal knowers.

Attempts to fit radical new discoveries into the presuppositional framework of already existing science may produce incongruity and a sense of its inadequacy, the more so as the issues in question demand major changes in thinking. At crucial points in the enterprise, inadequacy of an older integrating framework becomes evident, and the future depends on a more open approach to tacit or unquestioned presuppositions. Just at such moments, Polanyi argued, the personal, tacit component in our power of knowing is most essential to creativity, and the formalized elements of method and analysis offer us least help in "breaking out" of an old framework and "indwelling" a new one. Some of the "scientific revolutions" to which Kuhn<sup>8</sup> and later others have drawn so much attention are not just "paradigm shifts" at the mundane level of theoretical models, but constitute profound changes in our entire perception of what may constitute legitimate *scientific meaning*.<sup>9</sup>

*Does a purely mechanistic description really explain what is essential to biology: namely, its complex functional entities and their unique behavior?*

What makes biological systems distinctive (and transcends purely physical description) is that they embody, at every level—from a whole organism down to the molecular structure of a cell and its constituent parts and processes—a logic controlling achievement of certain tasks or *functions*. This abstract logic (rather than the causal logic of physical mechanisms) is what *explains* the particular organizations of physical/chemical structure present. This is not just philosophical speculation, but is suggested by biological research itself as complex details of molecular structure and mechanism in biosystems become better known.

In *The Chief Abstractions of Biology*, the late Walter M. Elsasser argued for such a view on purely scientific grounds.<sup>10</sup> A physicist by experience and critical viewpoint, Elsasser realized that the phenomena of greatest importance for biology arise from highly coordinated functions of structurally complex systems. He argued that the main conceptions of physics are not appropriate to describe these phenomena, although the detailed behavior fully obeys physical principles. Physics deals with relations which are determinate and causal in great detail, for which mathematics provides apt descriptive tools and language (e.g., in the differential equation). But such a theory is not effective for the problems of central interest to biology, such as *morphogenesis* (development of biological form in an organism). Illustrating this thesis, Elsasser pointed out, for example, that there is enormous variation in all the chemical and physical parameters characterizing a particular organ or body feature over the individuals of a species, often 30%–40% or even a factor of 2 or 3 in some cases. Yet nearly all these individuals are fully *functional* representatives of their species. Such variation in physical/chemical parameters is, of course, essential if biological life is to be even minimally adapted to variable environmental resources and constraints; but it powerfully suggests that the logic governing exploitation of these resources for an individual organism's development is organized toward the overall performance of the organ or body function as an outcome or achievement. The challenge for our thinking about such problems is indicated, Elsasser said, by the fact that the part of biological function we understand best is just *the part most like physics*, i.e., the exact replication processes operating in genetic material; morphogenesis by comparison is a much more formidable problem to characterize logically.

This observation remains true today. With the development of chaos theory and better understanding of higher-order pattern formation in complex dynamical systems, we can account for some aspects of growth and development and give plausible mechanical explanation for some elementary developmental principles; but we still have no understanding of the organizing logic, which uses these mechanisms in a clearly programmatic way. While Elsasser was not able to push his discussion

through to synthetic construction of a “bio-logic,” he presented arguments supporting the idea. In particular, he argued that (a) biological systems obey rules and constraints which are logical and coherent, but are not derivable from physical laws, even while fully compatible with them; (b) the relevance of mathematics for formulating these rules is problematic, since the processes they regulate are not rigorously determinate at a macroscopic level; (c) no adequate grounds exist for using statistical principles to deduce or explain such logical organizations as “most probable,” because the number of individuals of any single species which have ever existed over geologic time is fantastically smaller than is required for a statistically significant sampling of the available parameter space spanned by *observed* individual variations.

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*What makes biological systems distinctive (and transcends purely physical description) is that they embody ... a logic controlling achievement of certain tasks or functions. This abstract logic ... is what explains the particular organizations of physical/chemical structure present.*

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Some evolutionary biologists, notably S. J. Gould, propose that the specific history of living things is highly idiosyncratic (as Elsasser also emphasized), and argue that the complex functions they have developed over time are peculiar to the particular path which evolutionary development took. This would imply that Elsasser's logical “rules” are perhaps “learned” and handed down from the past as a vital part of biological inheritance, along with the particular structural entities which embody them. This is a plausible thesis, to be considered on its own merits. However, it neither explains such a logic as the *result* of mechanism, nor invalidates the claim that it is *objectively real*. We should take the existence of these “rules” seriously, and learn their logical organization, before we assume too much *a priori* about their origins. As Elsasser proposed, this can best be done by examining biosystems from a different, logically disjoint standpoint. We should not obstruct that task by *a priori* legislation of materialist strictures against the hypothesis that such a logic could be *objectively real*, just as the physical order is real. This offers a genuinely *scientific* response to the judgment of many people today that a purely mechanistic theory of biological evolution cannot explain what we see.



*In the four to five decades since the structures of DNA/RNA and their mechanistic relations were worked out, accounts of their meaning for biology, at both lay and professional levels, invariably make them intelligible by analogy with the role of code in a digital computer.*

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In the rest of this essay, I present further argument to clarify the idea of function vs. mechanical structure as logically distinct ways of looking at a system, and illustrate ways in which the idea has tacit influence on scientific practice.

#### **Biosystems and the Logic of Function**

##### **What is the *logical* status of the idea of a genetic "code"?**

Let's consider that topic of biology most congenial to physics: the genetic replication system. In the four to five decades since the structures of DNA/RNA and their mechanistic relations were worked out, accounts of their meaning for biology, at both lay and professional levels, invariably make them *intelligible by analogy with the role of code in a digital computer*. Such "explanation" is now so familiar that it is tacitly accepted as legitimate without anyone raising an eyebrow. But this analogy does not refer to the physical structures and mechanisms in the two kinds of systems, biosystem and computer. It refers to the *function* of sequenced code in controlling complex operations, i.e., to the logical meaning of the computer as a Turing machine.

Attempts to point out this distinction often meet with immense suspicion. The magic of reductionism, the belief that physical structure and mechanism must somehow be able to account also for complex function, is so strong that people work and live every day with such tacit "explanations" and never recognize their philosophical importance. While many people recognize a problem posed by the "information" encoded in DNA/RNA, the hypothesis that it may be intelligible or explainable only in terms of a logic disjoint from that of physics is not readily considered or accepted. Perhaps one reason for this odd state of affairs is that everyone knows that the digital computer, the entity whose analogous functional performance makes DNA/RNA intelligible to us as biologically significant, happens to be an artifact of human design. That fact raises philosophical and religious questions more

disturbing to some people than the strange surprises of modern cosmology.

Here a disclaimer is necessary! *I am not trying to argue in any way for "intelligent design" as a scientific hypothesis*. I do not wish to draw that particular parallel from the DNA/RNA-digital computer analogy. I have a much more limited point to make.

In understanding a digital computer, we recognize that there are two distinct and logically disjoint ways of looking at it. One description is most relevant to the electrical engineer; it looks explicitly at the computer as a particularly organized bundle of physical connections and the mechanisms those connections set up (to do whatever a computer does). A logically complete and internally coherent account of the computer as a purely physical entity certainly exists. But there is another, logically disjoint account of the computer, equally complete and coherent; this account describes it as an entity accomplishing certain kinds of tasks or functions called *computation*, and subsumed under the abstract concept of the Turing machine.

To say that this second account of the computer is nothing more than the first one dressed up in a different language, or to claim that in the long run the first description sufficiently explains the computer, would be both absurd and operationally useless. We accept the fact that the logic of computation embodied in a particular digital computer is real and coherent in itself; quite different embodiments of the same logic may exist, whose physical structure and mechanisms are fundamentally different from those now in use. Further, we also recognize that the second account of the computer has a certain logical priority in relation to the first one. Such mundane acceptance of the reality and utility of a disjoint logic, a logic concerned with a different level of meaning and different questions and answers than physics deals with, is all I am after from a *scientific* viewpoint. The fact that we did not create the genetic replication system, but discovered its objective existence and then found its "explanation" in analogy to the computer, may raise legitimate *nonscientific* questions; *but they are not the concern of this essay*.



**The logically dual nature of a machine offers a useful introductory paradigm.**

Historically, the picture of nature as a machine formed the initial paradigm for the rise of a mechanistic physical science. It gave Boyle a powerful heuristic way of distinguishing the immediate, limited aims of physics from the broader concerns of theology; it encouraged the “disgoddling of nature”, i.e., the rejection of the pagan idea of nature as divine, replacing it with the biblical doctrine of the transcendent *monarchia* or sovereignty of God over creation. Reconsidering the idea of the machine as a paradigm of nature can offer us now a further point of departure for innovative *scientific* thinking which is both philosophically reasonable and maximally consistent with our historical scientific past. It also preserves the theological emphasis on a transcendent divine sovereignty so important to Boyle.

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Michael Polanyi introduced the idea of a disjoint logic embodied in biosystems by taking just such a second look at the concept of a machine.<sup>11</sup> To know some entity as a *machine*, Polanyi said, we must understand not only the physical principles on which it relies, but must also have a conception of the achievement it embodies: those *rules of proper function* which really govern what it is and does. Without a knowledge of these rules and their coherent logical relationships, one can neither understand a thing as a machine, nor fix it if it is broken. The indispensable character of this knowledge, and its logical independence of physics, can be shown by two simple observations: (1) A broken machine which no longer functions correctly obeys physical laws as fully as one in perfect working order; and (2) To any person who knows nothing of this disjoint logic of function, the machine—broken or not—is merely a strange and meaningless set of physical connections. Everyone realizes the truth of these common-sense principles when trying to understand (or repair) a strange or very complicated machine for the first time.

In the case of machines we have built, a kind of isomorphism normally exists (for reasons of economy) between the logic of function governing the machine's proper working and the set of physical mechanisms this logic uses in its operation. Thus we often overlook the important logical distinction between the two levels of understanding: machine structure and machine function are tacitly merged in our thinking. But the distinction immediately becomes relevant if we entertain the hypothesis that some entity *we did not make* is in fact a machine, or appears to behave like a machine, *because it achieves logically coherent tasks or functions*. In that case, our tacit faculties of judgment must be called into play, and we begin to look at the entity, not merely as a meaningless jumble of physical mechanisms and components, but in terms of some imaginative, synthetic reconstruction of the task or tasks it accomplishes—that is, what its *function* is. *Precisely this kind of synthetic thinking is critically important to research in molecular biology today.*

**The logic of function and Behe's idea of irreducible complexity**

Substantial scientific meat has been put on these philosophical bones in some clear examples of such logical organization in biological systems presented by molecular biochemist Michael Behe in *Darwin's Black Box*.<sup>12</sup> Behe begins by remarking that while the use of limited teleological explanations for organism structure and function always formed a part of biological understanding, this was always excused by claiming that the need for such explanatory paradigms would disappear when we finally analyzed biosystems at a microscopic, molecular level. There, the reductionist creed asserted, the sufficiency of simple mechanism to account for the complex and apparently coherent behavior of the whole would become obvious. But this is *not* what has happened. Instead, in detailed microscopic structure within a single cell, one finds *molecular machines*, assemblies of extraordinarily complex mechanical units which together function coherently and, in a logically unique, usually time-sequenced fashion, perform specific tasks such as the synthesis of particular enzymes/proteins. Still higher level organizations of molecular structures to form mechanical devices with obvious function, such as the bacterial *flagellum*, also exemplify Polanyi's idea of the machine as a logically dual entity, described both by a logic of achievement and by the physical principles this logic employs.

Behe challenges the claim that such systems can be explained as the result of infinitesimal modifications of simpler precursors by random microscopic mutations, reinforced at each step by natural selection. He describes them as *irreducibly complex*, i.e., “composed of several, well-matched interacting parts that contribute to the basic function, wherein the removal of any one of the parts



*The notion of the achievement or function performed by an "irreducibly complex" system, and the logical rules governing the assembly of physical mechanisms which perform that function, are essential to scientific understanding of what the system is and means.*

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causes the entire system to effectively cease functioning." Such a system *has* no discernible simpler precursors; no simpler fragments of it achieve anything whatever.

I agree with Behe that the existence of such systems is a strong argument against the myth of the blind watchmaker.<sup>13</sup> However, I want to make a quite different point, which I think is even more obvious.

The notion of the achievement or function performed by an "irreducibly complex" system, and the logical rules governing the assembly of physical mechanisms which perform that function, are essential to scientific understanding of what the system is and means. The idea of an irreducibly complex system tacitly implies that such a system's function is logically simple or unitary, while the particular assembly of physical components achieving that "minimal function" has an otherwise inexplicable complexity. Understanding such systems necessarily involves thinking about how they are organized toward the functions they achieve, quite apart from any hypotheses about their emergence or origins. Therefore, scientifically meaningful accounts of biological systems can and should be given in terms of their logical organization toward function or achievement. This logic is what explains and determines their complex physical structure.

To insist that such logic is only "apparent," that it has no objective reality independent of our minds, or that it is merely a by-product or epiphenomenon of the physical processes themselves, is an obstructive and sterile argument whose only basis is dogmatic belief in materialism. Yet just such an arbitrary, dogmatic and a priori legislation in favor of a materialist, mechanist and reductionist account of biology, rejecting any other view, is the program of extreme Darwinism. Those who argue that other accounts are "purely subjective" should remember that before the rise of physical science, equally plausible claims could have been made that the concept of *physical* laws is "subjective." Confidence in their objective reality results from the manifest knowledge of nature which responsible commitment to them has produced since the seventeenth century.

While Behe's book describes only a few examples of irreducibly complex systems, such systems are not rare, but a characteristic feature of biological organisms.<sup>14</sup> Behe concludes that the universal appearance of such "molecular machines" in living things is evidence for "intelligent design." While this is a legitimate *theological* reflection, I do not think the idea of "intelligent design" helps us with the *scientific* problem posed by biological systems; Behe's idea of "irreducible complexity" does.<sup>15</sup>

#### **Function is crucial, not mere complexity.**

The idea of "irreducible complexity" has scientific merit because it depends crucially on the concept of an achievement or "defining function" accomplished by such "molecular machines." Complexity itself, or the potential merit of non-reductionist accounts of complex dynamics, are not the real issue. Many people agree that functioning biological systems are instances of extremely complex physical dynamics and that the most fruitful descriptions of such systems are non-reductionist; but they would still argue that the functions achieved are incidental to scientific understanding. This misses the point.

Many natural physical systems of great complexity exist, which are *not* machines because they accomplish no logically comprehensible task. The ring systems of the outer planets and other extraordinarily intricate dynamical systems which astrophysics has explored are examples; so are structures such as Benard convection cells in a heated fluid, flame pattern dynamical structures, and many other forms of self-ordering behavior in nature. Perhaps the *weather* is the paradigm example of a complex, highly organized kind of behavior exhibiting recognizable patterns of order, and having a definite, coherent relation to certain kinds of events; but it is behavior which certainly does not have any discernible function or achievement in the sense understood here. What defines a *machine* is the existence of a coherent logic specifying a particular kind of achievement; and I am arguing, as Polanyi did and Behe demonstrates, that biological systems clearly manifest such an internal logic. The fact that leaf contours or branching of trees

follow rules described in non-reductionist models of mechanical behavior is interesting; it shows we still have much to learn about the multiplicity of physical levels at which biosystems function. But it has no direct bearing on the idea of a distinct logic of function.

The frequently emphasized distinction between the notions of *order* and *information* is also relevant here. It has been suggested that somehow "information" is merely highly complex order, and that (presumably) some inherent physical stability in this order explains its emergence. Attempts to explain the information in DNA/RNA by comparing it (for example) to the kinds of self-replicating long-range crystalline order produced by subtle physical stability principles in certain kinds of clays are often rejected by critics, however, because there is a huge disparity in the amount of "information" involved.

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*"Information" ... is not simply a mathematically definable concept or parameter, but is understood as such in relation to some coherent logic, within which its particular content ... has a significant set of consequences or effects.*

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But the paradigm case of the weather shows that the *amount* of information required to specify the system is not the real issue. To describe a particular weather system in sufficient detail to offer fine-grained near-term or general long-term forecasts, we would need an inconceivably large and precise amount of data specifying the system's state (assuming we had a computational algorithm and a computer able to use it). In a sense, this data is "information-rich" and could easily require as much space in a computer as the storage of the information in a genome. Yet no one would argue that there is "information" in weather systems in the *same sense* as it exists in the genetic replication system. The reason is not a great disparity in the quantitative amount of "information" in the two types of systems, but rather the fact that in the genetic system, this "information" is clearly and coherently connected to significant functions or achievements of the organism carrying it, while we do not attribute to the weather any such rationally comprehensible function or achievement. "Information" is therefore not simply a mathematically definable concept or parameter, but is understood as such *in relation to some coherent logic*, within which its particular content (in contrast to some other, equally improbable particular contents) has a *significant* set of consequences or effects. In this sense, "information" is in the eye of the

beholder (though this by no means discredits its objective reality). Thus, arguments about information in living things ultimately appeal to the idea of a logic of function, disjoint from the mechanistic principles of physics, which employs the data in question *as* information.

## Tacit Role of "Functional Logic" in Current Biological Science

Research motivated by tacit use of a functional logic as meaningful for biosystems has developed beyond elementary stages. For example, what concepts have intellectual interest and explanatory value in genetic manipulation/transfer research? Structural characteristics and chemical mechanisms are necessary minimal knowledge about a strand of genetic material, but only provide an admission ticket to studying the function involved. When such material is inserted into a new biological context, the important question is whether it retains its functional capacity and integrity. A "functional logic" is the real, if tacit, topic of such research. It involves an altered paradigm of *scientific explanation*.

Conversation with acquaintances active in immunological or other medical biochemical work supports the same conclusion. Research program design in such fields is based on a tacit assumption that certain functional rules operate in biosystems – and learning what these rules are is the key to further progress. Understanding depends intimately on detailed chemical and structural knowledge, but the essential logic studied is functional and research jargon displays this. Entities are routinely described by names such as *receptor*, *messenger*, *trigger*, *sensor*, *label*, etc., as well as by simply mechanical terms from ordinary chemical dynamics such as *inhibitor* or *activator*. Molecular components enabling biological achievements are defined by their role in overall function of the system, not by what they are in themselves.

Long segments in DNA called *introns* are interspersed between genetically active sequences with recognized roles in protein or enzyme synthesis. Initially, it was proposed that these apparently inactive segments were merely "junk DNA" – material left over as the "molecular fossils" of evolution. However, more recent research has shown that though the role of introns is not yet understood, they have subtle effects; genetic material lacking them exhibits impaired function in some cases. When understood in greater detail, biological systems reveal a high degree of *economy* in physical structure used, *especially at a molecular level*. Some biologists explain this remarkable economy, and the resulting scantiness of a "molecular fossil record," by arguing that biosystems are incredibly efficient in using old and no longer essential subsystems as sources of "spare parts" for new tasks. But such language *tacitly presupposes an organizing logic of achievement* transcending physics.



*I have argued here that learning such logic empirically from the study of living things is a legitimate scientific inquiry – and that biologists in many fields are already pursuing such studies without marking explicitly the paradigm change involved.*

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This essay does not aim to deny the "weak" evolutionary hypothesis that living things have emerged by some sort of process involving biological descent. Rather, I argue that the rules governing such unfolding are still largely unknown to us because they cannot be derived only from the mechanisms and constraints which physical science deals with. If biological systems are "machines" in a scientifically meaningful sense, they will be found to exhibit rules of proper function and organization, essentially a *logic of achievement*, employing the lower-level logic of physical structure and mechanisms for performing their higher level achievements. The scientific objectivity of such concepts, if they are valid, will be manifest in the more coherent understanding of biological systems they sponsor. I have argued here that learning such logic empirically from the study of living things is a legitimate scientific inquiry – and that biologists in many fields are already pursuing such studies without marking explicitly the paradigm change involved. Learning to do this, to rethink what we see in terms of such a new paradigm, offers us the opportunity to develop a different perspective on biological science, within which we may first understand better how living things function and develop as they are today. Only after such paradigm change transforms our understanding of biology would a more fruitful approach to the more difficult problem of origins be possible.

I find some encouragement for views expressed here in Ernst Mayr's latest book, *This is Biology: The Science of the Living World*.<sup>16</sup> In sharp contrast to his earlier work, Mayr now stresses the inadequacy of reductionism in biology and the essential importance of a logic uniquely governing biological systems, which he sees clearly displayed in the genetic system. In the preface he says, concerning inanimate and living worlds:

Both worlds obey the universal laws discovered and analyzed by the physical sciences, but living organisms obey also a second set of causes, the instructions from the genetic program. This second type of causation is nonexistent in the inanimate world.

Mayr's ideas about the *origins* of this "second set of causes" remain deeply committed to more traditional dogmas of evolution presented in his earlier works. His discussion of the vague general term "emergence" in the introduction to the book seems to offer refuge for the belief that such things have their roots in merely physical complexity. For me, Mayr's work is also seriously flawed by his misrepresentation of the ideas of both Polanyi and Elsasser as "vitalism"; actually, both thinkers were well ahead of him in recognizing the logically disjoint character of a true biological science. However, the emphasis Mayr now places on the reality and importance of such a "second set" of rules for understanding biology can only be constructive toward the ideas argued here. ♦

## Notes

<sup>1</sup> W. R. Thorson, "Legitimacy and Scope of 'Naturalism' in Science: Part I. Theological Basis for a 'Naturalistic' Science," *Perspectives on Science and Christian Faith* [This journal hereafter abbreviated as *PSCF*] 54 (March 2002): 3–13.

<sup>2</sup> There is an extensive and growing literature on "intelligent design," bearing on both (a) its philosophical defense (vs. philosophical naturalism) and (b) its scientific justification. I do not cite this literature extensively here since I argue for a different approach to science, and do not agree with the project's main assumptions. As a well-known and rationally cogent example of argument for its *scientific justification*, see William A. Dembski, *Intelligent Design* (Downers Grove, IL: InterVarsity Press, 1999). For other citations bearing on the rejection of naturalism in science (notably, works by Phillip E. Johnson), see references listed in Ref. 1.

<sup>3</sup> The view given here of Boyle's thinking about science is partly my interpretation, but has substantial historical basis. Cf. in particular Eugene M. Klaaren, *Religious Origins of Modern Science* (Grand Rapids, MI: Wm. B. Eerdmans Publishing Co., 1977) especially chapters 4, 5, & 6, and an Appendix of Boyle's works cited by the author. For additional brief references to Boyle's views, see R. Hooykaas, *Religion and the Rise of Modern Science* (Edinburgh, UK: Scottish Academic Press, 1972).

<sup>4</sup> This interpretation of the effects of "mechanical philosophy" (and implicitly of the "naturalism" advocated by Boyle and Newton), and a view favoring a philosophy of science more Aristotelian in its assumptions, has been given wide currency by Nancy R. Pearcey and Charles B. Thaxton, *The Soul of Science: Christian Faith and Natural Philosophy* (Wheaton, IL: Good News Publishers, Crossway Books, 1994).

<sup>5</sup> A notable exception, of course, was Thomas Hobbes, whose thoroughgoing philosophical materialism was *anathema* to Boyle on the grounds it was atheistic. The issue was so important to Boyle that he was determined (successfully) to keep Hobbes from becoming a member of the Royal Society—a fact which supports the thesis that what really mattered in Boyle's view of a naturalistic science was setting it in a theological background context.

<sup>6</sup> See, for example, Peter J. Bowler, *Evolution: The History of an Idea* (Berkeley, CA: University of California Press, 1984), esp. chap. 5; Colin A. Russell, *Cross-Currents: Interactions between Science and Faith* (Leicester, UK: Inter-Varsity Press, 1985), chap. 6, 109ff.

<sup>7</sup> Michael Polanyi, *Personal Knowledge: Toward a Post-critical Philosophy* (London, UK: Routledge and Kegan Paul, 1958), [paper ed., New York: Harper Torchbooks, Harper & Row Inc. (1977); and subsequent printings] esp. Parts I, II.

<sup>8</sup> Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 2d ed. (Chicago, IL: University of Chicago Press, 1970).

<sup>9</sup> An example of such profound change, though it was still fairly minor compared to issues considered here, is the revolution in physics entailed in James Clerk Maxwell's theory of the electromagnetic field and the subsequent discovery by Einstein of special and general relativity theory (which belong to the same new horizon of meaning in physics). For a useful historical perspective on this, see the edited reprint of Clerk Maxwell's key paper, "A Dynamical Theory of the Electromagnetic Field," T. F. Torrance, ed.; especially, the introductory prefaces and commentary on Maxwell's work by both Torrance and Einstein (the latter at the centenary of Maxwell's birth in 1931) [Edinburgh, UK: Scottish Academic Press, (1982)]. Polanyi [Ref. 7, Part II, chap. 6] also points out that after Maxwell and Einstein, the token of meaning in physical theories shifted from the ideal of a mechanical model to that of a complex system of mathematical invariances, or *symmetry*. But even in the case of this much less radical shift in thinking, Maxwell's crucial ontological claim, i.e., that the equations of his new theory stood coherently on their own account as a description of a reality independent of that described by Newtonian mechanics, earned him reproach in private correspondence with William Thomson (later Lord Kelvin), who suggested that he was indulging in "mysticism."

<sup>10</sup> Walter M. Elsasser, *The Chief Abstractions of Biology* (Amsterdam, Netherlands: North-Holland Publishing Co., 1975).

<sup>11</sup> Michael Polanyi, *Personal Knowledge*, *op.cit.*, Ref. 7 above; cf. esp. Part IV, chap. 11, Sections 1–3. Polanyi's approach to epistemological questions is important to understanding what he means by arguing that there is a "logic of achievement" manifest in biological systems. Many people have read these comments and related speculations in his writing about the significance of life, as simply the expression by Polanyi of essentially religious or metaphysical beliefs radically critical of reductionism in modern science and the culture it has shaped. Of course, this is quite true, since Polanyi's understanding of "knowledge" as something *persons* hold is also an implicit critique of any reductionist or positivist world view. However, it is very important to realize that because of his whole approach to epistemology, Polanyi's view of the scope of *science* was also extremely *open*: He believed in the possibility of many distinct, logically independent levels of meaning in the world, whose *objective validity* can be apprehended and affirmed by persons through acts of "responsible fiduciary commitment." Hence, the idea that a "logic of achievement" has potential *scientific* significance is implicit in his claim that biosystems manifest such a logic.

<sup>12</sup> Michael J. Behe, *Darwin's Black Box: The Biochemical Challenge to Evolution* (New York: Free Press, 1996).

<sup>13</sup> Richard Dawkins, *The Blind Watchmaker* (London, UK: W. W. Norton, 1985). The claim of extreme Darwinism to account for biological complexity and variety by a gradualist process of random microscopic mutations reinforced by natural selection (the thesis of Dawkins' book) is really a philosophical speculation,

which needs to be clearly distinguished from the much weaker (but scientifically more plausible) *general* hypothesis of "evolution"—the bare claim that living things have emerged by some (not fully specified) process involving biological descent from common ancestors. As critics with extremely diverse religious/philosophical beliefs point out, extreme Darwinism's thesis looks less and less credible against the background of relevant scientific facts and argument. Persistent, unwarranted public presentation of such speculative claims about the mechanism of evolution as though they were scientifically established should be vigorously criticized; they are really a kind of religious/philosophical myth about origins.

<sup>14</sup> Although the authors of the article do not consider the issues of interest here, a particularly beautiful example is provided by the detailed, incredibly efficient apparatus used by purple photosynthetic bacteria to convert visible light into chemically useful energy (Cf. Xiche Hu and Klaus Schulten, "How Nature Harvests Sunlight," *Physics Today* 50, no. 8 [August 1997]: 28–34). The energy transfer processes involved have been worked out in good detail in this case, and it is clear that the complex physical organization of the overall system is essential to its specific function of gathering multiple photons sequentially and using their accumulated energy to achieve a particular chemical reaction. The authors emphasize that the particular organization which makes this possible is highly specific; simpler precursors achieving the same task are not manifest.

<sup>15</sup> Behe's arguments using irreducible complexity to argue for intelligent design have been criticized by a number of writers arguing for an evolutionary explanation. See, for example, Kenneth R. Miller, *Finding Darwin's God: A Scientist's Search for Common Ground between God and Evolution* (New York: Harper Collins Publishers, 1999); and ongoing debate between Miller and Behe about examples/counterexamples of alleged/contested irreducible complexity is available on the Internet. Miller's criticisms however do not bear directly on the interpretation given here to the significance of irreducible complexity. He argues for the capability of evolutionary change in bacteria and similar simple organisms to account for such systems, without making any strong assertions about the detailed mechanisms. Such claims are not inconsistent with the idea of an embodied functional logic which can bring about such changes.

<sup>16</sup> Ernst Mayr, *This is Biology: The Science of the Living World* (Cambridge, MA: Harvard University Press, 1997).

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## Dialogue: Response

*Can Functional Logic Take the Place of Intelligent Design?*

# Can Functional Logic Take the Place of Intelligent Design?

**The point  
at issue  
is not  
God as  
object  
but  
God as  
agent.**

Walter Thorson's two-part article on the legitimacy and scope of naturalism within science attempts to identify a mediating position between the reductive naturalism of thinkers like Richard Dawkins and the complete rejection of naturalism by thinkers like Phillip Johnson. Thorson rightly notes that the purely mechanistic approach to science characteristic of reductive naturalism is inadequate. Nonetheless, he argues that science still needs naturalism as a methodological or regulative principle. Thorson's methodological naturalism leaves room for teleology in nature, though a teleology that falls short of full intelligent agency.

Thorson's rejection of reductive naturalism is in the spirit of Michael Polanyi. Though adequate for physics, reductive naturalism, according to Thorson, cannot make sense of the functional complexity of biological systems. Unlike physical systems, which can be understood scientifically purely in terms of their constitution and dynamics, biological systems—like human machines—need also to be understood in terms of their function. According to Thorson, biological systems operate according to a "functional logic" that is just as objectively real as the underlying physical mechanisms.

For Thorson, getting the scientific community to admit the reality of this functional logic and to make that logic a fundamental focus of scientific investigation would constitute the sort of paradigm shift in science with

which he would be entirely happy. He sees Michael Behe's work on irreducible complexity as feeding into such a paradigm shift inasmuch as Behe's work shows that a functional logic pervades biology all the way down to the molecular level (below which biology gives way to physics and chemistry). Nonetheless, Thorson is not willing to follow Behe to his conclusion of intelligent design. Why is that?

The problem according to Thorson is that any sort of designing agent responsible for that functional logic in biological systems would be a scientific surrogate for divine agency. Indeed, from a Christian perspective, it is hard to see what a designing agent responsible for biological complexity could be other than the Christian God. Intelligent design, if it could be developed as a scientific theory applicable to biology, would thus have immediate theological implications, not the least being that God's handiwork in nature was empirically detectable and therefore not inscrutable.

But this for Thorson is theologically unacceptable. Following Karl Barth and a theological tradition that places a premium on divine inscrutability, it is unacceptable to Thorson that God's agency in the world not be completely shrouded in mystery. In addition to Barth, Thorson cites Austin Farrer, who argued that the metaphysical joint at which divine agency intersects the created world is fundamentally inscrutable. Thorson concludes that "divine agency is essentially mysterious at every level."

I've long ceased to be impressed by claims of divine inscrutability. Whenever I'm confronted with such claims, I invariably recall G. K. Chesterton's epigram, "We don't know

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enough about the unknown to know that it is unknowable." To be sure, it might serve certain theological interests to keep God, and divine agency in particular, inscrutable. But the claim of divine inscrutability, just as any other controversial claim, needs an argument if it is to be judged in the market of ideas.

Thorson does sketch such an argument. The problem for Thorson is that God is not an object that we can name, define, comprehend, and thereby imprison in our concepts. This certainly seems right—we can never nail down God with our language. But the same is true for any human being as well—none of us is reducible to some verbal formula (even a long and complex one). Now the issue that intelligent design raises is not to objectify God in some verbal or scientific formula, but rather to come to terms with what God has done in the world. In other words, the point at issue is not God as object but God as agent.

God, after all, does act in the world. About this there can be no controversy among Christians. The nature of that activity and its epistemic support, however, are subjects of controversy. Unfortunately, Thorson's strong emphasis on divine inscrutability prevents this question from receiving fair consideration. Thorson, for instance, holds that biological systems embody information of a sort that is not reducible to blind mechanical processes. Moreover, he thinks that divine agency as the source of that information is a legitimate topic for theological reflection. But to treat intelligent agency, considered generically and without reference to the Christian God, as the source of that information holds for Thorson no scientific legitimacy.

But why should that be? Thorson holds that biosystems operate according to a certain functional logic. Thorson therefore would have a nonreductive biology focus on that logic and dispense with intelligent design and the intelligent agency it introduces. But is intelligent agency really dispensable in this way? Let me turn it around: Can Thorson's functional logic do all the scientific work that an intelligent agent does? Clearly, there are special sciences where functional logic cannot substitute for intelligent agency. Everything from archaeology to the search for extraterrestrial intelligence (SETI) are inconceivable without a robust notion of intelligent agency.

Thorson is after a general biology that gives pride of place to "certain functional rules [that] operate in biosystems." The problem is that such functional rules and the functional logic they embody may not be adequate to the functions and structures exhibited by biological systems. Thorson wants a paradigm change that makes the functional logic of biosystems that central organizing principle of biology and only then takes up what he calls "the more difficult problem of origins." But the problem of the origin of biological complexity cannot be deferred in this way.

If biological systems are in fact designed by intelligent agents, then the sort of functional logic to which Thorson

appeals cannot be adequate for understanding biological complexity. Consider the question of functional complexity more generally. What is the logic by which designing agents brought about such functionally complex objects as the Cray supercomputer, the Notre Dame cathedral, and the Hubble space telescope? To be sure, general design principles were employed here. But there was also ingenuity on the part of designing agents that introduced genuine novelty—a novelty that can never be captured by something so general as a "functional logic." There is no logic, whether explicit or tacit, to characterize inventive novelty. Invention entails the emergence of novel structures exhibiting novel functions. Agents, not logic, give rise to such novelty. Moreover, such novelty is not confined to human artifacts but also arises with biological systems (witness the bacterial flagellum).

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*Thorson's functional logic is not able to account for the inventiveness of designing agents, an inventiveness mirrored in the functional complexity of biological systems.*

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Ultimately, Thorson's project flounders on a category mistake—he attempts to get a functional logic do the work of a designing agent. To that end, he invokes a nonreductive naturalism as a methodological principle to keep intelligent design at bay. Yet it is hard to see how Thorson's naturalism can properly be called a naturalism at all since the functional logic upon which Thorson pins his hopes for a paradigm shift in biology cannot be squared with any traditional understanding of nature. That logic seems rather to reside in a Platonic heaven of forms rather than in a natural world of material objects.

As with so many half-measures, Thorson's project is destined to leave almost no one happy. The most glaring problem, as I see it, is that Thorson's nonreductive methodological naturalism imposes an artificial constraint on scientific inquiry. I have no problem with biologists focusing their research on the functional logic of biosystems (James Shapiro at the University of Chicago, for instance, is doing just that). I do have a problem, however, with making the study of this functional logic *de rigueur* for biology and ruling out intelligent agency from biology as unscientific, especially given that intelligent design is a live possibility with empirical consequences that go well beyond Thorson's functional logic. In particular, Thorson's functional logic is not able to account for the inventiveness of designing agents, an inventiveness mirrored in the functional complexity of biological systems. ♦



## Dialogue: Response

Can We Reclaim One of the "Stolen Words"?

# Can We Reclaim One of the "Stolen Words"?

**Creaturely  
existence  
need not  
imply  
that the  
trajectory  
of coming  
to this  
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necessarily  
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theology.**

### Stolen words<sup>1</sup>

"*Creationist*" was the self-designation used by a Calvinist professor of biology, J. Lever, in the Netherlands in the 1950s. He intended to communicate to the reformed constituency that he understood as "creation" in the scriptural sense the reality he studied as a biologist—even while accepting the best available biological knowledge of his time, including evolution and genetics. Those who would take the same reconciliatory attitude in our time cannot use the label "creationist" anymore. The word has become so tightly linked with a particular cluster of views opposing biblical faith and mainstream biology, that it no longer communicates that one believes this world, partly but reliably known through the sciences, to be God's creation.

"*Humanist*" may be another such word. Among the wider constituency of the churches, who would be aware of a tradition of "biblical humanism" (e.g., Erasmus) in the late Renaissance and early modern period, and even more, who could use that label for himself or herself without being misunderstood? "*Evangelical*" may be one more such term, which is in the process of losing the wider meanings it had (and, for instance, in the designation of Lutheran churches still has), becoming more and more a label for a particular style within the Protestantism.

### Naturalism and Theology—Top-down or bottom-up?

"*Naturalism*" is again another such term, which religious communities were in the process of losing—in this case, by associating it with outspoken atheist interpreters of modern science. Thus, I appreciate highly Walter Thorson's attempt to reclaim the right to use

the word "naturalism"—both in opposition to those outspoken atheistic interpreters and in opposition to those within the Christian community who have accepted the atheistic claim on "naturalism." Thorson seeks to appropriate "naturalism" for the Christian community, not as an unavoidable evil, a fate that has come over us, a need to accept the "status quo," but positively, as a theologically justified and valuable insight regarding the human vocation.

I appreciate Thorson's insights in this respect. I find important the observation that naturalism became identified with the idea that the world would be *self-sufficient* (p. 3). I would like to add and emphasize that self-sufficiency is not to be identified with *integrity*—a coherent world well described by laws of nature has integrity, without thereby being self-sufficient.

However, I do wonder whether Thorson does not claim too much when he places this theological justification of naturalism in an epistemic top-down setting, as if theological ideas (and philosophical alternatives) precede and determine the sciences. For instance, he writes: "Such limited, 'naturalistic' enterprises are necessarily sustained and informed by some broader, essentially religious/philosophical understanding" (p. 2). The header on page 3 indicates that naturalism in science *requires* a theological foundation. Is it not the case that our naturalism is, at least in part, a lesson we have learned from reality? We could have lived in a world which would not have been amenable to a naturalistic treatment even in the realm of physics, say a world with physically effective demons and ghosts—and this world might still have been God's creation and a world which would call for a Christian way of life. If it is the case, as I surmise, that we have learned our "naturalism" also from reality, and not from theology alone, that itself should not be a problem for Christians who accept that one can learn something

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practically and theologically significant from "the Book of Nature." Of course, whatever the world is like, the Christian will understand this world as sustained by God, ontologically speaking. However, this creaturely existence need not imply that the trajectory of coming to this understanding necessarily begins with theology. Many elements of our current understanding of reality, including our self-understanding regarding the nature and implications of faith, have been influenced by secular understanding—and thus seem to be more *a posteriori* than Thorson's paper seems to indicate.

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*By placing too much weight on assumptions and ideology, Thorson fails to distinguish authors who ... use evolutionary biology also as an ideology ... and others who do accept evolutionary biology as scientifically adequate ...*

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If he had allowed more mutual interaction between science and religious or philosophical commitments, Thorson would have been able to maintain a more flexible view of the rise of modern science. There is, certainly, some influence of religious ideas and values, including some highlighted by the Reformation, on the rise of modern science, but those influences are part of a vastly wider and more complex network of "causes" of the Scientific Revolution.<sup>2</sup>

If one grants that there is also some role for a bottom-up approach from our experiences with the world to religious reflections, one might also be more appreciative of authors who think in terms of "the mystery behind creation" (p. 6). By the way, the word "behind" seems an unhappy choice, as most authors in this vein would rather speak of "mystery" *in, of, or underlying* creation, and avoid too strong reminiscences of dualisms indebted to earlier views of reality. But even more do I have concerns regarding Thorson's next sentence: "Religious ideas of nature fill the vacuum left when we deny God as the Author of creation" (p. 6). Thinking in creative ways about nature and its religious significance is not automatically denying "God as the Author." It may be more a matter of humility, of awareness that as creatures we do have the "Book of Nature" at hand, and thus may seek to discern meanings there. Besides, it may be attempts at exploring other images—speaking of "Author" is just as metaphorical and human as other articulations of "the Ground of our being." The strong opposition which some theologians (with Karl Barth as a prime example in the twentieth century) have made between religion and Christian faith, seems to result in an unnecessary opposition between the multitude of serious quests for understanding and articulation appropriate and significant views of faith and of reality.<sup>3</sup>

## The Dismissal of "Extreme Darwinism"

Last but not least, the second part of Thorson's contribution is devoted to a discussion of biology. The main suggestion seems to be that the functionality of biological phenomena undermines expectations regarding a complete physicalist understanding. It is suggested that "extreme Darwinists" are lead by *a priori* assumptions (e.g., p. 13), whereas they might well present their work as *a posteriori*, emerging out of increased knowledge of the traces of evolutionary history in fossils and in living organisms, with its explanatory schemes justified in a hypothetic-deductive fashion. By placing too much weight on assumptions and ideology, Thorson fails to distinguish authors who indeed use evolutionary biology also as an ideology, whether socially or metaphysically, and others who do accept evolutionary biology as scientifically adequate without attaching these ideological consequences to it. In this respect, the second part confuses what the first part of Thorson's contribution helpfully disentangled, and thereby seeks support for faith in marginal if not even mistaken science.<sup>4</sup> It is a pity that by choosing this contested territory as his prime example, Thorson's valuable insights regarding naturalism and theology risk being lost.



## Notes

- <sup>1</sup> The reflections on "stolen words" were triggered by a comment by Ernan McMullin on such words during one of a series of consultations at the Center of Theological Inquiry in Princeton, 1993–1996; consultations at which I also had the pleasure to meet Walter Thorson.
- <sup>2</sup> A rich survey of the variety of historical views on the emergence of early modern science in Europe, and its non-emergence in China and the Islamic world, has been given by H. Floris Cohen, *The Scientific Revolution: A Historiographical Inquiry* (Chicago: University of Chicago Press, 1994); I offered some similar observations, far less extensive, in W. B. Drees, *Religion, Science and Naturalism* (Cambridge: Cambridge University Press, 1996), 77–88.
- <sup>3</sup> For some reflections on contemporary "religious naturalism," see W. B. Drees, "Thick naturalism: Comments on Zygon 2000," *Zygon* 35 (4 December 2000): 849–60.
- <sup>4</sup> A good example of careful analysis without the exaggerated social or metaphysical claims of the "extreme Darwinists" may well be the work of Philip Kitcher. In his *The Advancement of Science* (Oxford: Oxford University Press, 1993), he analyses extensively and carefully the standing of biological understanding. His criticisms of sociobiology, *Vaulting Ambition* (Cambridge: MIT Press, 1985) and of genetic determinism, *The Lives to Come: The Genetic Revolution and Human Possibilities* (New York: Simon and Schuster, 1996; Penguin Books 1997), illustrate well that appreciating evolutionary biology as a scientific understanding need not imply accepting it as an ideology. "Function" does play a major role in evolutionary understanding for example, for one particular analysis of functional language in relation to a physicalist view, introducing history as an additional major ingredient, see A. R. Millikan, "Proper function," *Philosophy of Science* 56 (1989), 288–302; reprinted in Millikan, *White Queen Psychology and Other Essays for Alice* (Cambridge: MIT Press, 1993).



## Dialogue: Response

*Is God Transcendent or Immanent in Creation?*

# Is God Transcendent or Immanent in Creation?

**Science based on a theological postulate of God's total transcendence, I believe, leads ineluctably to deism and atheism.**

Walter Thorson attempts to carve out a theoretical working space for Christians to pursue naturalistic science. He grounds his view in theological doctrine in Part I and extends the parameters of science toward a new model of biology in Part II. According to Thorson, science operates legitimately using the creaturely reason to query the domain of creation. Recent scientific activity indicates that life is too complex to permit adequate explanation by models and principles originating in mechanistic physics. Hence, Thorson offers a scientific naturalism superior to previous versions because it places scientific activity under the appropriate theological constraint and, simultaneously, offers a more robust biology. In his two-part article, he provides science a theological basis and outlines the scope of new scientific paradigms in biology. Surely naturalism that gets God and the complexities of life right holds promise for Christians engaged in scientific inquiry. Due to this promise, Thorson's ambitious project warrants careful reflection.

I focus my reflection on three issues and possible differences with Thorson's project. These issues indicate no discomfort with the end project of achieving a naturalism open and available to Christians practicing science. Such a naturalism is a most worthy goal. My questions concern whether such a naturalism is the likely outcome of Thorson's specific claims about (1) God's transcendence, (2) reason's capacities, and (3) the adequacy of mechanistic explanations in science.

*Must God be so transcendent?* Classic Christian theology affirms God's trans-

cendence. Thorson makes God's transcendence the bedrock theological assertion grounding naturalism. However, there are differing conceptualizations of God's transcendence. Thorson attempts to remove God totally from creation leaving creation, not God, open to scientific investigation. With God totally out of the scientific picture, reason, limited though it be, moves freely across the face of creation. By positing God's absolute transcendence, Thorson both frees God of the irritant of human rational scrutiny known as science and frees science of the limit of the immanent mysteries of the divine. But are these actual gains? Put another way, is creation so distanced from God good for science? And is it good theology?

Science based on a theological postulate of God's total transcendence, I believe, leads ineluctably to deism and atheism. The history of modern science offers evidence for this claim. Thorson's assertion of God's transcendence seems to force God so far out of the picture as to make God scientifically irrelevant. Presumably, scientists who are Christian are free to practice personal piety. They may conduct scientific research as if God did not exist yet speak worship of God. Any attempt, however, they make to live the union of knowing and faith will run up against difficulties similar to those experienced today when scientists attempt to integrate their scientific work with theistic belief.

I propose that Christians engaged in science risk a different approach—that of making God immanent in nature. Instead of seeing creation as an alienation of God's activity—God created the universe as something totally other than God's self—scientists need to view nature as God's expression, creation as being intricately connected to God's nature and activities. This may mean that scientific inquiry encounters mysteries it cannot comprehend. Transcendence, on this understanding, finds its place in mystery in

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creation. Viewing God as immanent in creation differently shapes the tenets and character of science while foreclosing an easy deism.

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*Thorson provides an insufficient remedy for the unwelcome outcomes of the Enlightenment scientific project. God's transcendence, reason's defects, and mechanism's descriptive accuracy are the underpinnings of today's atheistic materialism.*

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Practicing Christians in science may suffer simplistic and mistaken charges of pantheism when affirming God's immanence in nature. However, to bear the risk of these charges may be the cost of a more integrated theology and scientific practice. Also, some additional benefits may come in preserving ecosystems, controlling destructive practices and living more harmonious lives by coming to see God expressed in creation.

*Must reason be "creaturely"?* Thorson's affirmation of God's transcendence isolates God from being subjected to "mundane rational scrutiny." However, it is one thing to claim that God is such a being that reason cannot completely comprehend God. It is another, to claim that reason has serious limitations that make it ill-equipped for comprehending God. The difference is more than one of emphasis. Is the problem the epistemological vehicle or is it the nature of the being? I believe that God's nature alone proves sufficient to hang classical theological claims of God's mystery upon. There is no compelling reason to raise questions about the capability of reason itself. Reason is, after all, the means by which scientific enquiry will be pursued. To make reason suspect is to implicitly undermine the project of science. I believe that Thorson need not downplay reason in order to protect God from mundane rational scrutiny. The mysteries of the nature and character of God prove a sufficient challenge to even the most hearty rational investigation.

*Must nature be mechanistic?* My final question challenges the implications of accepting mechanistic models of nature. Thorson basically accepts a mechanistic model. He hopes to overcome the shortcomings of mechanism by introducing complexity in nature that is so robust, that mechanistic understanding necessarily falls short—at least with respect to biology. His new paradigm introduces the notion of a functional analysis of life, a bio-logic that is not itself reducible to principles of mechanistic physics.

The mechanistic understanding of creation which Thorson accepts for physics, I believe, leads inevitably to materialism. Materialism supports and is supported by the deism and atheism that comes, I contend, from asserting God's radical transcendence. Thorson's supplement of a new bio-logic will, I fear, always remain an outlier in the aspirations of a unified science. Until the underlying mechanism/materialism is challenged, a universe without God will remain the unstated assumption of science.

My point simply is that mechanistic models imply materialist metaphysics and materialist metaphysics implies an atheistic ontology. To challenge atheistic materialism, it is not enough to point to it as a biased assumption, something functionally equivalent to religion. To challenge atheistic materialism, one must renounce its operational expression which is mechanistic explanation.

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*An ontology that affirms God's immanence, as well as transcendence, an epistemology that affirms reason as not congenitally defective, and a metaphysics that challenges mechanistic explanatory models offer another alternative.*

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I applaud the direction of Thorson's work—to reaffirm the practices and findings of science while maintaining a theistic cosmology. This has been the chief ambition of believing scientists since the Enlightenment. My questions arise when it seems that Thorson provides an insufficient remedy for the unwelcome outcomes of the Enlightenment scientific project. God's transcendence, reason's defects, and mechanism's descriptive accuracy are the underpinnings of today's atheistic materialism. An ontology that affirms God's immanence, as well as transcendence, an epistemology that affirms reason as not congenitally defective, and a metaphysics that challenges mechanistic explanatory models offer another alternative. When linked with theistic belief there may be in process thinking, current studies of dynamical systems, and new investigations into quantum physics, models of naturalism that offer greater predictive and explanatory power than the mechanistic models of the previous three centuries. Or perhaps Thorson can demonstrate that his notion of transcendence does not lead to deism, mechanism does not imply materialism and questions can be raised about reason's adequacy without undermining the scientific agenda he wishes to advance. If he answers these questions, his version of naturalism may be satisfactory. ✧



## Dialogue: Response

*Can Many World Views Agree on Science?*

# Can Many World Views Agree on Science?

**There ...  
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science.**

**M**ethodological naturalism has been attacked and defended in this journal<sup>1</sup> and elsewhere. A naturalism which *a priori* rules out supernatural causations would seem to be problematic for Christians; however, there also seems to be a proper role for naturalism in science. Walter Thorson's article makes a good contribution examining naturalism's legitimacy and scope.

### Legitimacy of Naturalism

Thorson makes several excellent points. For Christians, naturalism in science requires a theological basis which cannot be side-stepped by a simple distinction between philosophical and methodological naturalism. The most important biblical doctrine here is God's transcendence. God grants creation an authentic existence and a limited freedom to be itself. God gives humans a task of exploring and ruling creation. To Thorson's points, I would add the following thoughts.

What are the fundamental philosophical beliefs underlying science? Philosophers of science have written books to answer that question. A short summary might look like the following:

- (P1) Events in the natural world typically have (immediate) causes in the natural world. (If a tree falls and a sound is heard, then the sound was somehow caused by the falling tree and not by some "tree spirit" or "sound spirit.")
- (P2) Natural causes and effects have some regularity across space and time.
- (P3) They can be—at least in part—rationally understood.

(P4) We cannot deduce from first principles nature's fundamental constituents and behaviors. We must augment logic and intuition with observations and experiments.

(P5) Studying nature is worthwhile.

These are metascientific beliefs. Atheistic or agnostic scientists have their own particular reasons for believing those statements. Why might a Christian believe P1–P5 to be true? Consider the following theological beliefs:

(T1) Creation is not pantheistic.

(T2) God is consistent, not capricious, in his governance of nature.

(T3) We are made in God's image and given abilities suitable for this world.

(T4) God was free to create as he wished. We are limited and fallen. Our preconceptions about how the world should work may not be the same as God's.

(T5) Nature is God's creation, so it has value.

A biblical view of God and nature can support P1–P5. Sound theology can motivate a Christian to look for naturalistic patterns of cause and effect in creation. A Christian scientist who looks for these naturalistic patterns is not acting "as if God doesn't exist." He or she really is acting like there is a God—not a capricious God, but the God of the Bible who made an orderly world and governs it in an orderly fashion.<sup>2</sup>

### Scope of Naturalism

Thorson writes that divine agency is fundamentally inscrutable and, therefore, divine agency necessarily is outside of science's (limited) scope to detect. This seems to imply that a Christian should always seek (and hope to find) naturalistic explanations

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every time he or she investigates the properties, behavior and formational history of the universe.<sup>3</sup> Here I part company with Thorson's article.<sup>4</sup>

Science cannot prove that a miracle happened. Science cannot prove that miracles never happen. The relationship is more nuanced. Suppose God caused an event or series of events which scientists could empirically demonstrate to be highly improbable under *any* model employing only known natural laws. This would not prove that a supernatural event occurred. Other possibilities exist (e.g., unknown natural laws, super-human agency, many universes). So although supernatural agency cannot be proved through science, science can detect improbable events.

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*I believe there are good scientific and theological reasons for expecting that God probably did not act miraculously (at least not detectably) in biological history.*

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This does not mean that Christians ought to search for "improbable events," but neither should they be barred from searching. When sufficient scientific and theological reasons exist, Christians need not limit themselves to naturalistic explanations for events in the natural world.<sup>5</sup> On this philosophical point, I agree with advocates of the "Intelligent Design" movement; however, I disagree with them regarding whether biological history is a good place to expect to find events which defy naturalistic explanations. I believe there are good scientific and theological reasons for expecting that God probably did not act miraculously (at least not detectably) in biological history.<sup>6</sup> The discussion remains open. When conducted in the proper spirit, such discussions can be useful for understanding the legitimacy and scope of naturalism in science.

### Non-reductionistic Naturalism

In Part II, Thorson argues that biological systems obey rules which are logical, coherent, and not reducible to physical laws. While reading this part, I sometimes worried that Thorson was going to propose the existence of new, quasi-vitalistic laws of nature. He does not. Thorson does give an eloquent argument for the usefulness of concepts such as *information*, *function* and *purpose* in biology.

I have two minor quibbles with Part II. First, it seems to uncritically accept Michael Behe's proposal that biochemical systems which display interlocking complexity could not evolve naturalistically. I believe the scientific evidence is going against Behe's hypothesis. Second, while

Thorson's article urges biologists to think in terms of *function* and *purpose*, it does not explicitly urge biologists simultaneously to seek the connections between this higher level of analysis and the lower level of physics and chemistry—to learn how these "bio-logical rules" are embodied in particular physical/chemical systems in particular organisms.

Thorson's article argues against extreme materialistic reductionism, reductionism which is not infrequently encountered in biology. He urges biologists to do more of what they are already doing—think in terms of information, function, and purpose—and to do such thinking openly, systematically, and unapologetically. While we must admit that the science of biology has advanced over the last few centuries in no small part because it rejected the flawed teleological arguments of the past, I believe that Thorson's article gets teleological thinking back into biology in the right way.

In summary, Christians and non-Christians may disagree about the ultimate purpose of living organisms; however, they *can* agree on the useful insights gained by studying living systems in non-reductionistic ways. Christians and non-Christians may disagree on the proper scope of naturalism in science; however, they *can* agree on whether a particular naturalistic model is successful or unsuccessful. Christians and non-Christians may disagree about why naturalism is legitimate in science; however, they *can* agree on a limited subset of relevant philosophical beliefs which allow them to work side-by-side and reach consensus on scientific results. Christians with a sound theological understanding of the legitimacy and scope of naturalism in science can fully participate in the scientific community in ways which glorify God. ✧

### Notes

- <sup>1</sup> For example, Nancey Murphy, "Phillip Johnson on Trial," *Perspectives on Science and Christian Faith* 45, no. 1 (March 1993): 33–4; and Richard E. Dickerson, "The Game of Science," *Perspectives on Science and Christian Faith* 44, no. 2 (June 1992): 137.
- <sup>2</sup> For more details on this line of reasoning: <http://www.calvin.edu/~lhaarsma/MethNatHumanBehave.html>
- <sup>3</sup> The domain of science described as "the properties, behavior and formational history of the universe" comes from Howard VanTill, Davis Young, and Clarence Menninga, *Science Held Hostage* (Downers Grove, IL: InterVarsity Press, 1988), 17.
- <sup>4</sup> I am here critiquing my understanding of Thorson's article—an understanding which might or might not be an accurate reflection of Thorson's actual views.
- <sup>5</sup> For more details on this line of reasoning: <http://www.calvin.edu/~lhaarsma/MethNatHumanBehave.html> For some good philosophy of science on this topic, I recommend Del Ratzsch, *Nature, Design, and Science* (Albany, NY: State University of New York Press, 2001).
- <sup>6</sup> See, for example, Howard VanTill's writings on the concept of creation's *functional integrity*. Some of my own thoughts on the topic can be found at: <http://asa.calvin.edu/archive/evolution/199505-10/1371.html>



## Dialogue: Response

*Is Scientism the Predominant Religion of Scientists?*

# Is Scientism the Predominant Religion of Scientists?

**Thorson emphasizes the creaturely, and hence limited, nature of our knowledge of both the creation and God.**

Before reading Walter Thorson's article, I admit I was skeptical that anything more could be added to the ongoing debates on the theological underpinnings of the scientific enterprise. My skepticism has proved unfounded: Thorson brings a solid and fresh perspective to this discussion. Part I, "Theological Basis For A 'Naturalistic' Science" does an excellent job of making a theological case for "naturalism." Thorson emphasizes the creaturely, and hence limited, nature of our knowledge of both the creation and God. From this, he makes a strong case for limiting science to creaturely explanations.

Thorson's analogy between the scientific enterprise and the activity of naming in Genesis is particularly effective. He points out that humans are given the vocation of naming the creation, but do not name God; from this he concludes that God should not be a subject of our scientific investigations in the same way that the creation is. He writes: "Science is an enterprise whose aim is to offer understanding and explanation of created things *in the (limited) context of cultivating and keeping them*" (p. 9). Therefore, "naturalism" is "a theologically based policy aiming to discuss creation in terms of reference defined by creaturely things themselves" (p. 10). Identifying God's work in the world amounts to the study of God, and thus is the province of theology rather than science; science "deliberately refrains from claims to name God or detect God's agency by our own powers" (p. 10).

The second part, "Scope for New Scientific Paradigms," I find less compelling, because I am not convinced that the paradigms presented are particularly new. Thorson's "new paradigm" is the idea that scientific accounts of biological systems (ranging from organisms to macromolecules and organelles) should include the function of these systems rather than being limited to physical and chemical structure and atomic-level interactions. He writes:

Understanding such systems necessarily involves thinking about how they are organized toward the functions they achieve, quite apart from any hypotheses about their emergence or origins. Therefore, scientifically meaningful accounts of biological systems can and should be given in terms of their logical organization toward function or achievement. This logic is what explains and determines their complex physical structure (p. 17).

I am trained primarily as a physicist, but I collaborate with cell biologists on a biophysics research project, and I have completed graduate-level course work in developmental and cellular biology. Thus, I have done some reading in the cell biology literature. I completely agree with Thorson that function is a powerful explanatory concept in biology; but it seems to me that this concept is already used widely. Indeed, Thorson titles the final section of Part II, "Tacit Role of 'Functional Logic' in Current Biological Science," and writes: "Biologists in many fields are already pursuing such studies without marking explicitly the paradigm change involved" (p. 19). Presumably, the paradigm change Thorson has in mind is a change from explaining biological systems in terms of the physical behavior of the constituent parts to explaining them in terms of function. It does not appear to me that a paradigm change is needed; my perception is that both explana-

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tory modes are valued and used in current biological science. What do cell biologists think?

Thorson also suggests that once biology is transformed by the paradigm of functional logic, functional logic will also offer a more fruitful way to tackle the problem of origins. But it is not apparent to me how this paradigm would contribute to thinking about origins, since functional logic does not seem to answer the basic mechanistic problem of how functions develop and change in any kind of system (biological or not). For change to take place in function, attendant mechanical changes must take place; how do these changes happen?

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*It is not apparent to me how this paradigm [of functional logic] would contribute to thinking about origins, since functional logic does not seem to answer the basic mechanistic problem of how functions develop and change in any kind of system (biological or not).*

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It is clearly important for us as scientists and Christians to examine the theological foundations of our professional activities, and Thorson has made a valuable contribution to that process. Another equally important matter comes up as background for this work. In his two-part essay, Thorson—like many contributors to the discussion about naturalism in science—depicts the scientific community as dedicated to philosophical naturalism (or “scientism”) as well as the practice of science. “Christian thinkers correctly criticize [the] prejudicial influence [of philosophical naturalism] as a tacit (and perhaps even dogmatic) bias in the contemporary scientific community” (p. 3). “The scientific community is not really neutral on underlying spiritual issues” (p. 4).

In my experience, most non-scientists think that many, if not most, scientists are at best dismissive of and at worst hostile to religion. However, few of my scientific colleagues are philosophical naturalists, and almost none are dismissive or scornful of Christianity; all the American scientists I know from my generation (born in the 1960s and 1970s) range from relatively indifferent to religious matters to having strong religious convictions of their own. The few scientists I have encountered who do express scorn or skepticism about religious beliefs are substantially older than I am (mostly my parents’ age or older) or are from other cultures. While it is possible that the cohort of scientists I know are not fully representative of the scientific community, they are still a fairly broad sample. Perhaps an

ASA sociologist or historian of science could shed some light on this matter by statistically documenting current attitudes of scientists toward religion.

What has produced the perception that scientism is the predominant religion of scientists? A thorough answer to this question could be a dissertation in the history of science. I suspect that part of the answer is that formerly it was more typical for scientists to think that science could (and should) explain everything, and this has changed over time. Few people outside of science are aware of the change, however, because the scientific community’s out-of-date image is maintained by the rhetoric of a few prominent scientific popularizers such as Carl Sagan and Richard Dawkins. An important task for the community of Christians who are scientists is to correct this misconception. Let us not allow scientism to maintain greater prominence than it deserves. ♦

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## Dialogue: Response

*Is the Boundary Between Science and Theology Distinct?*

# Is the **Boundary** Between Science and Theology Distinct?

**Thorson's sharp distinction between persons, with their relationship, and "things" creates significant theological problems.**

Walter Thorson roots his kind of "naturalism" in a theological claim. While I enjoyed his lucid, wide-ranging appraisal of historical, philosophical, and methodological issues in science, and agree with much of it, my space for response is limited. Consequently, since I am a theologian, I will focus on his pivotal theological claim.

Thorson insists that God is utterly transcendent, sovereign, and free. In fact, we would not know God at all, had not God chosen to be revealed to us through Jesus. This knowledge of God is personal and relational. Thorson contrasts it with scientific knowledge, which he traces to Adam's naming of the animals. Science operates entirely within the human task of cultivating and ordering creation. It cannot tell us about the sovereign, utterly transcendent God. In support of his basic theological claim, Thorson apparently enlists Karl Barth.

This epistemology allows Thorson to distinguish science clearly from theology. He next clearly distinguishes mechanistic explanations from those most appropriate to biology (I agree with him here). He apparently values such clear divisions. The first limits science to a particular realm, delegated entirely to humans. This division keeps science free from interference by theology, and from murky intermingling at their borders. It also places God beyond rational human scrutiny and control.

So far as I can see, theological knowledge, for Thorson, deals with persons and relationships. Scientific knowledge deals with what many existentialist philosophers called "things" (something like "matter-energy" might be better). This distinction was fairly common in neo-Orthodox theologies. But not in Barth's.

Barth found God's freedom and transcendence most evident in God's being "God not only in Himself, but also ... in our cosmos, as one of the realities that meet us." God's transcendence is not basically one of distance, vastness, or inscrutability. "His majesty is so great" that God can become "identical with one of the realities of our cosmos" and be majesty "precisely in the midst of this lowliness ..."<sup>1</sup>

Barth is expressing something that most Christians, historically, would affirm. God was most fully revealed not in some distinct realm of personal relationships, but by actually entering that realm of matter-energy which science studies, and relating to us personally in this intrinsically physical way. For Barth, and most Christian tradition, this meant that Jesus' conception and resurrection, at least, were truly physical events, though produced by processes quite different from any yet elaborated by science.

I recognize that talk of "divine intervention" has often retarded scientific progress. It is also hard to discern what implications, if any, this notion might have for scientific practice, which seems to function nicely within a "naturalistic" frame. Yet Thorson's sharp distinction between persons, with their relationship, and "things" creates significant theological problems. I do not see how it

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could avoid implying that Jesus' conception and resurrection occurred by "naturalistic" processes, and that theology must distinguish between these "facts" and their "meanings." Accordingly, the meanings of *virginal* conception and *bodily* resurrection would have to lie in the personal, relational realm. Their purported physical features would have to be symbols of some existential or spiritual concern.

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*Despite the problems of leaving the theology-science border somewhat open, I do not see how it can be closed in Thorson's way without shutting down the very avenue which the free, sovereign, transcendent God chose for self-revelation.*

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I do not think Thorson's "naturalism" can really be rooted in God's transcendence and freedom, if these be understood biblically, as well expressed by Barth. "Naturalism" seems to be based, rather, on a concept of transcendence as vastness and as inscrutable, impenetrable mystery. This concept, however, appears to be simply the reverse of general notions like immanence and finitude. To be sure, Thorson enlists this concept to reverence God, to place the Infinite beyond finite scrutiny and control. Yet if theology begins from God's self-revelation, with God as known in Jesus, transcendence must be understood in connection with God's extraordinary self-humbling and self-giving. Transcendence must be, very largely, the marvelous transcendence of that Love over all else, actualized most fully by God's own entrance into the creaturely sphere.

I doubt that Thorson's notion of science can really be derived from Genesis 2 either. Theological history is littered with diverse, often discordant attempts to base anthropology on Genesis 1–3. This, I believe, has occurred precisely because these chapters provide very little data, and indirect data at that, for this enterprise. Consequently, numerous anthropologies can be read into them. (For me, anthropology begins with Jesus, the most complete human, as for Barth.)

Perhaps I simply seem to be rehashing what scientists too often hear from theologians. Perhaps theology seems to once again be curbing science simply through inferences from its own data, without really investigating science itself. In any case, my approach does leave the borders between science and theology somewhat murky and messy. Yet perhaps this is not all bad.

Thorson himself notes that scientific models and notions often arise not from a strictly delimited scientific realm, but through broader cultural processes. Science, he affirms, cannot prescribe what it should be, in the large, apart from, or in advance of, its actual explorations. Further, Christian notions—which theology articulates—have significantly shaped science as we know it.

It seems, accordingly, that both science and theology might continue to grow and be enriched by holding open some of those murky problems on their borders. Perhaps the very issues which seem most intractable will finally spark those imaginative leaps requisite for truly new insights and paradigms in both disciplines. Even if such speculation has sometimes appeared fruitless and has retarded, rather than advanced, theology and science, persistence at these messy borders has also borne much fruit.

In contrast, clear divisions between the two might actually encourage that human autonomy over against God that Thorson rightly fears. For they make science autonomous, if not ultimately, at least in methods and criteria. As Thorson says, they delegate the scientific enterprise entirely to humans, and imply that it can be rightly pursued without personal change, or repentance. (Of course, insistence on some murky interrelations could yield opposite effects. Perhaps faith would intrude too far into thought, or thought into faith. Perhaps religion would intrude into the public realm, or the public realm into religion.)

In sum, Thorson, if I understand him at all, proposes a relationship between science and theology largely informed by clear distinctions between things and persons, facts and meanings. Many sincere Christians have indeed found these the best way of relating faith to scientific understanding. Clear distinctions between ways of knowing will always appear attractive to numerous people. Yet if this model is viable, I do not think it can really be derived from God's transcendent freedom expressed through Christ, or from Adam's naming the animals.

At the end of the day, I suppose I emerge a theologian. Despite the problems of leaving the theology-science border somewhat open, I do not see how it can be closed in Thorson's way without shutting down the very avenue which the free, sovereign, transcendent God chose for self-revelation. ✧

### Note

- <sup>1</sup> Or, as Gregory of Nyssa put it: "The 'divine transcendent power' ... is proved by the fact that that which is high, without descending from its height ... itself appears in that lowliness, in that Deity becomes human and yet remains divine." All quotes are from Karl Barth, *Church Dogmatics*, Vol. I, Part II (Edinburgh: T & T Clark, 1956), 31.



## Dialogue: Response

*Can We Trust the Logic of Function?*

# Can We Trust the Logic of Function?

**The solution of adding in an “organizational logic” component appears to be a viable option.**

Walter R. Thorson has shown that to understand biological systems, one needs more than the present simple mechanical models imported from the physical science. As he has documented, others have also seen and addressed this problem. The solution of adding in an “organizational logic” component appears to be a viable option. My comments are not to detract from this vision but to introduce a few cautionary affirmations.

The goal of physical science is to form theories that model the behavior of physical systems. Thorson gives much credence to the idea of physical “laws,” seeming to imply that they are close to the truth of the universe. For example, he writes:

The laws of physics appear to provide a valid, coherent structural and mechanical account of the world—including biological systems. I do not think that we lack some unknown but essential principle of physics needed to account for the physical and chemical processes occurring in biosystems, or that the study of biological behavior will turn up mysterious violations of currently understood physical principles (p. 14).

Physicists today keep referring to such concepts as “Newton’s laws of motion” simply for historical reasons and not because they are any more absolute than other physical theories. In the process, Thorson implies that the set of models in physical science is essentially closed. He thus places aside such ideas as “quantum uncertainty or chaotic dynamic instability” (p. 14) when, in fact, it could well be these ideas, and others yet to be formulated, that may be most applicable to biological systems. Physics and its models are not a closed system. Rather, physical theories are continuously being tested, revised, replaced, and added to.

New advances in science come about because of inadequacies (or “holes”) in present concepts and models, but the presence of such shortfalls in a model should not be the main support for postulating a new idea. In other words, we should be careful not to throw out the idea that at some point in time physical theories or models may explain certain biological facts although they do not do so now. Simply because it is impossible in quantum mechanics to do the necessary mathematical calculations for a completely *ab initio* description of the behavior of electrons in a molecule does not mean that the underlying physical model is inadequate. Similarly, just because a physical model does not appear to be able to explain all of the functionality of a biological system does not imply that that physical model is incorrect. On the other hand, I affirm the notion that insurmountable complexities in a scientific model do open the door for scientists to propose approximations and refinements to such a model to make its conclusions tractable. Thus, the idea of “organizational logic” may be a very important addition to our models for understanding the functionality of biosystems.

A good scientific theory should predict new observations as well as explain previous observations. Just as we know that our view of Yahweh must be more than a compilation of the gaps in our understanding, so a good scientific theory should be more than only a proposal to fill the gaps in our knowledge of our physical and biological world. In my opinion, more quantitative explanations and predictions could strengthen Thorson’s ideas. If these ideas are reasonable scientific proposals, then they should be testable or else they are essentially only philosophical. While Thorson examines several systems and shows how the idea of a logic of function is applicable, it is not clear to me how one should proceed to test this idea. Maybe that is where researchers need to begin in exploring this concept further. ✧

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# Does Design Tip the Scales?

**W**alter Thorson says: "Adam naming the creatures forms the biblical paradigm for science." "Naming" involves the use of reason and the powers of description. When the material world is named, it is subjected to our mundane scrutiny.

Science, however, is more than descriptive. It is a tool by which scientists detect as well as describe. This differentiation between detection and description is helpful in understanding the limits that should be placed upon scientific work. Because science is a human tool powered by "creaturely reason," Thorson refuses to allow science to describe or to name God the Transcendent One, and maybe Thorson says that well. However, can science be used to detect God, or at least detect design? I submit that detecting design in no way subjects God to our mundane scrutiny and human reason.

Traditionally theists, as well as deists, allow for the detection of God as Creator via the created world. That is, the existence of the universe implies a creator. Even Thorson's use of the words "creatures" and "creaturely" tacitly indicates detection of a Creator God. Can a theist detect the existence of a sunset via the eyeball tool and ascribe glory to God the Creator? Similarly, can we, who detect design (or functional logic) via the scientific tool, ascribe glory to God the Designer?

The detection of design or the detection of functional logic may lead a person to desire an understanding, or further "naming," of the designer or the logician. The naming of the Judeo-Christian God comes as we read the Bible. As Thorson indicates, the God of the Bible is known not through reason, mundane scrutiny, and subjection. God revealed himself perfectly in Jesus Christ. We relate on a personal level by repentance and faith to a personal God who created us and designed our universe.

Having said the above, I tangle the argument. Does the detection of uncertainty in quantum theory imply philosophical uncertainty in the same sense that the detection of design in the natural realm implies that God is a designer? Maybe so. Here, understanding and using "naturalism" in the usual sense of the word is important. In a naturalistic world view, the natural world in its totality is woven together in a seamless tapestry where uncertainty, chance, relativity, and the fluke of design are all bound together with morals, religions, cultures, and peoples. In this world view, the scientific detection of uncertainty probably could imply philosophical uncertainty in the areas of morals and religion.

If, however, we start with the God of the Bible as Creator, the "design fluke" is set in a context where its detection has great ramifications. The hard to explain "design fluke" is now explainable: God designed the world. Equally evident in a world created by God are chance, relativity, and uncertainty. In a Christian world view the elements of chance, relativity, uncertainty, and even design are not bound together with morals, religions, cultures, and peoples as in the naturalistic world view. That is, detection of relativity, uncertainty, or design by scientific tools powered by human reason is not descriptive or proscriptive in the moral realm or in the religious realm. God stands above and outside. He is transcendent, yet he has revealed his wishes to us supremely in Jesus Christ through whom morals and religious values are described and proscribed.

In conclusion, I submit that the detection of design does not subject God to mundane scrutiny, nor does the detection of uncer-

**Science  
is a tool  
by which  
scientists  
detect  
as well as  
describe.**

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## Dialogue: Response

*What is the Logic of Functional Organization?*

tainty subject ultimate reality to mundane scrutiny. Neither design nor uncertainty is descriptive or proscriptive for God or for the human race. Since design can be detected, the question remains: Does the detection of design amid the detection of chance, uncertainty, and relativity tip the scales toward belief in the God of the Bible? While the design movement is of great interest for many Christians, design detection will probably not tip the scales for an unbeliever because a naturalistic world view gives philosophical uncertainty equal footing. ✧

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# What is the Logic of Functional Organization?

**Organization directed to function [is] the essential feature of living organisms.**

**T**horson has argued that "God and his mysterious agency in creation are not subject to mundane scrutiny; knowledge of God depends entirely on God's sovereign and gracious choice to be known personally" (p. 12). This seems to me entirely consistent with experience—"God's agency in creation" is readily recognized by those with faith, and routinely denied by those without it—and with what Scripture teaches both positively (Hebrews 11:3) and negatively (Romans 1:18–20) on the subject. Creaturely knowledge of creation is therefore necessarily restricted, and "scientific naturalism" is an apt description of an approach that respects the limited scope of unregenerate rationality.

But as Thorson says, such matters are likely to remain academic unless they have real consequences for science, and he proposes that "we need a new 'naturalistic' biological science which is more than the application of physical science to biosystems" (p. 13).

Thorson argues that what distinguishes the biological world is that it is shaped by purpose:

What makes biological systems distinctive (and transcends purely physical description) is that they embody, at every level from a whole organism down to the molecular structure of the cell and its constituent parts and processes, a logic controlling achievement of certain tasks or functions. This abstract logic (rather than the causal logic of physical mechanisms) is what explains the particular organization of physical/chemical structure present (p. 15).

Thorson is, I believe, exactly right in emphasizing *organization directed to function* as the essential feature of living organisms. A simple thought experiment is instructive. Consider at what stage of biological complexity "life" is identifiable. Molecules themselves—even biological macromolecules and their assemblies—are not "alive" (references to the "native" conformation of a functional molecule notwithstanding); nor are individual organelles (filaments, vesicles, membranes, etc.) "alive." But when large numbers of such components are *organized* in appropriate ways to form a cell, the features we identify as "life" emerge from the interactions of the components. The goal of cell biology is to discover the "logic" that produces this functional organization. ✧

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# Are the Standards of Evidence Realistic?

## Meanings of Naturalism

I am neither a theologian nor a philosopher so I shall restrict my comments to several portions of Thorson's papers rather than the text as a whole. I believe that he has considered carefully many aspects of the topic of naturalism and has made a number of constructive proposals. As a biochemist/molecular biologist, the term naturalism had no particular significance to me throughout most of my forty-year research and teaching career. No particular naturalistic assumptions were necessary for that research, which had to meet current standards for valid biochemical research.

In my later writings on the origin and development of organisms, I have used the following definition: "A naturalistic view of evolution is one guided entirely by chance events."<sup>1</sup> In contrast, my great uncle, Vernon Bailey, spent many years with the U.S. Biological Survey crisscrossing the country studying birds and small mammals. He entitled his biography, *The Making of a Naturalist* and I am certain his view of naturalism would have corresponded more nearly to the "limited" view of Thorson.

Thorson emphasizes in his first paper the significance of "what science means as a limited discourse about the world" (p. 3). He notes that this view of the limited meaning of naturalism was that of Boyle. He properly emphasizes that his own view of "naturalism" is radically different from the naturalism assumed in the "scientific world view." I would like to go a step further and point out how the presently accepted world view has refused to accept any limitations in its application to the origin and development of organisms. When one refuses to accept the possibility of divine agency being involved, one is left with the view that all life has been produced entirely by chance events. This has led to new standards being used for what constitutes scientific evidence.

We find Richard Dawkins proposing that a "ration of luck," i.e., events with probabilities of  $10^{-20}$ , were perfectly acceptable in scientific explanations of protein formation by chance events. Gerald Joyce and Leslie Orgel, in discussing RNA formation by chance as a component of their RNA World Hypothesis, refer to this synthesis as a Molecular Biologist's Dream, indicating their recognition of the impossibility of their proposals. As one who spent my research career carrying out biochemical research involving enzymes, metabolic pathways, analytical techniques, etc., I was expected to have data that met accepted standards of statistical analysis. Origin of life scenarios by chance alone always include many steps that are thermodynamically impossible or that utilize precursors that are unreasonable. The usual explanation for considering these is the claim that if millions of years are available, anything is possible. They neglect to note that degradative reactions would also be occurring over these millions of years, so increasing the time available has no synthetic advantage.<sup>2</sup> In their chapters on the origin of life and evolution, high school biology texts provide particular examples of this departure from good scientific evidence. This issue has been dealt with in more detail in a previous paper.<sup>3</sup>

## Naturalism and Divine Agency

Thorson proposes "naturalism" as an enterprise whose aim is to offer understanding and explanation of created things in the (limited) context of cultivating and keeping them. This would be acceptable to me, if those who now reject its limited use accepted it. In discussing naturalism, Thorson also says: "It is

**When one refuses to accept the possibility of divine agency being involved, one is left with the view that all life has been produced entirely by chance events.**

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**When we choose to provide explanations for scientific findings in biology, a possibility of divine agency should not be excluded.**

## Dialogue: Response

*Are the Standards of Evidence Realistic?*

not an attempt to understand, to explain or name God, or to detect God's agency in nature" (p. 9 and p. 11, note 21). He notes, correctly, the Old Testament emphasis of awe in regard to the divine name, and the Jewish use of the four letters (JHWH) to avoid expressing the name of Jehovah. I believe, however, his extension of this theme to exclude searching for God's agency in biology to be incorrect. When we choose to provide explanations for scientific findings in biology, a possibility of divine agency should not be excluded.

### Logic of Function

Thorson makes a major point in his discussion of the logic of function, that the meaning for biology of DNA/RNA is "explained" by analogy with the role of code in a digital computer (p. 15). I suppose one's background makes considerable difference in how one "explains" something like this. As one who taught graduate courses for many years dealing with the chemistry and metabolism of nucleic acids and their components, I do not need an analogy to explain DNA/RNA. The real explanation lies in the chemistry of purines and pyrimidines, ribose and deoxyribose, etc., and the types of reactions they undergo in forming the polynucleotides that we refer to as DNA and RNA. Analogies always present a picture that is less than the whole truth, and this is certainly true in this case. Thorson continues by saying "everyone knows that the digital computer, the entity whose analogous functional performance makes DNA/RNA intelligible to us as biologically significant ..." (p. 15). I would much prefer that Thorson would have talked about topics such as codons of DNA, exons, introns, information transfer, the different types of RNA and their roles, etc., and made his points from a molecular biology standpoint, rather than from the standpoint of a digital computer. However, when he applies his logic of function to the irreducibly complex structures described by Michael Behe, his reasoning becomes much clearer to me.

### Complexity and Function

In discussing the importance of function, as well as complexity, Thorson touches on an important point (pp. 16–17). I wonder, however, if this emphasis is as new as he implies. Having taught biochemistry to medical and graduate students for forty years, I have always emphasized the con-

cept of function for the metabolic pathways of biochemistry. As an example, I have often gone beyond "function" to "purpose" when discussing the Krebs tricarboxylic acid cycle and the connected respiratory chain. I have noted their significance in the production of stored energy as adenosine triphosphate (ATP). The ATP is then used to drive a variety of essential reactions. Most graduate-level biochemistry textbooks are organized on the basis of function, particularly in their metabolic sections.

In summary, I have touched upon what I consider the major error of the current world view of naturalism: their unrealistic standards of evidence. I have disagreed with Thorson's rejection of "divine agency" as an appropriate topic for consideration. I have questioned his use of a digital computer as an analogy, and I have discussed "function" and "purpose" in the teaching of biochemistry. ♦

### Notes

- <sup>1</sup> G. C. Mills, "A Theory of Theistic Evolution as an Alternative to the Naturalistic Theory," *PSCF* 47 (1995): 112–22.
- <sup>2</sup> Challenges to the "scientific world view" of evolution were presented initially by C. B. Thaxton, W. L. Bradley and R. L. Olsen in *The Mystery of Life's Origin* (Dallas, TX: Lewis and Stanley, 1984); additional objections are provided in G. C. Mills, *PSCF*, see note 1; and G. C. Mills, *Christian Scholar's Review* XXIV (1995): 449–58.
- <sup>3</sup> G. C. Mills, M. Lancaster, and W. L. Bradley, "Origin of Life and Evolution in Biology Textbooks—A Critique," *American Biology Teacher* 55 (1993): 78–83.

## Upcoming ASA Conferences

### Aug. 2–5, 2002:

Pepperdine University, Malibu, CA

### July 25–28, 2003:

Colorado Christian Univ., Lakewood, CO

### July 23–26, 2004:

Trinity Western University,  
Langley, BC Canada

### Aug. 5–8, 2005:

Messiah College, Grantham, PA

### July 28–31, 2006:

Calvin College, Grand Rapids, MI





# What is the Deep Structure of "Naturalism"?

**T**horson's dilemma with "Naturalism" exposes its inherent lack of precision for dealing with the deep structure of its referent. After all, despite the tyranny of words, "naturalism" need not unequivocally be crudely construed, *naturalistically*. His *tour de force* touches upon several aspects of deep structure without drawing explicit attention to this complex feature. Besides terminological issues, deep structure would, in the first instance, include: the concept of nature and related epistemological issues; nature as reality replete with varied metaphysical content and interpretation; theological alternatives and meta-scientific aspects; nature as the proper subject matter of scientific investigation; nature as the source of appropriate terms of legitimization for such investigation; and also the primary content of a nature that may well be laden with hidden meaning and significance.

Thorson argues that the received *naturalistic* viewpoint, largely restricted to physicalist notions, requires emancipation not least because *hard* naturalism cannot cope with *functional* aspects appropriate to the logic of life. This distinction between structure and function exposes a truly differentiated reality within the very subject matter of natural science.

An enriched concept of naturalism capable of embracing *meta-scientific* aspects of reality beyond more traditional scientific aspects, whether physical or biological, would more easily avoid unreflective adoption by default of only a superficial standard scientific-level of understanding. Incorporating meta-scientific aspects like metaphysical and theological considerations is certainly important. While atheism, for example, may *prima facie* appear to be devoid of any theological or belief component, presuppositional beliefs actually do operate across the entire "belief" spectrum. *A fortiori*, taken even at a rudimentary level, naturalism *intrinsically* entails some "theological" foundation.

Though the tacit deeper foundation typically remains hidden and unrecognized, it continually provides terms of legitimization appropriate for the operation of science. As well, this tacit basis also establishes the range of science, demarcating it from any particular theological foundation, whether theistic or atheistic.

It is neither essential nor even appropriate in the normal operation of science to engage in ongoing reflection upon these "given" terms of legitimization. That is, the "game" of science is legitimated in its own right without having continually to reflect upon such foundational considerations. Nevertheless, scientists as full persons may well search the rich veins of meaning more deeply, beyond the immediate or primary findings of science.<sup>1</sup>

Searching for possible deeper veins of meaning necessarily transcends the normal or acceptable operational domain of science. Furthermore, not all such meta-scientific issues are equally useful. While of considerable interest from a personal perspective, exploring "intelligent design" as quasi-science, though well-intentioned, nevertheless is inherently quite incapable of providing scientifically decidable information or universally valid decision criteria with respect to deeper considerations.

In particular, the operation of evolution may exemplify "the orderly and regulative laws of nature," as Warfield might note, without expecting decisive scientific evidence regarding divine design. We are not privy to the *structure of randomness* that abounds in nature, the often-unpredictable causality of chance that yields true novelty. Therefore, chance-like stochastic events remain enigmatically moot, beyond the "no peeking" veil,

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**Taken even at a rudimentary level, naturalism intrinsically entails some "theological" foundation.**



## Dialogue: Response

### *Method or Metaphysics?*

as it were. Theologically, it is hardly appropriate to suggest that God would orchestrate such random acts of novelty when Nature itself could be so endowed to handle this process. In any case, available evidence simply remains underdetermined in principle for theists and atheists alike.<sup>2</sup>

However, paradoxical as it may seem, attitude often counts too. At the level of discovery, exemplified by luminaries like Faraday and Maxwell, scientific knowing can be enriched through a scientist's personal encounter with "relational" knowledge that is capable of engaging the heart in search of deeper meaning.

In summary, attending to the complex deep structure of Naturalism may assist in clarifying a few salient points: The operation of science is inherently neutral vis a vis foundational principles. Yet, the context of science is pregnant with deeper meaning. Searching for deeper meaning is not the proper purview of normal scientific activity. The findings of science, however derived, cannot legitimately attempt to resolve meta-scientific or foundational issues. Nevertheless, scientists, as persons, can encounter a greater depth of meaning through integrated *knowing* that holistically engages the heart as well as the mind. ♦

#### Notes

<sup>1</sup> C. A. Coulson, *Science & Christian Belief* (1955).

<sup>2</sup> Heb 11:1–4 & John 20:29; Book review in *PSCF* 53, no. 2 (2001): 122.

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## Method or Metaphysics?

I have long had a great respect for Walter Thorson's work in the philosophy of science. He it was who first introduced me—in the pages of this journal—to Michael Polanyi, whose philosophy I continue to learn from. I recall with special pleasure the hours Thorson and I spent chatting under the trees in *Sunset Magazine's* gardens near Stanford almost twenty years ago.

I have again found much to impress me in Thorson's two-part article. I am pleased that Thorson rejects both *mechanistic reductionism* and *methodological naturalism*, the reigning presupposition of many Christians who are scientists. His proposal—"naturalism"—is a step forward, as is his adoption of Polanyi's view that there is a "logically distinct aspect or 'level' of creation from the purely physical" (p. 3). In short, granted Thorson's theological foundation, his understanding of science is both insightful and consistent.

Here, however, lies my problem. Has Thorson correctly interpreted Scripture and fashioned a convincing theological framework for this understanding? Thorson rejects *imago Dei* as a foundation because its overemphasis triggered the Enlightenment notion of the *autonomy of human reason*. I instead would attribute the privileging of human reason to both the misreading of Genesis 1 by Christians and the rejection of God's existence by secular thinkers. When Genesis 1 is read in light of both Genesis 2 and Genesis 3, it need not spawn such an illegitimate child. Of course, human reason is limited; we cannot by our own unaided, unredeemed, untransformed reason argue from creation to the creator. Both human reason and the creation are fallen. The noetic consequences of sin are profound.

Thorson too places limits on human reason, not so much because of the noetic power of sin as because he sees science as an instance of the ability God gave Adam when he named the animals. Adam, of course, did not name God. Nor should we. However, why suppose that in naming the animals, Adam was not seeing the hand of the creator

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in his creation and giving them "creaturely" not "natural" names? What would such a "science" produced by an unfallen humanity look like? Any speculation would be wild.

Thorson, following Barth and Ellul, sees all natural theology as flawed. Nevertheless, this does not sufficiently acknowledge God's immanence. "The heavens declare the glory of God," says the psalmist. "Even their wordless words are everywhere" (Ps 19:1,4, partial paraphrase). Though much of God is hidden from us, he is not totally *deus absconditus*. Otherwise, the Apostle Paul would not argue that from nature itself one could detect the power and divinity of God. Thorson admits this. Still he says, "We do not know God himself through the knowledge of creation" (p. 7). Fair enough, if Thorson means that we cannot know God personally. However, design science, for example, does not claim we can know God personally through its methods, only that we may be able to see the presence of a design that implies a designer.

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*The imago Dei does not stand on its own; human reason is not autonomous. When the imago Dei works correctly, it reflects as image to reality the nature and character of God; when it works incorrectly, it betrays its brokenness prompted by the Fall.*

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"*Imago Dei* ... should not be misunderstood as some metaphysical essence or 'stand-alone' quality of human beings ...," Thorson writes (p. 8). Then he adds "in and by themselves." Exactly! Not *in and by themselves*. Nothing in this world is *in and by itself*. That is just the point. The *imago Dei* does not stand on its own; human reason is not autonomous. When the *imago Dei* works correctly, it reflects as image to reality the nature and character of God; when it works incorrectly, it betrays its brokenness prompted by the Fall. By thinking of the *imago Dei* as solely relational, do we not limit the essence of human "being" to the utterly natural? Does it not then become so divorced from God's Being that even a relational *imago Dei* is scarcely possible? The Son of God became a man. Was not his *imago Dei* more than relational? I raise all these as questions. I am not sure of the answers. Nevertheless, I am unwilling to write-off the possibility that we should look to both Genesis 1 and Genesis 2 for a scriptural foundation for our understanding of science. Nor am I willing to agree that "a metaphysical doctrine of nature is not needed to justify science and the 'naturalism' proper to it" (p. 7). Likewise I cannot agree with Austin Farrer that "the 'metaphysical joint' where divine agency intersects the created world

is fundamentally inscrutable" (p. 9). I would rather say that this joint has never been much examined.

It still seems appropriate to me to examine nature for marks of intentionality, marks of design, that point to the nature and character of God as both creator and designer. Since we know from revelation that God is such a designer, why must we bracket out this knowledge? Should we not expect to detect in creation the marks of God's mind as well as his hand? Natural theology is not all of theology; but it is an important part. It is, in my view, not to be the sole purview of theologians but of scientists as well, especially those who work with biblical presuppositions and put themselves under the guidance of the Holy Spirit. A brief but eloquent comment by John Henry Newman is relevant here:

[Even though God as Creator is infinitely separate from his creation,] yet He has so implicated Himself with it and taken it into His very bosom by His presence in it, His providence over it, His impressions upon it, and His influences through it, that we cannot truly or fully contemplate it without contemplating Him.<sup>1</sup>

Sadly, Newman's own plan for university education contains what can only be seen as a nineteenth-century version of *methodological naturalism*, as Mark A. Kalthoff has so well pointed out in "A Different Voice from the Eve of *The Origin*: Reconsidering John Henry Newman on Christianity, Science, and Intelligent Design."<sup>2</sup> However, the implications for science of the foundation that Newman outlines have yet to be built on.

Look at it this way. God is the I AM, the ultimately unified Being, the creative source of all other than himself. If God is unified, then so is his creation, and, therefore, his revelation in Scripture must necessarily relate in some deep way to his revelation in creation. What would happen if Christian scholars from all disciplines were to work consistently from such a perspective? I think the whole Christian academic world would be transformed. We might, of course, end up not with just a Christian philosophy (we already have more than the outlines of this), psychology, sociology, and literary criticism, but with a Christian physics, chemistry, and even mathematics. This prospect often frightens Christian academics, especially untutored ones. "Who will publish my papers?" I have been asked. "How can I advance in my field? I would be a laughing stock." Perhaps. But the community of Christian scholars might themselves be laughing all the way into the kingdom.

In summary, though Thorson's "naturalism" is a healthy step away from *methodological naturalism*, it still relies (incorrectly, in my judgment) on *method* rather than *metaphysics* as a proper foundation for a Christian understanding of science. ✧

## Notes

<sup>1</sup> John Henry Newman, *Idea of a University*, ed. Frank M. Turner (New Haven: Yale University Press, 1996), 37.

<sup>2</sup> Mark A. Kalthoff, "A Different Voice from the Eve of *The Origin*: Reconsidering John Henry Newman on Christianity, Science, and Intelligent Design," *Perspectives on Science and Christian Faith* 53, no. 1 (March 2001), 14–23.



## Dialogue: Reply

Legitimacy and Scope of "Naturalism" in Science

# Thorson Replies ...

**Theological concerns were raised about my claim that God's transcendence with respect to creation means we cannot "catch him at it" ...**

**T**he person who crawls into "no-man's-land" contested by warring parties can expect to be fired upon, and my two-part essay on 'naturalism' is such a venture. Theological concerns were raised about my claim that God's transcendence with respect to creation means we cannot "catch him at it" in the routine, mundane affairs of the natural world with which science deals. Other responses were concerned with science and philosophy of science. A third class of respondents defends the "intelligent design" hypothesis. Certainly, my essay argues that "intelligent design" (ID) as it stands is not "naturalistic" as I argue legitimate science must be, and it offers a different proposal for thinking about biology, which is "naturalistic." Defenders of "ID," therefore, are bound to disagree with my arguments. However, a good number of respondents find my arguments against "intelligent design" in *science* clear and convincing.

I am particularly grateful to Thaddeus Trenn for his concise and careful summary of my most important conclusions, which he has restated and in some cases amplified. I hope Trenn will pursue some of the "deep structure" questions further. I am glad he did not focus on possible weaknesses of my arguments, but saw the overall strength and integrity of the position advanced.

Loren Haarsma and Peter Vibert understand my main intentions correctly and their endorsement of the general argument is encouraging. Haarsma thinks I might agree with Michael Behe that "systems with interlocking complexity could not have evolved 'naturalistically'" (p. 29). This is not the case. Rather, I argue that thinking in terms of a logic of function may offer better understanding of such organizational features.

Two earlier articles that I wrote on related topics may help to clear up the theological misunderstandings:

(1) "Fingerprinting God? Divine Agency and 'Intelligent Design'," in *CRUX*, a quarterly journal published by Regent College, Vancouver, BC (*CRUX*, XXXVI, no. 2 [June 2000]: 2-9). There I argued conclusions like those presented here but introduced the subject by *first* appealing to theological concerns beyond science. In particular, I stressed that biblical faith entails belief that God sometimes "intervenes" in the course of otherwise "natural" events. In such cases, reasonable judgment concludes that divine agency has been shown openly (and, on God's part, *deliberately*). Miracles (including answered prayer, in memorable cases at least) are such "interventions" (and are not amenable to scientific inquiry); but the regular phenomena and order of biology (or physics) are "mundane" or "natural," and "intervention" is not a concept appropriate to *scientific* explanation. Those who think I argue that divine agency can *never* be recognized/identified in human experience should read the *CRUX* article.

(2) "Constructing a Legitimate Natural Theology," essay #18 in J. I. Packer and Loren Wilkinson, eds., *Alive to God: Studies in Spirituality* (Regent College 1992; Downers Grove, IL: InterVarsity Press, [1992], 225-38). In this essay, I argue that natural theology is legitimate, but should be distinguished from natural science. It may persuade some critics that I affirm validity of *theological* reflections on creation.

Haarsma rightly points out that extraordinary features of the universe emerging from scientific investigation might not have "naturalistic" explanations in *every* case; instead, they might *correctly* point us beyond the limited framework of scientific under-

standing. (A physicist thinks immediately of the remarkable “fine-tuning” aspects of the universe in the standard cosmological model, or “Big Bang theory.”) Of course, scientific judgment is relevant, since resolutions based on further inquiry may be possible. My argument in the essay is consistent with Haarsma’s point. Some features of the universe which science describes do not have further *scientific* explanation; we must say as Newton did: *hypotheses non fingo*—I do not make hypotheses.

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*In relation particularly to scientific inquiry, transcendence means that God and God’s agency in creation cannot be subjected to scrutiny by the unrepentant and autonomous rational powers of humans.*

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I have certainly not argued in this essay, nor would I claim, that the doctrine of divine transcendence precludes either (1) a valid knowledge of God as a rationally convincing fact of human experience, or (2) the reasonable, *objective* conclusion of Christian thought *about creation*, that it is the purposed handiwork and design of God. However, such knowledge is *not* accessible on the “naturalistic” terms of reference for science. Some respondents have unduly *extrapolated* from claims regarding what “naturalism” means, to an existentialist or neo-orthodox interpretation of the theology behind such claims—e.g., Thomas Finger mistakenly infers that “theological knowledge, for Thorson, deals (only) with persons and relationships” (p. 32). I fully agree with Finger’s statement of important orthodox elements in Barth’s idea of transcendence. However, Finger has interpreted a “soft” claim about implications of transcendence in relation to mundane knowledge of creation, as a very “hard” one, which I do not hold. What I actually argued is: In relation particularly to scientific inquiry, transcendence means that God and God’s agency in creation cannot be subjected to scrutiny by the *unrepentant and autonomous* rational powers of humans. To those analytical/synthetic powers, God’s presence and agency within creation remain “ineluctably mysterious” apart from revelation received *and* believed. The terms of reference for science—particularly that its truth-claims are universally accessible to all persons, regardless of their condition—deal only with that kind of scrutiny, and the knowledge of which it is capable. Michael B. Foster’s arguments make this case very clearly (p. 11, note 23). Austin Farrer’s specific philosophical case against the possibility that the “scientist” of his dialogue (p. 11, note 22) could ever systematically analyze the “metaphysical joint”

where divine agency affects things is pretty airtight—and I would happily argue that point with James Sire.

A relevant point here is that I think in the framework of an epistemology of personal knowledge, claiming faith or “responsible commitment” by persons is entailed in holding *all* knowledge. Michael Polanyi made pioneering contributions toward this epistemology in *Personal Knowledge* (1958). Implications for thinking about faith, theology, and theological knowledge have been discussed by many people, notably by Lesslie Newbigin in some well-known works in the 1990s. I do *not* accept the rationalist position in epistemology, metaphysics, and theology still uncritically maintained by many evangelicals, and validly criticized by T. F. Torrance (in *Reality and Evangelical Theology*) and more recently by Mark Noll (in *The Scandal of the Evangelical Mind*). However, my position neither makes me an existentialist in respect to theology, nor implies that valid inferences about God’s work cannot be drawn by people from created things.

[I may comment parenthetically here on Richard Bowman’s remarks on the philosophy of science and the unspecified/unspecifiable nature and future of the enterprise. Since I share Polanyi’s view of science, I neither conceive it as a closed system of laws and principles nor argue that in this essay (cf. my essays on Polanyi in *PSCF* in the 1980s).]

I thank Willem Drees for endorsing my aim to restore a right view of “naturalism” in science. I agree that the history of science is more complex than my essay suggests, and that insights based on secular readings of the “Book of Nature” have helped to reshape later Christian thinking about creation (and some classical theological problems). However, those wider issues were not my focus. I agree with Drees that real humility is a quality often lacking as much in theological tradition as in modern secular culture. However, I do not share Drees’ agenda for a “bottom-up” approach to religion starting from scientific understanding. While I “take science seriously,” I understand Christian faith and the knowledge it claims to offer to be based on *revelation* centered in the person of Jesus Christ. In theology, that implies foundational priority for Scripture, given careful exegesis—and a certain priority for a *theological and spiritual understanding of creation* such revelation privileges. (That is what I think the biblical creation accounts are mostly about.)

Willem Drees and biophysicist Catherine Crouch both thought my criticism of “extreme Darwinism” unfair. I *was* speaking of professionals, not just scientism. Many great scientists communicate a materialist belief as well as valid scientific knowledge in their writing. Among them are G. Gaylord Simpson, Richard Lewontin, Jacques Monod, Stephen J. Gould, Ernst Mayer, and, among the physicists, Steven Weinberg. As a young scientist, I did not believe the great achievers and thinkers in our enterprise could be



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## **Dialogue: Reply**

### *Legitimacy and Scope of "Naturalism" in Science*

uncritical of their own philosophical assumptions; but in time I realized that all alike based their lives on presuppositions of some kind, in many cases much less carefully examined than my own—and even sometimes were arrogantly sure that the world in which they and their thoughts counted for so much was the only world there is. Settled views of influential people can shape a limiting viewpoint and underlying mindset which tacitly influences/controls the scientific community's norms. That is not so much a matter of outspoken or explicit dogma; rather, it is manifest in closed attitudes to the open creation in which we really live. Success in science (as in all human endeavors) tends to bring pride along with a selectively closed mind—both a collective and individual phenomenon.

Phillip Johnson has made a helpful distinction between a "weak" and a "strong" evolutionary hypothesis. The "weak" version is that variety and complexity of biological systems today have somehow resulted from biological descent according to principles of genetic inheritance with modification; all biological forms are then related on some phylogenetic tree. In the "strong" version, this plausible and fruitful working hypothesis turns into something quite different. Not only is the above the case, but in addition we know that the adequate *mechanism* to account for this is (a) chance mutation, (b) natural selection, and (c) incremental change over time; it remains only to work out the details. Item (c) is not in happy agreement with the fossil record, and Gould, for example, has other ideas. Proponents of the "strong" view insist on it as a working explanation *not* because it really is very convincing, but because *a priori* they do not choose to think outside the metaphysical world view adequate to physics—materialist, mechanist, and reductionist. Since God created the world, lots of other things and levels of organization besides physics are possible—and some of them can be explored by the organized common sense and experienced judgment that really lies behind science.

I agree that existence of a functional logic embodied in living systems does not *necessarily* show that a "purely physicalist account" of such logic cannot be given. However, the task is formidable: to show how an organizing logic of purpose and

function is logically derivable from pure mechanical causality. I plead (as Polanyi and Elsasser did) for an attitude to the problem which leaves the range of possible scientific explanations more open than many evolutionary biologists are willing to do. I stand by the claim that the evolutionary biology community is heavily biased *a priori* in favor of purely physical, mechanistic accounts as the only "real" or "objective" explanations for what we see. To me this bias seems most evident in the appeal of most prominent evolutionary theorists to chance mutation (i.e., the *null hypothesis*) operating at a purely mechanical level as essential to the "explanation." As a physicist, I have always considered that unless it is shown to be robustly justified by the inevitable (and therefore often relatively trivial) character of the results derived (e.g., as in statistical mechanics), invocation of the null hypothesis is really the admission of poverty in an explanatory paradigm.

Catherine Crouch and Gordon Mills, who argues for "ID," both wonder whether analogical arguments about the "explanation" of DNA/RNA are appropriate. The analogy has been widely used since the 1950s when the structure and chemistry was first worked out; I heard it as a Ph.D. student at Caltech. Crouch correctly says that the idea of a functional logic is not particularly new, but is alive and well in biological research. However, research biologists need to recognize *philosophical implications* of the fact that a logical organization working toward particular achievements really is not *physics*, although the biosystems embodying it can be given a parallel physical description, i.e., are also physical systems. I thought the analogy with the digital computer clarified that obvious point. Polanyi was the first to say all this long ago in *Personal Knowledge*. The dismissive attitude of far too many biologists, however, is displayed in Ernst Mayr's unfair description of Polanyi's ideas as "vitalism" (cf. p. 21, note 15).

Crouch wonders how thinking in terms of a functional logic would help address the problem of origins. My short answer is that I do not know—and did not intend any particular view. However, here is an argument a physicist will appreciate. We have been doing physics with a reasonable methodological framework for about 350 years, and



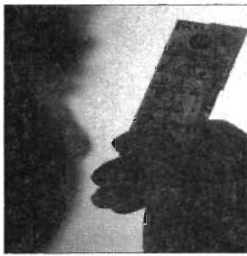
have not formed a half-decent theory of physical origins until the last few decades (I think the standard model qualifies). It is a reasonable inference that the problem of *biological* origins is probably too hard to tackle first. What is needed is learning to think in such terms about lots of less challenging and more accessible problems, as was done for centuries in physics within its proper paradigms.

Thomas Finger, Elva Miller, and James Sire comment on the metaphor of "Adam naming the animals" in Genesis 2:19ff as a theological paradigm for science, and William Hawk also raises issues related to it. I think the metaphor is apt; its picture of science contrasts with a rather different picture, drawn exclusively from Genesis 1, based on *imago Dei*, and giving primacy to reason as presumptively divine in its essence. Of course, the second account of creation is not unrelated to the first one; its perspective is complementary—from within creation. Some further comments may help resolve issues raised by Sire and others:

1. Genesis 2:19ff offers an *affirmative* theological basis for science. I presuppose that enterprises *not* implicit in the servant's mandate of Genesis 2:15 cannot be given theological legitimacy.
2. Sire depicts Adam's "creaturely" naming as informed and indeed sustained by an awareness of a divine Presence, figuratively "at his side"—a view in full harmony with mine. The text powerfully conveys divine interest in the human enterprise. My essay on natural theology stresses this sustaining role for *Christian* understanding in creative thinking about science, and note 9 on p. 21 mentions the remarkable insight of James Clerk Maxwell as an instance of just such faith-sustained creativity.
3. I affirmed "naturalism" in *science* on the ground first that Adam's names for creaturely things themselves are *appropriately* framed in *creaturely terms of reference*. This contrasts clearly with the idea long entrenched in medieval thinking about nature, and derived from traditional Christian readings of Aristotle, that "true" explanations for natural phenomena must ultimately be derived from *a priori* theological or rational principles, while explanatory paradigms framed from within the created order itself can at most "save the phenomena." As historical study shows, the rise of modern physical science depended on changing that evaluation.
4. Science is still a possible enterprise for *fallen* humanity, without resolving all the spiritual problems resulting from alienation from God, based on what theologians have called "common grace." The creative rational activity manifest in science is an exercise of gifts not totally ruined by sin.
5. However, such creaturely rational powers are limited; in particular, they are unable to "name" God or discern God's agency in creation on an *autonomous* basis. Such

knowledge depends on revelation and entails personal reconciliation to God. The Pentateuch's consistent view that God cannot be "named" by autonomous reason assumes humanity's fallen condition; Foster's argument that limits on scientific knowledge arise from the requirement that it be accessible to all persons *in their present condition* has the same effect.

6. Sire speaks warmly of "Christian" scholarly enterprises distinct from the secular ones now carried on. He is on firm territory if he argues that for the social disciplines, the arts and letters, "naturalism" of the kind I advocate for science is evidently *not* appropriate, or is severely limiting; and, that fruitful development of these disciplines benefits from a Christian theological context openly affirmed. On the other hand, it is questionable how a "Christian" physics would differ from the physics we already have. On the contrary, I am convinced that in physics, a policy of "naturalism" has really been vital to its proper development—as Christian physical scientists well understand. Physics on the old naturalistic terms of reference familiar to us does not (so far) appear to be broken, and therefore does not need fixing. It is conspicuous that those who really know physical science well agree with this assessment (and this includes many proponents of "ID" in biology); Sire should consider the tacit implications of this fact for his argument. Perhaps the noetic power of sin has had as much influence on theological reasoning in some cases as it has had on secular scientists. Certainly, that is my view of the phony kind of science young-earth creationism has spawned.
7. I think of biology as a transitional area lying between physics and discourses dealing more directly with human life and thought, where "naturalism" as an appropriate/adequate framework is a viable possibility. I have opted for "naturalism" and against the introduction of a surrogate deity or his design as legitimate *biological* hypotheses, while agreeing that valid theological reflections can and should be made about biological findings. I see a serious credibility problem in demanding that biology be a privileged activity explicitly presupposing belief in a divine agent. Formulating a "naturalistic" alternative is a "soft" compromise; it permits an enterprise already found effective to some degree to continue on extended terms of reference *similar to but richer than* those proper to physics. After all, beetles are interesting objects of inquiry to all kinds of people, many who have no atheist axe to grind, although they do not know the Lord. The hypothesis that biology may have organizing principles described by a logic of achievement does entail some shift from a materialist world view toward richer understanding. I think it is a shift credible for the scientific community; and offers a context in which scientists who are Christians can use creative insight. On the other hand, it seems to me that many persons, who argue "intelligent



**[Dembski asserts] that the divine fingerprint is detectable by rational analysis, independent of faith or repentance. I do not believe that ...**

## Dialogue: Reply

### Legitimacy and Scope of "Naturalism" in Science

design" as the proper resolution, opt in the end for a "Christian" biology privileged by explicitly theological presuppositions. This is particularly true if they are exclusively preoccupied with issues of biological *origins*; in that respect they are as unreasonably limited in their focus as old-style young-earth creationists.

I am not sure what Sire means by "methodological naturalism," which he thinks I have rejected. The "naturalism" argued is methodological, since it is adopted only for the enterprise of science, but its metaphysical options are richer. *Contra* Sire, I do not repudiate metaphysics; we all and at all times carry some around with us. However, views on metaphysics are often notoriously influenced by what we think we know or control in this world, and I did not think that the best biblical way to legitimate "naturalism." Instead, I followed the more epistemological line of thought reflected in Boyle's surprising advocacy of "mechanical philosophy," even while he believed ultimately in absolute divine sovereignty and its agency in creation.

William Hawk thinks the ideas regarding new "functional logic" paradigms in biology remain *mechanistic*. I do not think this is quite correct; these paradigms do commit us to the idea that a limited kind of *telos* is manifest in biology, though its mundane operation is "natural" rather than ascribed to divine agency. Hawk also argues that this "naturalism" is, in its turn, as vulnerable to misappropriation by unbelief as the old purely mechanistic naturalism was. He is right. I am sure Boyle would be aghast if he could see what has been made of his "mechanical philosophy" by generations of unbelief; but he saw the possibility in the ideas of his contemporary Thomas Hobbes and clearly rejected them. This proposal about the scope of "naturalism" in biology risks perversion in the same way that Boyle's *naturalism* did; that is the fallen world in which we live.

Responses by William Dembski, Gordon Mills, and Elva Miller need brief comment. The position of the essays is clear *vis-à-vis* "intelligent design." I have said that I accept *natural theology* as a legitimate reflection on the same truths which science can discover, and not limited by "naturalism." In Part II,

I stated my belief that design in biology is a reasonable natural theological inference.

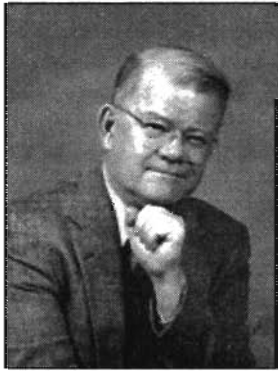
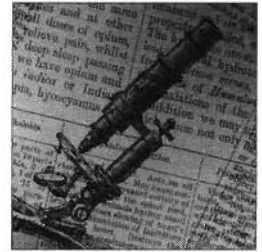
I often read Mills' interesting articles in *PSCF*, appreciating their scientific thoroughness and caution, but questioning how the systematic understanding he proposes to construct on the scientific facts necessarily leads a strict "naturalist" to his theological reading of those facts. I do not know how the ideas of Part II might bear on his work. I think of his papers as a combination of scientific and natural theological discussion, but without convincing arguments that the theological interpretation follows from the science. We disagree on the legitimacy of intelligent design as a *scientific* idea.

I do not know how to reply to Miller's comments, since I do not follow her argument that detecting intelligent design is normal scientific methodology.

Dembski concedes that the paradigm change proposed goes in the *right direction* by asserting that more than physics is objectively manifest in biosystems. I agree with him that in the so-called *cognitive sciences*, we do and should appeal to the idea of intelligent design as a legitimate and objective aspect of reality. In cases he cites, the entities studied are known artifacts of creature intelligence. But it begs the question to claim the same idea is appropriate to biology; beetles are not intelligent *themselves*. Since the implied intelligence to which Dembski ascribes design is not creaturely but *divine*, he is asserting that the divine fingerprint is detectable by rational analysis, independent of faith or repentance. I do not believe that and have said why in my essay.

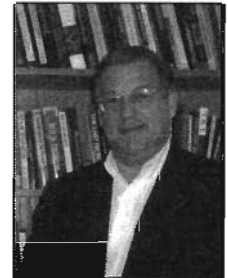
Dembski also wants "functional logic" to do everything he thinks "ID" can do. I never intended that. In particular, I have not attempted to argue anything much about biological *origins*. Part II's proposal is not a "category mistake" but a different and more modest policy – and one directly relevant to the actual research situation.

I thank respondents for many helpful insights or clarifying questions. These essays are intended to provoke work on a constructive project, not to lay down a definitive position closed to future modification. ✧



# Phillip Johnson and the Origins of the Intelligent Design Movement, 1977–1991

*Phillip Johnson is well known for his efforts to build a movement that opposes scientific naturalism and embraces the notion of intelligent design. Movements, however, do not emerge out of thin air, and rarely are they simply the product of one man's vision; they emerge out of an historical context. For intelligent design, that context was a loose collection of people, ideas, and organizations all sharing a desire to question an established scientific paradigm on primarily scientific and philosophical grounds rather than on the basis of biblical authority. Johnson arrived on the American intellectual cultural scene with an argument and strategy well suited to mold these various impulses into a movement that captured considerable attention in the origins debate of the mid- to late-1990s.*



In 1991, a brilliant, pugnacious Berkeley law professor burst onto the scene. His book, *Darwin on Trial*,<sup>1</sup> was a surprise bestseller, and within a year or two after its publication, Phillip E. Johnson was a controversial fixture within American intellectual culture. He championed a “new” approach to the origins debate—dubbed intelligent design<sup>2</sup>—which, despite the academy’s firm commitment to the validity of naturalistic explanations and methodologies, has shown few signs of going away. Ten years after *Darwin on Trial*, design theory is making headlines, all but replacing creation science in the public discussion of origins. In April 2001, *The New York Times* ran a front-page story on the intelligent design movement that, according to prominent science writer Robert Wright, “granted official significance to the latest form of opposition to Darwinism.”<sup>3</sup>

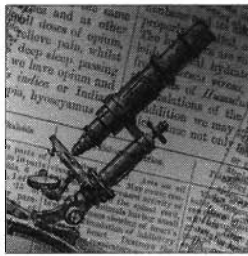
An indicator of the importance of intelligent design theory in the contemporary origins debate is the number of books and essays that have hit the presses in the last five years assessing the merits of design

theory.<sup>4</sup> These assessments along with a growing body of literature by design advocates<sup>5</sup> tend to focus on the scientific, philosophical, and even cultural merits and implications of design. Rarely, however, do writers addressing the design argument give sufficient attention to the historical account of the emergence of an intelligent design movement with Phillip Johnson in the forefront. Like so much of the remembered past, it is an interesting narrative, one that suggests the importance of human agency and the contingency of events.

Using the historian’s most powerful and potentially distorting device—hindsight,<sup>6</sup> it is possible to detect at least three streams that fed into the contemporary intelligent design movement.<sup>7</sup> During the 1980s, new concerns were expressed about the underdetermination of several aspects of evolu-

*Design theory is ... all but replacing creation science in the public discussion of origins.*

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## Article

### *Phillip Johnson and the Origins of the Intelligent Design Movement, 1977–1991*

*Denton charged the scientific community with embracing the evolutionary paradigm to the exclusion of mounting evidence to the contrary in his field of molecular biology.*

tionary theory. At the same time, cosmologists were suggesting that a strong teleological thread seemed to be running through cosmic history. So-called anthropic arguments gave encouragement to those inclined to recoil from the stark materialist assumptions of some spokespersons of science. Also during the 1980s, there were a growing number of neocreationists whose objections to scientific naturalism and aspects of evolution were as much religious as they were scientific, but for whom the approach of creation science was woefully inadequate. In the 1990s, Johnson was able to bring these streams together under the banner of intelligent design.

In the mid-1980s, the neo-Darwinian synthesis of Dobzhansky, Mayr, and others came under attack, most notably in two books that provided impetus to a new approach in the creation-evolution debate. Charles Thaxton (a biochemist), Walter Bradley (a materials scientist), and Roger Olsen (a geochemist) wrote a seminal book, *The Mystery of Life's Origin*, which cast doubt that "simple chemicals on a primitive earth did spontaneously evolve (or organize themselves) into the first life." Moreover, they concluded that "the undirected flow of energy through a primordial atmosphere and ocean" is a "woefully inadequate explanation for the incredible complexity associated with even simple living systems."<sup>8</sup> The authors noted that DNA is information or intelligence encoded in the biological structure. Such intelligence implies an intelligent agent. Their argument was not entirely novel; Henry Morris and A. E. Wilder-Smith had anticipated parts of it already.<sup>9</sup> What was noteworthy, however, about this book is that the authors, while themselves Christians, attempted to argue against biogenesis not from biblical authority but exclusively on scientific grounds.

*The Mystery of Life's Origin* was followed in 1986 by Michael Denton's *Evolution: A Theory in Crisis*. Denton, an Australian molecular geneticist and an agnostic, provided further ammunition for those whose objections to evolution were as much philosophical and cultural as scientific. He presented a bold and controversial anti-evolutionary thesis that life might very well be a "discontinuous phenomenon," rather than a continuum. Denton was well aware

that this assertion challenged the whole thrust of modern biological thought. But he concluded that the fundamental axioms of macroevolution—the idea that there is a "functional continuum of all life forms linking all species back to a primitive cell" and the belief that blind random processes are the author of biological design—have never been substantiated by direct observation or empirical evidence and remain matters of scientific faith.<sup>10</sup>

Invoking Thomas Kuhn's *The Structure of Scientific Revolutions*, Denton charged the scientific community with embracing the evolutionary paradigm to the exclusion of mounting evidence to the contrary in his field of molecular biology. The reasons for this were clear, he argued. There are no scientific alternatives to Darwinism; it has dominated biology more by default than merit. And, more importantly, evolution forms the keystone of the entire modern world view. Consequently, evolution holds tremendous cultural importance as "the centrepiece ... of the naturalistic view of the world."<sup>11</sup> Darwin's theory of evolution has become the foundation for the materialism of the twentieth-century West. And it now served as a "great cosmogenic myth" satisfying modern humanity's need for an explanation of origins. Denton's conclusion clearly warmed the hearts and emboldened the spirits of those who had been looking for a different approach with which to combat Darwinism.<sup>12</sup>

In 1955, G. J. Whitrow published a paper in the *British Journal of the Philosophy of Science* in which he argued that a "variety of astronomical conditions must be met if a universe is to be habitable." Over the next decades, other cosmologists extended this line of thinking so that by 1986 British astronomer John Barrow and American mathematical physicist Frank Tipler could publish a dense book entitled *The Anthropic Cosmological Principle*. In it, Barrow and Tipler suggested that there were a surprising number of physical features of the universe—brute contingent facts—that cooperate to make life possible. While many leading scientists rejected the argument that the finely-tuned structure of the universe could be taken as evidence that there was some purpose or *telos* behind it all, others saw a compatibility between so-called "anthropic

coincidences" and the view that the universe was in fact designed.<sup>13</sup>

In 1977, well before *The Mystery of Life's Origin, Evolution: A Theory in Crisis* and *The Anthropic Cosmological Principle* were written, a group at the University of California at Santa Barbara founded Students for Origins Research (SOR) as "an alternative viewpoint" to that of Henry Morris's Institute for Creation Research (ICR), on the one hand, and the prevailing science establishment, on the other. The founders of SOR, according to Dennis Wagner, editor of its journal *Origins Research*, disagreed with the ICR and other creationist groups primarily over the issues of authority and style. In addition to its marriage to only one model for the age of the earth, creation science argued on the basis of the authority of Scripture. This stance would never permit a genuine dialogue over origins since biblical authority was not accepted by the secular academy. Too frequently, creationists were attempting to advance "a fiat creation alternative" without sufficient attention to the type of scientific evidence needed to engage the academic and scientific communities. Beyond that, SOR founders wanted to be less polemical and to adopt a stance more marked by dialogue than debate. SOR launched *Origins Research* as a forum wherein proponents of both sides could put forth their best arguments "leaving readers to draw their own conclusions."<sup>14</sup> While *Origins Research* attempted to focus attention on the scientific evidence and major arguments in the literature of the evolution/creation debate, SOR was self-consciously engaged in what Wagner termed the "struggle of world views between the theist and the materialist" that was at the heart of the "large scale 'world view' war in our society."<sup>15</sup> What this neocreationist perspective craved was credibility in the marketplace of ideas. Clearly, the ICR had no standing in the academy, but the newer, more irenic stance of the SOR needed some way to break out of the creationist ghetto.

Enter Phillip E. Johnson. He quickly became the spokesperson for a new approach, which drew from this loose collection of ideas, thinkers, and organizations that had been percolating during the 1980s. Wagner claims that SOR, for example, "wandered around" in the 1970s and 1980s attempting to refine its approach and focus. But "things really came together in the early [19]90s with the emergence of Phil Johnson, a strong, recognized voice in the secular university who was a strategic thinker and able to focus the discussion around a few key issues."<sup>16</sup> Within a couple of years, Johnson had galvanized various elements into a self-proclaimed "movement," rallying behind the banner of the intelligent design argument. Books and articles appeared in increasing numbers; an institutional infrastructure was created; bright young scholars were brought into the fold; and a movement was born or, at least, announced.

In the late 1980s, Johnson was a recognized authority in criminal law, a tenured professor at Boalt Hall, the law

school of the University of California, Berkeley. Born in 1940 in a small midwestern town, he had received a B.A. in English Literature from Harvard and a J.D. from the University of Chicago. He had been a clerk for United States Supreme Court Chief Justice Earl Warren. But he was a mid-career professional, somewhat restless with the standard trajectory of a law professor's career. A decade earlier a personal crisis prompted a profound change in his life. Johnson became a committed Christian (Presbyterian) and gradually found that his intellectual interests were changing.

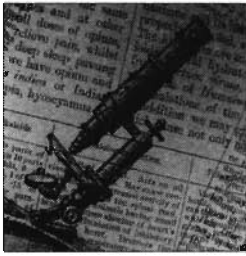
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*Johnson quickly became the spokesperson for a new approach, ...rallying behind the banner of the intelligent design argument.*

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During the 1987-88 academic year, Johnson left Boalt Hall to become a visiting professor at University College in London, where he found himself in an academician's heaven. He headed into his office three days a week and traveled with his wife the rest of the time. The route to his London office took him past a scientific bookstore, wherein he encountered Richard Dawkins' polemic *The Blind Watchmaker*. Johnson concluded that Dawkins' argument was carried by the same kind of brilliant rhetorical devices that gifted lawyers employ to overcome insufficient evidence. With ample time to devote to reading whatever caught his fancy, Johnson began devouring other popular scientific accounts of evolution by Denton, Stephen Jay Gould, and John Maynard Smith. As Johnson recounts it, he told his wife one evening that "I think I understand the problem with this whole field. But, fortunately, I'm too sensible to take it up professionally or to write about it. I'd be ridiculed. They would say, 'You're not a scientist, you're a law professor.' It would be something once you got started with it, you'd be involved in a lifelong, never-ending battle." Johnson, however, found the temptation irresistible. He began writing the next day.<sup>17</sup>

Upon his return to Berkeley, Johnson continued to read and write, soon creating a manuscript that would undergo steady revision and appear three years later as the influential manifesto of the intelligent design movement, *Darwin on Trial*.<sup>18</sup> The process of refining his thoughts and searching for a publisher gave exposure to Johnson's ideas in anti-evolutionary<sup>19</sup> and neocreationist circles. Two events prior to the appearance of *Darwin on Trial* were particularly important in the emergence of Phillip Johnson as chief spokesperson for this group: a gathering in late 1989 at the Campion Retreat Center in Weston, Massachusetts, and another in Portland, Oregon, in 1990.



## Article

### *Phillip Johnson and the Origins of the Intelligent Design Movement, 1977–1991*

*Johnson [in the Johnson-Gould encounter at the Campion Retreat Center] had demonstrated that he could hold his own in debate with arguably the most prominent evolutionary scientist in America. ... Johnson advocated the strategy of an aggressive assault on the materialist philosophy underpinning the scientific theorizing.*

In the wake of the 1987 United States Supreme Court decision of *Edwards v. Aguillard* which banned the teaching of creation science in science classes, a small ad hoc group of concerned individuals began a dialogue about how to ensure that science and religion had appropriate places in the secondary curriculum of American public education.<sup>20</sup> The group noted that there were fears that scientific creationists might attempt to mount end-runs around *Edwards v. Aguillard*, while the scientific community might try to expel religious world views from school curricula altogether. So they organized a private conference, "Science and Creationism in Public Schools," and invited some of the top scholars in the United States to discuss these matters in December 1989 at a Jesuit retreat center run by Boston College geologist and Jesuit priest, James Skehan.<sup>21</sup> Participants included University of Chicago paleontologist David Raup, University of Chicago theologian Langdon Gilkey, Harvard astronomer Owen Gingerich, Cornell geologist E-an Zen, biochemist Charles Thaxton, first amendment lawyer Michael Woodruff, Harvard paleontologist Stephen Jay Gould, and Phillip Johnson.<sup>22</sup>

While the gathering focused on the implications of *Edwards v. Aguillard*, there was also some discussion of Johnson's critique of evolution.<sup>23</sup> Several participants recall a spirited exchange between Johnson and Gould. According to Johnson, Gould had read his paper attacking Darwinism, and the two of them squared off at the urging of the assembled group.<sup>24</sup> It would be tempting to depict the ensuing encounter as something of a culture wars *High Noon*, but several participants consider such a characterization hyperbolic. According to Johnson, Gould was literally shaking; he was so upset at his argument. From Johnson's perspective, Gould had attempted to overwhelm him "with a full court press of intimidation." Johnson recalls little else about the details of the exchange other than that Gould assailed him on his lack of scientific sophistication. He does remember, however, that David Raup intervened at one point and stated that while one could certainly disagree with Johnson's conclusions, he had gotten the science right.

The exchange ended apparently in a draw. While it must have been a colorful event to witness, the specific outcome of the

Johnson-Gould encounter at the Campion Retreat Center was fairly unimportant. What in hindsight was truly significant, however, was that, in the estimation of those at the Campion meeting who were sympathetic to his arguments, Johnson had demonstrated that he could hold his own in debate with arguably the most prominent evolutionary scientist in America. Perhaps now the critics of a reductionistic scientific materialism had an eloquent champion who could engage the scientific establishment on its own terms. But there was as yet no strategic plan or infrastructure in place to enable Johnson-type arguments to gain even a modest level of credibility in American intellectual culture.

While Johnson was on sabbatical in England, a mutual acquaintance introduced him to a young American working on a doctorate in philosophy at Cambridge University, Stephen C. Meyer. Meyer was writing a thesis that analyzed methodological issues in origins sciences. The two were kindred souls and hit it off famously. Meyer later noted that in Johnson he had "encountered a man of supple and prodigious intellect who seemed in short order to have found the central pulse of the origins issue."<sup>25</sup> Johnson not only impressed Meyer with his grasp of the issues, but also with his ideas about how to get their notions a more successful hearing. Meyer was connected with a group in the Northwest which, according to Johnson, was attempting to forge a stance and organization based upon Thaxton, Bradley, and Olsen's, *The Mystery of Life's Origin*.

In 1990, Meyer invited Johnson to Portland and introduced him to his associates, the nucleus of the future Discovery Institute. Johnson's engaging and confident personality and his advocacy of a new approach won the group over, and ever since he has been the public leader of the intelligent design movement. Like many anti-evolutionists and neocreationists, Johnson believed that the fossil evidence did not substantiate the Darwinists' claims. But he challenged them to ditch the notion that this was essentially a scientific problem. Rather, Johnson advocated the strategy of an aggressive assault on the materialist philosophy underpinning the scientific theorizing. In his own words, he brought a "big case litigation point of view" to the issue. Those who would challenge



the scientific establishment must not fool themselves into thinking that evolutionists or even theistic evolutionists would welcome an open exchange about the scientific evidence. Their minds were already set, Johnson claimed. Attack the jugular: the materialist philosophical assumptions!<sup>26</sup>

In 1991, Regnery Gateway published Johnson's *Darwin on Trial*, a milestone in the emergence of the intelligent design movement. In it Johnson put forth with aggressive eloquence his thesis that Darwinism was essentially applied materialist philosophy. He had attempted to get it into print with a major trade publisher, but he was told that evolution was a dead issue in America. Nothing more needed to be said about it, especially from a law professor. The Christian publisher InterVarsity Press and the conservative-oriented Regnery Gateway Inc., however, expressed interest in the project. Johnson decided to go with Regnery, since he believed that it was important for the book to be published by a secular press. The book took off, and Regnery sold 50,000 copies. Regnery and InterVarsity reached an agreement whereby InterVarsity bought the rights to distribute the book in the evangelical Christian market. It has since been translated into several languages and has sold hundreds of thousands of copies.<sup>27</sup>

The unexpected success of *Darwin on Trial* catapulted Johnson, who had heretofore been a behind-the-scenes voice, to national prominence. But his initial success was only one of a series of developments that contributed to the emergence of the intelligent design movement out of the various intellectual currents of the 1980s. That story—which includes the development of an institutional framework (Access Research Network and the Discovery Institute and its Center for the Renewal of Science and Culture), the formulation and articulation of Johnson's "Wedge strategy," and the subsequent work of Michael Behe, William Dembski, Stephen Meyer, et al.—is beyond the modest purview of this article. Moreover, we lack the distance to be able to determine whether the intelligent design argument warrants being considered a bona fide scientific movement. To be such, it must be able to sustain a rigorous research program or, at the very least, inform empirical research in a demonstrable way. Much hard theoretical and empirical work remains to be done, and the jury is still out.

But what is indisputable at this point is that *Darwin on Trial* and the events leading up to its publication were crucial in the transformation of a loose collection of scholars and their ideas into a nascent movement based upon anti-materialistic and design notions. Johnson provided that movement not only with a manifesto and a strategy but also with a powerful voice. Movements, however, do not emerge out of thin air, and rarely are they simply the product of one person's vision; they emerge out of an historical context. For intelligent design, that context was the grow-

ing awareness in the 1980s that continuing the origins debate in American intellectual culture from the stance of biblical authority was unlikely to be effectual. Johnson arrived on the scene with an argument, strategy, and temperament well suited to mold these impulses into a movement that captured considerable attention in the origins debate of the mid- to late-1990s. More than any one person Phillip Johnson shaped the course of the origins debate in the 1990s.<sup>28</sup> ♦

## Notes

<sup>1</sup> Phillip E. Johnson, *Darwin on Trial* (Washington, DC: Regnery Gateway, Inc., 1991).

<sup>2</sup> Nomenclature is a very contentious issue in the origins debate. According to author Larry Witham, the term intelligent design first appeared in 1989 in a book written by Percival Davis and Dean H. Kenyon, *Of Pandas and People: The Central Question of Biological Origins* (Dallas: Haughton, 1989). Critics often associate intelligent design with creationism by adopting labels like *the new creationism* or *intelligent design creationism*. (See Robert T. Pennock, *Tower of Babel: The Evidence against the New Creationism* [Cambridge: MIT Press, 1999], xiv, 28–9.) Most advocates of intelligent design reject the label *neocreationism* as a condescending attempt to refute their position by linking it to a discredited creation science. They prefer *design theory*. I have opted to use the phrase *intelligent design movement* to refer to the maturing design argument and infrastructure of the mid-1990s. For the prior period covered in this essay, no one label accurately reflects the several streams that fed into what became the design movement. The term *nascent design theory* is general enough to be serviceable, but since it implies a measure of whiggish inevitability, I will use it sparingly.

<sup>3</sup> James Glanz, "Evolutionists Battle New Theory on Creation," *The New York Times* (April 8, 2001); Robert Wright, "The 'New' Creationism," *Slate* (April 16, 2001) <<http://slate.msn.com/Earthling/01-04-16/Earthling.asp>>.

<sup>4</sup> This rapidly expanding body of literature includes: Del Ratzsch, *Nature, Design, and Science: The Status of Design in Natural Science* (Albany: State University of New York Press, 2001); Michael Ruse, *Can a Darwinian Be a Christian? The Relationship Between Science and Religion* (Cambridge: Cambridge University Press, 2001), 111–28; John F. Haught, *God After Darwin: A Theology of Evolution* (Boulder, CO: Westview Press, 2000); Kenneth R. Miller, *Finding Darwin's God: A Scientist's Search for Common Ground Between God and Evolution* (New York: Cliff Street Books/HarperCollins, 1999); Pennock, *Tower of Babel*; Phillip E. Johnson and Denis O. Lamoureux, *Darwinism Defeated? The Johnson-Lamoureux Debate on Biological Origins* (Vancouver: Regent College Publishing, 1999); Branden Fitelson, Christopher Stephens, and Elliott Sober, "How Not to Detect Design—Critical Notice: William A. Dembski, *The Design Inference*," *Philosophy of Biology* LXVI, no. 3 (September 1999): 472–88.

<sup>5</sup> See William A. Dembski and James M. Kushiner, eds., *Signs of Intelligence: Understanding Intelligent Design* (Grand Rapids: Brazos Press, 2001); Phillip E. Johnson, *The Wedge of Truth: Splitting the Foundations of Naturalism* (Downers Grove, IL: InterVarsity Press, 2000); Michael J. Behe, William A. Dembski, and Stephen C. Meyer, *Science and Evidence for Design in the Universe* (San Francisco: Ignatius Press, 2000); William A. Dembski, *Intelligent Design: The Bridge Between Science & Theology* (Downers Grove, IL: InterVarsity Press, 1999); William A. Dembski, ed., *Mere Creation: Science, Faith & Intelligent Design* (Downers Grove, IL: InterVarsity Press, 1998); William A. Dembski, *The Design Inference: Eliminating Chance Through Small Probabilities* (Cambridge, UK: Cambridge University Press, 1998); Phillip E. Johnson, *Objections Sustained:*

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<sup>6</sup> To mention the term "hindsight" in historical discussions these days is to raise the question of whether history ought to be presentist and whiggish (i.e., given insurmountable epistemological limitations, the historian should view the past in terms of the present or at the least should feel comfortable in asking "questions about the past inspired by the concerns of the present") or contextualist and priggish (i.e., the historian's task is to attempt to understand the past on its own terms). There are, of course, practical *via media* positions that most working historians adopt. I trust it will be apparent to the reader that my stance in this essay is pragmatically *via media*. For an interesting discussion of this matter from the perspective of the history of science, see Stephen G. Brush, "Scientists as Historians," *Osiris* X (1995): 215–31.

<sup>7</sup> The history of the design argument would require a book-length examination. For my purposes, it is sufficient to note that the novelty of contemporary design theory can easily be overstated. Design arguments have been around since the time of Plato and Aristotle, and the core notions of the contemporary intelligent design movement have antecedents going back centuries, even millennia. See, for example, William L. Rowe, *The Cosmological Argument* (New York: Fordham University Press, 1998), 7, 10–23; William Lane Craig, "Design and the Cosmological Argument," in *Mere Creation*, 332–33; Anna Case-Winters, "The Argument from Design: What is at Stake Theologically?" *Zygon* XXXV, no. 1 (March 2000): 69–70.

<sup>8</sup> Charles B. Thaxton, Walter L. Bradley, and Roger L. Olsen, *The Mystery of Life's Origin: Reassessing Current Theories* (Dallas: Lewis and Stanley, 1992, 1984), 186–87; Nancy R. Pearcey, "The Evolution Backlash: Debunking Darwin," *World* XI, no. 38 (March 1, 1997).

<sup>9</sup> See, for example, Henry M. Morris, *Many Infallible Truths: Practical and Useful Evidences of Christianity* (San Diego: Creation-Life Publishers, 1974, 1996); A. E. Wilder-Smith, *Man's Origin, Man's Destiny: A Critical Survey of the Principles of Evolution and Christianity* (Wheaton, IL: H. Shaw, 1968).

<sup>10</sup> Michael Denton, *Evolution: A Theory in Crisis* (Bethesda, MD: Adler & Adler, 1986), 344–47.

<sup>11</sup> *Ibid.*, 355–57. Denton echoed in part the pathfinding work of historian John C. Greene in *The Death of Adam: Evolution and Its Impact on Western Thought* (Ames: University of Iowa Press, 1959).

<sup>12</sup> Denton, *Evolution*, 358. Denton later lamented the misuse of his work. To be sure, he finds the Darwinian model inadequate. But Denton considers himself a "philosophical naturalist," who flatly rejects special creationism and fully accepts that evolution is "driven entirely by natural processes and by natural law." Where he differs from many evolutionists is his teleological view that the naturalistic evolutionary process is "a designed whole with mankind as its end and purpose." See Michael Denton, "Comments on Special Creationism," in Johnson and Lamoureux, *Darwinism Defeated?* 152–53.

<sup>13</sup> John D. Barrow and Frank J. Tipler, *The Anthropic Cosmological Principle* (Oxford: Oxford University Press, 1986), especially 1–23; Ernan McMullin, "Fine-Tuning the Universe?" in *Science, Technology, and Religious Ideas*, ed. Mark H. Shale and George W. Shields (Lanham, MD: University Press of America, 1994), 97–112; Karl W. Giberson, "The Anthropic Principle: A Postmodern Creation Myth?" *Journal of Interdisciplinary Studies* IX, no. 1/2 (1997): 63–90. McMullin notes that the phrase "anthropic principle" was first used by Brandon Carter in 1974.

<sup>14</sup> Dennis Wagner, "Put Another Candle on the Birthday Cake," *Origins Research* XX, no. 1 (Spring/Summer 1987): 3; personal correspondence, Dennis Wagner to Donald Yerxa, May 13, 1999.

<sup>15</sup> Wagner, "Put Another Candle on the Birthday Cake," 3.

<sup>16</sup> Wagner to Yerxa, May 13, 1999.

<sup>17</sup> A composite of Johnson quoted in Russell Schoch, "The Evolution of a Creationist," *California Monthly* (November 1991) reprinted <<http://www.origins.org/pjohnson/testimony.html>>; Tim Stafford, "The Making of a Revolution," *Christianity Today* (December 8, 1997): 17–8.

<sup>18</sup> Johnson circulated drafts of his work in progress to generate feedback and interest. Phillip E. Johnson, "Science and Scientific Naturalism in the Evolution Controversy" (typescript ms, August 1988); "Darwinism: The Faith and the Facts" (typescript ms, September 1989); memorandum, Phillip Johnson to Campion Center Participants, (November 30, 1989).

<sup>19</sup> The phrase *anti-evolutionary* is somewhat problematic in this context since it implies a blanket rejection of evolutionary explanations. Most of the thinkers that have been attracted to the design movement accept evolutionary mechanisms at the micro-level. It is fair to say, however, that in general they are intensely skeptical that neo-Darwinian mechanisms (particularly the gene-centered approach of the so-called Darwinian "fundamentalists") can account for biological complexity.

<sup>20</sup> Charles Haynes, Project Director of Americans United Research Foundation and President of the National Council on Religion and Public Education; E-an Zen, Chair of the Committee on Precollege Geological Education of the Geological Society of America; Fr. James Skehan, Boston College Professor of Geology and Director of the Weston Observatory; Oliver Thomas, General Counsel, Baptist Joint Committee on Public Affairs; and Michael Woodruff, Director of the Christian Legal Society's Center for Law & Religious Freedom.

<sup>21</sup> Memorandum, "Provisional Agenda for Group Discussion: 'Science and Creationism in Public Schools'" (August 31, 1989).

<sup>22</sup> The organizers invited Thomas Kuhn and Freeman Dyson, but these prominent scholars did not attend.

<sup>23</sup> This paragraph is based on the author's interview with Phillip Johnson (March 24, 1999) and the following personal correspondence: Skehan to Yerxa (October 7, 1999); Raup to Yerxa (October 4, 1999); Gingerich to Yerxa (October 19, 1999); Woodruff to Yerxa (October 29, 1999).

<sup>24</sup> Owen Gingerich recalls that neither he nor Gould had ever heard of Johnson prior to the Campion meeting, but that their exchange was lively. Gingerich to Yerxa (October 19, 1999).

<sup>25</sup> Stephen C. Meyer, "Darwin in the Dock," *Touchstone* XIV, no. 3 (April 2001): 57.

<sup>26</sup> Interview with Phillip Johnson (March 24, 1999).

<sup>27</sup> *Ibid.*

<sup>28</sup> The author would like to thank The John Templeton Foundation for a grant that underwrote some of the research evidenced in this article. He would also like to thank Michael Woodruff, Esq. for supplying him with documentation on the Campion meeting; Karl Giberson for his encouragement and fruitful collaboration; fellow participants in the John Templeton Oxford Seminars on Science and Christianity; and the anonymous reviewers for their careful reading on an earlier draft of this article.

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# Book Reviews



## ENVIRONMENT

**SAVING THE PLANET: The American Response to the Environment in the Twentieth Century** by Hal K. Rothman. Chicago, IL: Ivan R. Dee Publisher, 2000. 216 pages, index. Hardcover; \$24.95. ISBN: 1566632889.

Rothman is editor of the *Environmental History Review* and is professor of history at the University of Nevada, Las Vegas. Among his other publications are books about tourism in the twentieth-century American West, a history of environmentalism in the United States since 1945, and the preservation of American national monuments. This book is one of twenty publications that comprise the American Ways Series, a series that focuses on various aspects and issues of American history. Most of the books in this series are available in both hardcover and paperback editions.

The title of this book is somewhat misleading as the book is not about "Saving the Planet." However, the subtitle is accurate as the author provides a fast-moving survey of the American response to the environment throughout the twentieth century. The book begins with a chapter on the situation in the United States in the late 1800s which then sets the stage for the important developments that take place during the presidency of Theodore Roosevelt. Rothman clearly explains the difference between the preservationist ideas of John Muir and the concept of conservation promoted by Roosevelt and his chief of the U.S. Forest Service, Gifford Pinchot. The book then traces the political and public response to various conservation issues through the New Deal era of Franklin D. Roosevelt, the economic growth of post-World War II America, and the rise of the environmental movement during the last part of the century. Five of the eight chapters of the book focus upon important events in American environmental history that have occurred since World War II.

While the book is primarily a survey of twentieth-century environmental history in America, Rothman does pause at times to provide additional information regarding several events which greatly influenced the direction of this history. Events discussed include the building of the Hetch-Hetchy Dam in Yosemite National Park, the battle against the Echo Park Dam within the Dinosaur National Monument, the toxic waste problem at Love Canal, and the partial meltdown of a nuclear reactor at Three Mile Island. Other important events and influential individuals, while at least mentioned, are treated more superficially.

Throughout the book, the actions of the federal government and the attitudes of the public take center stage. Regarding the latter, Rothman accurately traces the evolution of thinking about the environment in twentieth-century America from a utilitarian view of conservation to the present day concern with "quality of life" issues. He attributes post-World War II changes in attitudes to the decline of outright faith in technology and the increased

lack of trust in pronouncements made by those in positions of authority. He concludes the book by suggesting that attitudes of the American people toward the environment at the end of the twentieth century are in many ways similar to the views of the progressive conservationists at the beginning of the century.

This book is a highly readable and compact account of one of the most important movements in the past century of American life. Although a formal bibliography is absent, the author does include several pages on sources at the end of the book. Footnotes and endnotes are also missing which limits the usefulness of the book as a source of research material. In spite of these limitations, this book could easily be used as a textbook in a survey class on American environmental history. It is also recommended to anyone interested in reading about the individuals, legislation, and events which have influenced the American response to the environment during the past century.

*Reviewed by J. David Holland, Biology Instructor, Springfield College in Illinois, 1500 N. Fifth Street, Springfield, IL 62702.*

**RELEASING HEAVEN ON EARTH: God's Principles for Restoring the Land** by Alistair Petrie. Grand Rapids, MI: Baker Book House, 2000. 261 pages. Paperback; \$12.99. ISBN: 0800792785.

Petrie is an ordained Anglican minister who is presently the Canadian coordinator for the Spiritual Warfare Network. He is also director of Joshua Connection Canada, an interdenominational mission ministry that serves the Church throughout North America and overseas. He is a frequent conference and seminar speaker whose main thrust of ministry has been in helping the church discover the "cutting-edge insights of turning an entire community toward Christ." Petrie earned a Doctor of Ministry from Fuller Theological Seminary in the area of Spiritual Issues of Church Growth. This book is a description of Petrie's "extraordinary journey of discovery connecting the stewardship and healing of land with the release of evangelism on that land, resulting in the extension of the Church and overall growth in the Kingdom of God" (p. 16).

The book is divided into three sections, the first of which presents the foundations of biblical stewardship. Petrie argues that what we do on the land has a cause-and-effect impact on our relationship with God. Biblical stewardship teaches us that we are responsible for managing and caring for God's resources, remembering that they always belong to him and never to us. However, as long as we live in a world estranged from God, our stewardship is subject to defilement and therefore requires cleansing. We can bring defilement into our lives by what we do ourselves, through the way we relate to others, and from the inheritance we receive from earlier generations.

The stewardship of the land is the focus of the second section of the book which is also the longest of the three sections. This section begins with an overview of several world views that can lead us toward the worship of the creation rather than the Creator and which can become an open door for the defilement of the land. Four specific causes of defilement are then summarized and supported from the Old Testament. These defilements include idola-

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try, immorality, bloodshed, and broken covenants. Petrie goes on to suggest that "whenever mankind is filled with self, rather than with the Holy Spirit, the land and those who dwell on it suffer the consequences" (p. 65). These consequences or judgments on the land include famine, ecological destruction, war, and disease.

Several other important concepts are presented in section two, the first of which is that supernatural powers exist behind institutions and the human agents that so often represent them. When spiritual forces of evil gain the upper hand, strongholds of unbelief, self-will, and rebellion can become established within specific localities. Petrie defines a stronghold as a sphere of influence that feeds on sin and that gives spiritual and geographical leverage to the enemy of God's people. These strongholds can be released, inherited, or transferred from person to person, city to city, and even from generation to generation. Citing evidence from the Old Testament, Petrie argues that strongholds that are left unchecked can become hereditary factors that will affect generations to come. This section concludes by looking at two specific examples of strongholds that can lead to curses being placed on people and the land; the influence of Freemasonry and the existence of ley lines.

The last section of the book provides insight into the various ways in which land that has been defiled through generations of human sin can be cleansed and healed. All of these methods emphasize the importance of using spiritual means to overcome what the author believes is primarily a spiritual problem. Methods discussed include spiritual mapping, identificational repentance, intercessory prayer, confession of sin, evangelism, and the use of various symbolic acts. Once the Church realizes that the healing of the land can be accomplished by taking up these weapons of spiritual warfare, heaven can be released on the earth as transformed localities, cities, and even nations experience the blessing of God. These blessings, which are described in Leviticus 26, include ecological health, economic health, personal security, civil security, international security, growth, creativity, and the presence of God among his people.

Many Christians would agree with Petrie's basic thesis that human sin is the underlying cause of environmental degradation and ecological destruction. One concern with his approach to the problem, however, is the assumption that Old Testament promises given by God to Israel are directly applicable to our situation today. Petrie assumes that God's "promise" of 2 Chron. 7:14 (to heal the land if the people humble themselves, pray, seek his face, and turn from their wicked ways) is just as valid for cities and societies around the world today as it was for the people of Israel. One could question the validity of this assumption since the context in which this promise was given is completely ignored. Another concern is the lack of evidence that the methods of spiritual warfare described in the book actually work. Although a few examples of spiritual transformation from different parts of the world are briefly mentioned, the inclusion of several, more detailed accounts would certainly have enhanced the credibility of the book.

Who should read this book? Since the principles for restoring defiled land are spiritual rather than scientific, this book is recommended primarily for pastors, evangelists,

lists, missionaries, and others who are in church leadership positions. This book is filled with references from Scripture and most of the books that are cited in the bibliography deal with issues of spiritual warfare which are based upon a supernatural view of ecology. While some will challenge the author's tendency to interpret verses of Scripture out of context, the basic thesis of the book is one that needs to be seriously considered by all Christians.

*Reviewed by J. David Holland, Biology Instructor, Springfield College in Illinois, 1500 N. Fifth Street, Springfield, IL 62702.*

**THE COMPLETE IDIOT'S GUIDE TO SAVING THE ENVIRONMENT** by Greg Pahl. Indianapolis, IN: Alpha Books, 2001. 348 pages. Paperback; \$16.95. ISBN: 0028639820.

As many Christians are concerned about good stewardship of the environment, the topic of this book is timely and relevant. The cover assures the reader that contained inside is "expert advice on what you can do to help fight our planet's greatest threats" including "practical strategies" and "foolproof ways to conserve our natural resources."

What the reader actually gets is a book that seems to be a modern (i.e., shallow) junior-high audience text replete with fun graphics, various environmentalist dogma, and rather obvious methodologies for reducing one's impact on the planet. In fact, many conservative Christians may be somewhat offended by many of the stances taken in the book. It is stated as fact by the author that Noah's story as related in Genesis is just a rehash of "an earlier Babylonian Story from 1700 B.C.E." (p. 16). The biblical view of the wilderness is "an evil place" (p. 18).

While God does not appear in the index, it is apparent the author places a higher value on creation than he does on the Creator, or indeed his fellow man. He states that, "We still have time to make the *difficult choices* needed to resolve overpopulation" (italics added by the reviewer, p. 290). This is a thinly veiled reference to abortion, which is listed in the index as appearing in the neighborhood of that quote. Apparently, however, the author lost his nerve, and has not quite yet advocated abortion or infanticide.

Several of the insights in the book are good, such as the maxim that you are not really recycling unless you are purchasing recycled products. Others are just flat out misleading, such as his statement that it takes only a gallon of used oil to make a 2.5 quarts usable motor oil, as compared to 42 gallons of virgin crude (presumably, the other 41.625 gallons of crude distillate was poured into the local creek). He also gives the rather breathtaking admonition to those in the developed world to change their ways, lest they be copied by the developing world. "Unless we are willing to change our ways, and learn to live in balance with the our environment, we can hardly ask them to do the same." As someone who has traveled in America and Europe, I can hardly think of a better thing to do than to coax the third world to emulate Western civilization, politically, culturally, religiously, and environmentally. Just imagine a world in which the North Koreans could vote, worship God, and feed themselves. The author apparently subscribes to the myth that indigenous peoples are in



harmony with nature, simply because they live in poverty. As a rule, the most developed nations have the best balanced environmental policy.

If you are looking for a compilation of some handy tips to reduce your environmental footprint, this may be a good book for you to look up in the library. Otherwise, simply live a balanced, considered life, and shut off the lights when you exit the room.

*Reviewed by Steve Batzer, Assistant Professor of Mechanical Engineering, University of Arkansas, Fayetteville, AR 72701.*



## FAITH & SCIENCE

**STAGES OF THOUGHT: The Co-Evolution of Religious Thought and Science** by Michael Horace Barnes. New York: Oxford University Press, 2000. 334 pages. ISBN: 0195133897.

Barnes is professor of religious studies and alumni chair in humanities at the University of Dayton, a Catholic, Marianist university. He is the author of the introductory text *In the Presence of Mystery*, editor of the volume *An Ecology of the Spirit*, and the author of many journal articles. Barnes specializes in philosophical theology including the dynamics of religion, the problem of God, religion and science, and process thought.

As Christians we decry the thought that our faith is merely the result of an evolutionary process that was necessary to provide a productive culture that would ensure the survival of our species. Yet as scientists we do see that cultures change, that the faith of a community can evolve, and that our own faith and understanding of God and our relationship with him also change. So how do we, as Christians in the sciences, evaluate the condition of our faith and the extent of its growth? What tools of the scientific trade can be incorporated into this study and self-examination?

This book makes some attempt to answer these questions and provides some interesting things to think about with respect to our faith, culture, science, and the evolution thereof. The book is based on the controversial supposition that Piaget's theory of cognitive development can also be applied to cultural development and to both the religious and scientific thought within that culture. This is controversial in that it measures the cognitive development of one culture against another culture and also shows a strong relationship between scientific and religious development. The author states that the levels of cognitive reasoning in both religious thought and scientific thought correlate and the two areas have much more to share than either area would like to admit. The stated contention of the author is that a better understanding of culture, and the development of religion within a culture, will help peoples of different cultures be better able to coexist and make decisions on how they want their cultures to grow and develop. But I think that the book can also be used as a self-examination of one's personal stage of cognitive development and a measure of the evolution of one's personal faith. The book is well documented with a useful index and an extensive bibliography.

The book is organized around the defense and the application of Piaget's theory of cognitive development applied, not to individuals, but to cultures. It begins with a defense of this method in regards to cultural prejudice and gives examples of the stages of cultural development. The discussion of cultural development begins with archaic thought, including both preliterate and literate, and then moves to the classical style of thought. Later comes a discussion of western cultures and models of reality in science and religion.

The book ends with a discussion on religious responses to modern science. This part of the text deals with types of religious truth claims and how theologies deal with miracles, cosmology, and evolution. These discussions are again organized around the ideas of Piaget, though one could argue that this part of the book goes beyond the original treatise. I found it to be the more interesting part of the book. This final section of the book provides an excellent survey and critique of the various ways religious theologies have dealt with the findings of science and the scientific method and is applicable to the general topic of science and religion regardless of the application of Piaget's theory to the development of cultures. The author concludes with the point that our system of theology must deal with establishing methods for determining religious truthfulness in a manner that is similar to that found in science and that a rejection, by religion, of scientific means for determining religious truth will not serve the long-term interests of religion.

This book allows for an academic and scientific analysis of the development and operational level of our religious and scientific beliefs and methods. No doubt it provides food for thought that should allow all of us to evaluate and enhance our own cognitive levels of reasoning.

*Reviewed by Gary De Boer, Assistant Professor of Chemistry, LeTourneau University, Longview, TX 75602.*

**THE SAVIOR OF SCIENCE** by Stanley L. Jaki. Grand Rapids: Eerdmans, 2000. 256 pages. ISBN: 0802847722.

Many ASA members will be familiar with the work of Jaki. His work has been reviewed in *PSCF* on several occasions, and his long list of publications frequently deals with the interplay between science and theistic thought.

This book is a republication of lectures delivered in 1987 and originally published in 1988. The main argument is that Christian faith provides the only viable intellectual context for the development of science, so in this sense Christ is "the savior of science." The author begins by arguing that scientific developments begun in several ancient cultures were not sustained because of the absence from those cultures of the particular theological and intellectual orientation and impetus that result from faith in Christ. There are some detailed arguments showing how Christian thought provides a context for reflection on and harmonization with modern scientific developments.

The main argument is one that can be debated fervently. But there are doubtless other reasons that might be given for what Jaki sees as inherent shortcomings in non-Christian world views as a context for science. The author

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has a tendency to dismiss opposing viewpoints in cavalier ways. For example, the (somewhat dated) enthusiasm (pp. 190, 191) about the eventual success of the Star Wars initiative because of the developments of faster computers misses the point that opponents of the system were making when he was writing (inherent intractability rather than capacity limitations). And in the same passage, the reference to the possibility of a "general code-breaking mechanism" made possible by "superconductivity" and "super chips" again underrates the difficulty of the problems. It makes me nervous to see such issues in the areas of my own specialty (computer science) and causes me to wonder about similar statements in other domains.

Having said this, the main argument of the book is an intriguing one, and the author is articulate and widely read. Those interested in this idea, and not minding a presentation somewhat dated in its circumstantial expression, could benefit from reading this book.

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



### GENERAL SCIENCE

**SCIENCE AND TECHNOLOGY ENCYCLOPEDIA** by A. E. Walsby, et al. Chicago: University of Chicago Press, 2000. 572 pages. Paperback; \$22.50. ISBN: 0226742679.

This handy reference work first appeared in Great Britain in 1999. Twelve leading British scientists and engineers served as consultants to the creation of more than 6,500 concise, authoritative entries from "aa" ("a type of lava with a blocklike structure") to "zygote." To provide a flavor of entries consider this one-page sequence: Deneb, denitrification, denominator, densitometer, density, dental formula, dentine, dentistry, dentition, denudation, deoxyribonucleic acid (see DNA), dependent variable (see VARIABLE), depletion, and deposition. A later one-page example is: Neanderthal, neap tide (see TIDE), near-sightedness (see MYOPIA), nebula, neck, necrosis, nectar, Neel (Louis Eugene Felix), nekton, nematocyst, nematode, neo-Darwinian, neodymium, Neolithic, and neon.

Metric units are employed throughout with imperial measurements in brackets. Over 850 brief biographies of scientists and engineers, ancient and modern, are included with a heavy emphasis on European and North American names. Additionally over 250 detailed black and white illustrations appear at appropriate points in the text. These include schematic diagrams, natural history artwork, and technical cutaway diagrams that greatly enhance the understanding of technical descriptions. Their visual and technical quality is excellent. A system of over 20,000 cross-references makes it easy to navigate to related topics or explore one particular area in considerable depth. The majority of entries are four to six sentences in length. The longest entries are about half a page. This volume is a great resource for classroom teachers, students, and professionals since it packs a lot of quality, up-to-date information into a small, almost pocket-size reference.

*Reviewed by Dennis W. Cheek, Director, Office of Research, High School Reform and Adult Education, RI Dept. of Education and Adjunct Professor of Education, University of RI, 255 Westminster St., Providence, RI.*

**THE UNDERGROWTH OF SCIENCE, DELUSION, SELF-DECEPTION AND HUMAN FRAILTY** by Walter Gratzer. New York: Oxford University Press, 2000. 321 pages, index, bibliography. Hardcover; \$27.50. ISBN: 0198507070.

While stories of deliberate fraud in the scientific enterprise are often entertaining, says the author of this fascinating book, of much more interest are the tales of collective delusion and human folly which appear in our world from time to time. Some of these apparently stem from virtuous scientific principles, some from a desire for fame or fortune, some from self-righteousness, and some, living in infamy evermore, from political convictions. Gratzer writes about many of these, including N-Rays, mitogenic radiation, polywater, parapsychology, cold fusion, eugenics, and, in two horrifying chapters, Soviet and Nazi "science" in captivity to deviant political thought.

Gratzer, who writes book reviews in *Nature* on a regular basis, is at the Randall Institute, King's College, London. Although he has served as editor to two other publications, *A Bedside Nature* (1996) and *The Longman Literary Companion to Science* (1989), this appears to be his first book. It is a good book on a topic of substantial importance to many of us, and I have no hesitation in recommending it to my ASA colleagues. Gratzer's writing is precise, sometimes encyclopedic, easy to digest, for he is "telling stories," stories in which the scientific enterprise does not always appear as the hero, and in which the self-correcting nature of science is slower to take effect than we might like.

Editorializing, while inevitably present, is kept to a minimum; Gratzer is content to tell the stories and let the reader draw his own moral and ethical conclusions. The bibliography is particularly valuable; the author includes comments on each source, urging the reader to dig deeper. I recognized many of the references; Gould's *The Mismeasure of Man* does a better job on eugenics than this one does, but this one is, after all, an overview. Likewise, Gratzer urges interested readers to look up Irving Langmuir's classic 1953 lecture transcript, "Pathological Science," in *Physics Today* 42 (1989): 36.

Gratzer concludes that "... scientists, for all their vaunted training in observation and skepticism, are as much a prey to human frailty as anyone else ..." (p. 309). It is when that warning is ignored, or worse, denied, that bad things are about to happen. Buy the book. Read the book. Make its stories part of your own world view. This book is a keeper.

*Reviewed by John W. Burgeson, Stephen Minister, First Presbyterian Church, Durango, CO 81301.*



### NATURAL SCIENCES

**THE CICHLID FISHES: Nature's Grand Experiment** by George W. Barlow. Cambridge, MA: Perseus Publishing, 2000. 335 pages, glossary, references, index. Hardcover; \$28.00. ISBN: 0738203769.

Barlow is professor emeritus in the Department of Integrative Biology at the University of California at Berkeley.

He is an ichthyologist; the study of the cichlid fishes has been central to his work for over thirty years. This book is a labor of love by one of the world's foremost experts on the subject, written both for specialists (aquarists and ichthyologists) and for those interested in the larger questions of natural history and speciation.

The first chapter tells what makes a fish a cichlid (the Angelfish and the Oscar, known to aquarists, are cichlids) and where cichlids are found (chiefly in Africa, tropical America, and India). The next ten chapters are devoted to the unique features of cichlid anatomy (including the presence of two sets of jaws, one in the mouth and one in the throat), plastic cichlid gender (the dominant female in a harem will change sex in a matter of days if the male is removed), feeding behaviors (varied), and, above all, the diversity of cichlid social structures and mating behaviors.

Cichlid speciation, "nature's grand experiment," is the subject of the last two chapters of the book and perhaps a matter of greater interest to most readers of *PSCF* than the material covered in the first eleven chapters. Speciation is a cichlid specialty: "In sheer number of species, [cichlids] are one of the most successful of all families of vertebrate animals." Not only are there hundreds of species in the cichlid family, but their rate of speciation is mind-boggling. Lake Victoria, in East Africa, has been in existence only 12,400 years. In that time the original founders (two "tribes" of cichlids) have radiated into somewhere between 400 and 500 species. Barlow believes cichlid speciation has been largely or exclusively allopatric (as opposed to sympatric), despite the fact that much cichlid speciation has occurred in rivers and lakes without obvious physical barriers to prevent the interbreeding of variants. His reasoning will not necessarily convince those inclined toward the sympatric view, but the majority of evolutionary biologists, leaning toward the allopatric view, will probably find his arguments plausible.

The entire book is a fine read, even for someone who is neither an aquarist nor an ichthyologist. One does not have to be a cichlid specialist, or even a biologist, to be drawn into the world of cichlids by Barlow. His love for and intimate knowledge of the cichlids and his ability to write clearly for the nonspecialist enable him to make the details of cichlid life and love interesting to the general reader. As for the chapters on speciation, they certainly illustrate microevolution in action, though whether cichlid speciation deserves to be called "nature's grand experiment" is open to question. (The ease with which aquarists regularly hybridize even radically different cichlids in captivity suggests that perhaps only microevolution is going on.) Indeed, Barlow does not draw far-reaching conclusions about the evolutionary process *à la* Gould or Dawkins; he simply assumes evolution and sees it in action in the exuberant speciation of the cichlids. Clear illustrations throughout and eight pages of well-chosen color photographs add to the attractiveness of the book. I commend it to any *PSCF* reader who has an interest in zoology or natural history.

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

**THE BIRTH OF TIME: How Astronomers Measured the Age of the Universe** by John Gribbin. New Haven, CT: Yale University Press, 1999. 237 pages, index. Hardcover; \$22.50. ISBN: 0300083467.

Gribbin, a visiting fellow in astronomy at the University of Sussex, is the author of many books for the lay reader on a variety of scientific subjects from quantum physics to cosmology. He therefore comes well qualified to write a book addressing the longstanding problem of determining how long the universe has existed. The book is certainly timely since the age of the universe has been the subject of especially intense study among astrophysicists in the last two decades.

Gribbin has written an engrossing account of how astronomers have progressively focused in on an ever more accurate value for this vital number. Because of the finite speed of light, astronomers observe light from a galaxy today that was emitted at a much earlier time. But this means that, since the speed of light is a well-known quantity, how long ago the light was emitted can be determined if the distance can be measured. So Gribbin's book is really the story of how astronomers through history up to the present have measured the distances to stars and galaxies.

The book begins with a brief introduction summarizing some of the aspects of the age problem, for example, the embarrassing fact that not very long ago the age of some stars was measured to be greater than that of the universe. The remainder of the book consists of eight chapters, the first and longest of which is devoted to an engaging and informative history of the subject. It essentially begins in the seventeenth century with Archbishop Ussher's calculation based on biblical lifetimes that the world began in 4004 B.C. In the next two centuries, however, with the geological study of fossils by Leclerc, Fourier, Hutton, Lyell, and others it was realized that the world was much older. The time was further extended by the calculations of Kelvin and Helmholtz on the lifetime of the sun. It was extended still further early in the twentieth century by studies such as those of Rutherford of naturally occurring radioactive uranium to more than two billion years.

The next chapter deals with the nuclear burning of stars, their size and lifetime, including the important discussion of how the stars in globular clusters around the center of galaxies consist of some of the oldest in the universe. In the third chapter, Gribbin actually begins the treatment of early distance measurements to nearby stars and galaxies by means of parallax triangulation techniques by observing the angle to a star at the extremes of the earth's elliptical orbit. He also treats cepheids, stars of periodic luminosity, which were the first among a number of stars of known luminosity, or "standard candles," used in extending distance measurements beyond that possible with geometry.

The next four chapters contain the story of modern cosmology and its associated distance measurements. It includes the seminal work of Hubble, Humason, Slipher, and others in establishing that the universe extended beyond the Milky Way and was expanding at a rate proportional to distance. A description of the big bang theory from the early work of Lemaitre and Gamow to the discovery of the cosmic microwave background is interlaced with explanations of standard candles for distance

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measurements such as RR Lyrae stars and type Ia supernova, the latter of which now seem to be telling us that the universe is expanding at an accelerating rate. A significant part of the recent history is the drama of the disagreement between two groups of astronomers as to the value of the Hubble constant, giving the present rate of expansion from which the universe's age can easily be calculated. Although one group started with an age of about sixteen and the other about twelve billion years, they are now converging to roughly halfway in between. Gribbin's final chapter includes a description of the contribution of his own work with the group at Sussex University.

It must be realized that the subject is considerably richer and more complex than can be treated in this brief capsulization. Although a few photographs about the heavens are included, lacking are any diagrams which could help the lay reader better understand the concepts involved. Nevertheless, despite a little too much time discussing the many varying values for the Hubble constant in chapter 7, this reviewer found the book enlightening and enjoyable, in part because of charming glimpses of the personalities of the many scientists involved. It is to be well recommended for ASA readers.

*Reviewed by Lawrence Fagg, Research Professor of Nuclear Physics, Catholic University of America, Washington, DC 20064.*



### ORIGINS AND COSMOLOGY

**SCIENCE AND EVIDENCE FOR DESIGN IN THE UNIVERSE: The Proceedings of the Wethersfield Institute, September 25, 1999** by Michael J. Behe, William A. Dembski, and Stephen C. Meyer. San Francisco: Ignatius Press, 2000. 234 pages. Paperback; \$12.95. ISBN: 0898708095.

The authors of the three papers that constitute the body of this volume hardly need an introduction to readers of this journal. Michael J. Behe, William A. Dembski, and Stephen C. Meyer are, along with Phillip Johnson, the most recognizable names in the intelligent design movement. Dembski is without a doubt the most prominent and, lately, controversial design theorist; Meyer is the movement's leading philosopher of science and methodological specialist; and Behe is its most noteworthy practicing scientist. The three combine their insights in this compilation of papers from a 1999 conference of the Wethersfield Institute to produce a very serviceable and useful summary of the intelligent design movement to date. Dembski, Meyer, and Behe, however, break no new ground in this brief anthology and are, in the main, offering the reader reworked versions of essays published elsewhere. As an introduction to intelligent design, *Science and Evidence for Design* ranks among the best and is certainly a viable candidate for adoption in undergraduate science and religion courses. But *aficionados* of the design movement can safely pass on this one.

Dembski opens the book with a fairly straightforward and accessible distillation of his work in a paper entitled; "The Third Mode of Explanation." He makes his now-

familiar case for rehabilitating the legitimacy of design—along with chance and necessity—as a mode of scientific explanation. It is all here: the signal that the SETI researchers found in the movie "Contact," the "explanatory filter" that provides a means of detecting design based upon the criterion of "specified complexity," and, of course, "methinks it is like a weasel."

Meyers follows with "Evidence for Design in Physics and Biology," a very readable essay that is helpful as much for its documentation as its argument. His section on design and the origins of the universe is one of the finest brief introductions to the anthropic principle and related topics I have encountered. He attaches this to his now standard DNA-design essay that he has already published under various titles.

Behe concludes the main section of the book with "Evidence for Design at the Foundation of Life." In it, he surveys the case for irreducible complexity, utilizing the familiar examples of the cilium and the bacterial flagellum. We are spared the mousetrap illustration but not the argument.

The conference papers are supplemented with three additional essays. In the first, Behe nicely synthesizes his various responses to scientific objections raised against intelligent design. He takes heart that critics like Russell Doolittle and Kenneth Miller are advancing scientific arguments against intelligent design. This suggests to him that design is in fact falsifiable and can be debated on the basis of observation. Meyer supplies a new opening and title for an essay that appeared in *The Creation Hypothesis* (1994) as "The Methodological Equivalence of Design & Descent." It remains the single best essay on design methodology, but I am puzzled that the original source was not cited, especially when forty of its forty-four pages of text are lifted verbatim from the earlier book. Lastly, Dembski and Meyer's 1998 *Zygon* article on the dialogue between science and theology is included. They argue that "the logic of explanation suggests that theology might provide science with a source of (albeit in many cases metaphysical) hypotheses and explanations for its empirical findings and results."

It is bad form for a reviewer to criticize a book for not being what the authors never intended it to be. In fairness, Ignatius Press makes no claims that *Science and the Evidence for Design* is a groundbreaking work, and it is likely that the book was intended simply as an introduction to intelligent design, especially for Catholic audiences. As such, it succeeds. After all, the Wethersfield Institute has as one of its missions the exploration of "the cultural and intellectual dimensions of the Catholic Faith." That aside, I am disappointed with the redundancy evident in the published work of prominent design theorists. Like many others, I am looking for evidence that design theory is maturing as a research program. *Science and the Evidence for Design* does little to alter the impression that the design movement seems not to have progressed all that much from its first intriguing manifestos.

*Reviewed by Donald A. Yerxa, Professor of History, Eastern Nazarene College, Quincy, MA 02170; Assistant Director, The Historical Society, Boston, MA 02215.*

**DEAR MR. DARWIN: Letters on the Evolution of Life and Human Nature** by Gabriel Dover. Berkeley, CA: University of California Press, 2000. 268 pages, index, glossary, bibliography. Hardcover; \$27.50. ISBN: 0520227905.

Molecular biologist Gabriel Dover uses imaginary correspondence as a literary device for explaining how our ideas about evolution have evolved since Darwin's day. Dover is the developer and champion of the molecular drive theory of evolution. A gifted writer, his imaginative style lightens the load for one not tuned to the reading of intricate details of modern biology.

In fifteen exchanges, Dover moves from Darwin's natural selection to "an intricate and fascinating mix of a variety of evolutionary activities of which natural selection is one" (p. 5). As time has passed, the place of natural selection in the face of the contributions of Mendel, the "jumping genes" of Barbara McClintock and other DNA mechanisms such as unequal crossing-over, DNA slippage and gene conversion, which can lead to an internally driven spread of elements through a population of individuals, has been problematic. Dover sees natural selection as promoting the co-evolution of systems of repression of "jumping genes" which improves the "levels of internal tolerance" to potentially destructive mobile elements.

Dover's fourth letter "The Ignorant Gene" reflects his mission to refute the metaphysics of Richard Dawkins and "the fundamental ignorance of the workings of natural selection that it reveals ... I intend to use a provocative anti-Dawkins polemic as a device to paint a much larger picture of some of the late twentieth-century excitements of new genetic discoveries and their evolutionary implications ... [which] have no room for Dawkins' misappropriation of your theory of natural selection as embodied in the selfish-gene illusion" (p. 50).

Dawkins calls genes, and other things from which copies are made, *replicators*. The problem with this term is that the suffix, -or, refers to the *doer* of the action. How can the *doer* (active agent) become the (passive) *product*? The photocopier/photocopy metaphor is instructive. Dover argues that cells replicate genes and that organisms are active agents in evolution by virtue of their roles in restructuring the genome in the process of producing compatibility among the components of organisms and species.

In the process of debunking Dawkins and the limitations of the Neo-Darwinian synthesis, Dover spells out the details of his "molecular drive." The problem for the non-biologist reader is in the abstruse details. If you already have a good grasp of "alleles" and their ilk (their place on chromosomes and how they function) *Dear Mr. Darwin* would be valuable in understanding the state of evolutionary theory.

*Reviewed by John W. Haas, Jr., Emeritus Professor of Chemistry, Gordon College, Wenham, MA 01984.*



## PHILOSOPHY & THEOLOGY

**GOD AND THE UNIVERSE** by Arthur Gibson. London: Routledge, 2000. 377 pages, index. Hardcover; \$29.95. ISBN: 0415236665.

Gibson is a philosopher at the University of Surrey, Roehampton. He has also been an active researcher in other areas that impinge on philosophy, such as astronomy, genetics, and religion. The title of the book indicates that its subject matter covers just about everything, and that is indeed the case.

The book is divided into four main parts, each part contains several chapters. The first part, "Renaissance in Language," argues that philosophy can do more than analyze. It can also propose solutions. Gibson claims that science and "soft" subjects (such as religion) have more in common than generally supposed. For instance, both mathematicians and musicians recognize "beauty" in their subjects; and both science and religion use inexact metaphors to describe concepts that are beyond complete human understanding. The second part of the book, "All in God's Space-Time," says that both scientific and artistic communication are alike in that their meaning depends on time-varying culture. Gibson continues his emphasis on scientific metaphor in this part (e.g., scientists use literary metaphors for the subatomic structure of matter and for quantum theory). The third part of the book, "The Cosmology of Life," argues that there is no certainty that biological evolution could (by itself) lead to the beginning of life. Gibson also touches on the problem that the existence of human consciousness presents to naturalism. The last part of the book, "Cosmological Ethics," switches from the science/religion relationship to the science/ethics relationship. Gibson discusses such issues as the connection between Aristotle's and Christ's ethics, and the concept of just war.

The book has an extensive bibliography of over 800 references. It also contains about twenty-five figures and photographs, some in color. The book's main point seems to be the author's speculations on the hidden similarities between religion and science. However, details are difficult to recognize. Written by a philosopher, the book's abstruseness is matched only by the obviousness that it is not written for the layperson.

*Reviewed by Dan Simon, Assistant Professor of Electrical Engineering, Cleveland State University, Cleveland, OH 44115.*

**SEEKER CHURCHES: Promoting Traditional Religion in a Non-Traditional Way** by Kimon Howland Sargeant. New Brunswick, NJ: Rutgers, 2000. 256 pages. Paperback; \$20.00. ISBN: 0813527872. Hardcover; \$50.00. ISBN: 0813527864.

"Although seeker churches are the main topic of this book, the larger question this project considers is: What does it mean to be religious, especially to be an evangelical, at this moment in history?" writes Sargeant in the preface, setting the tone of the book.

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The seven chapters discuss the approach seeker churches take to such topics as traditional religion, ritual, message, strategy, organization, and translation. This is followed by a brief history of Willow Creek Church which is the major focus of the book and the best-known seeker church.

Willow Creek Community Church, in a suburb of Chicago, is the flagship of the seeker church movement although Sargeant visited other seeker churches including well-known Saddleback Community Church in California. The basis of the book is an analysis of a survey of leaders of seeker churches across the country. While the tone of the book can sound like a dissertation, Sargeant raises and discusses several points that are of concern to any of us who, like me, are active in a seeker church.

Matters of methods including marketing, worship styles, and theology are discussed in detail. The author concludes that the theology of seeker churches is evangelically sound—at least at present. But with a tone of Reformed theology, Sargeant asks if the expedient has not replaced the transcendent in this modern church movement, implementing techniques which even mainline denominations are now using to swell declining memberships. I am reminded of David Wells, *No Place for Truth—Whatever Happened to Evangelical Theology*, who has argued that what is needed in the modern church is an emphasis on the Transcendent rather than on therapy. I think Sargeant would agree.

I found this a most insightful and helpful book for anyone who is interested in evangelical church growth. While I cannot comment on the research techniques in the social sciences, it appears that the design and execution of the survey were good. An appendix deals with the methodology of the survey. Replete with well-chosen examples, extensive references, and thought-provoking discussion, *Seeker Churches* is well written and well edited ensuring that it will be a useful resource for years to come.

This book is an important contribution to understanding where the church is headed and will be required reading for church planters as well as for many of us who appreciate an analysis of the most dynamic movement among evangelicals in the last fifty years.

*Reviewed by Lytton John Musselman, Mary Payne Hogan Professor of Botany, Old Dominion University, Norfolk, VA 23529.*



## RELIGION & CHRISTIAN FAITH

**THE C. S. LEWIS ENCYCLOPEDIA: A Complete Guide to his Life, Thought, and Writings** by Colin Duriez. Wheaton, IL: Crossway Books, 2000. 240 pages. ISBN: 1581341369.

This book is based on a previous work by the author (*The C. S. Lewis Handbook*, 1992). It is presumptuous to think that a work of this size could be "complete" relative to the much larger corpus of Lewis' own work. However, it is a very helpful presentation of a great deal of information. The intention is to promote interest in Lewis and his vast array of writing, and it should prove very effective to that end.

The topics covered include Lewis' popular Christian writings, his fiction, and his scholarly books. Lewis wrote many things, so even those who are familiar with his work can take advantage of the kinds of summaries that are available here. For newcomers to Lewis, this book can help give an overview of the various components of Lewis' work and thought. It can be recommended to admirers and readers of Lewis, both experienced and neophyte.

The book suffers from some sloppy copyediting. For example, on page 30, there is a reference to "animals, talking" but the actual entry is "talking animals"; on page 58, there is a cross reference to an entry for "King Arthur" that does not exist; on page 63, the author of the Inspector More novels is given as Colin Dextor rather than Colin Dexter; and there are others.

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## SOCIAL SCIENCES

**THE EVANGELIST: The Worldwide Impact of Billy Graham** by Lewis A. Drummond. Nashville, TN: Word Publishing, 2001. 288 pages. Hardcover; \$22.99. ISBN: 084991208.

This book details what Billy Graham believes and how these beliefs impact who he is and what he does. Material about Graham's life and crusades is only given to illustrate his convictions and methods of operation. Some of Graham's beliefs are catalogued in chapters on the Holy Spirit, the Gospel, God's Sovereignty, and Christ. Chapters on suffering, boldness, godliness, and revival provide insight on how Graham functions.

Although Graham must sometimes rely on bodyguards, he has never canceled a crusade because he feared for his own personal safety. An incident which occurred at a crusade in Augusta, GA, illustrates Graham's boldness and courage. One night a wild party was in progress in the hotel room next to those where he and Grady Wilson were staying. Since the noise was keeping them awake, and they wanted to be fresh for the next day, Graham put on his bathrobe, and knocked on the door of the noisy room. Graham announced that he was an evangelist, chastised those present, invited them to his crusade, and preached a short sermon on the spot. Several people responded to his message, and there was no more noise that night!

Some people might question John R. W. Stott's statement in his introduction that this book "never descends to the level of hagiography" (p. x). Maybe not, but if Graham is not called a saint, he's presented with all the characteristics of one. Readers will have a difficult time finding anything negative recorded. And perhaps this is appropriate since Graham has seemingly avoided the pitfalls of some of his contemporaries. And perhaps also it is not surprising since the author is an obvious admirer and friend of Graham's. Drummond currently serves as the Billy Graham professor of evangelism and church growth at Beeson Divinity School at Samford University in Birmingham, AL, and ministers at conferences sponsored by Graham.



For certain, Graham has not pleased everyone. His critics have included separatists like Carl McIntire, Bob Jones, Sr., and Ian Paisley. Liberals, Unitarians, and the *Christian Century* have also found fault. Graham has not responded to his critics, but he has not been oblivious of them. He said, "I don't want to get to heaven without any scars." Slight chance of that, with so many conservatives and liberals putting Graham's words and deeds under a theological microscope.

Perhaps the most unfair criticism ever made of Graham resulted from an interview he gave to some *Charlotte Observer* reporters in the 1980s. Based on their research, this headline appeared: "Billy Graham's Secret \$23 Million Fund." An Orlando, FL newspaper printed a picture of a dollar bill with Washington's face replaced by Graham's. This aroused questions in readers' minds about Graham's financial integrity. It shouldn't have. There was nothing secret about the fund which was established for a building at Wheaton College and a conference center in Montreat, NC. The foundation which held the money was approved by the IRS, had been audited every year, had been announced in many press releases, and was not for Graham's personal use. Nothing illegal or unethical had been involved. Eventually criticism faded, and sufficient funds were collected to complete the projects.

Billy Graham's life and ministry have been presented via many books, articles, documentaries, and television interviews. This book takes a unique approach in demonstrating that Graham's beliefs, actions, and personal qualities are firmly based on the Bible. The book is a very good source for a primer on basic Christian doctrine. Five appendices provide some helpful documentation about Graham's ministry. For instance, one gives a list of Graham's writings; another the 13-page Corporate Statements of the Billy Graham Evangelistic Association.

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**ODD GODS: New Religions and the Cult Controversy** by James R. Lewis, ed. Amherst, NY: Prometheus Books, 2001. 435 pages. Hardcover; \$33.00. ISBN: 1573928429.

Lewis, associate professor of religious studies at the University of Wisconsin, is the author of *Doomsday Prophecies: A Complete Guide to the End of the World* and *The Encyclopedia of Cults, Sects, and New Religions*. In *Odd Gods*, Lewis and three dozen experts deal with religious expression in the USA which is described as a "crazy-quilt landscape." Most of the book describes the history and beliefs of unusual religious groups including sects derived from Christian, Jewish, Islamic, Hindu, Buddhist, and Sikh persuasions. Also dealt with are the "Moonies," Wiccans, Satanists, Spiritualists, Channelers, Scientologists, The Heaven's Gate Cult, New Age and UFO devotees, and many others.

Lewis accurately points out that the public often has false perceptions of cults which lead to public fear with subsequent scapegoating. Some cult groups are socially pathological, but there are also many unorthodox sects which pose no threat. Lewis analyzes the differences between dangerous groups and the merely innocuous, and discusses the appeal of minority religion affiliation.

This substantial book contains an expansive index, lengthy bibliography, and black and white photos of many cult founders. With accounts of cults from A (Anthroposophical Society in America) to Z (Zoroastrianism), this is the book to buy if you are curious about America's so-called cult phenomena.

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# Letters

## Inversion and Resolution

I wish to make further comments on Jerry Bergman's article "Is the Inverted Eye a Poor Design?" (*PSCF* 52, no. 1 [March 2000]: 18-30). I challenge the specific assumption of Edinger (pp. 19-20, note 7) that the retina is sub-optimal because its photoreceptors are on the back so that light has to get through the nerves and blood capillaries first.

It may surprise some readers to learn that "inverted" photographic paper has been proven to give quite satisfactory performance. For some years, the major German manufacturer Agfa produced "Agfachrome Speed," a color printing paper, which was much appreciated by users because of its matchless simplicity in use. A color slide was mounted in the negative-carrier of the enlarger and the image projected onto the baseboard; Agfachrome Speed was then placed on the baseboard, with the light-sensitive emulsion DOWNWARDS—i.e., away from

the light source—and after appropriate exposure was developed (in a single bath).

Its relevance to the controversy about the architecture of the retina is that it refutes the assumption of inferior resolution in photoreceptor surfaces mounted on the back. Many of us were astonished when Speed came out with its "back-to-front" arrangement; but its resolution was not inferior to that of papers with the usual arrangement of emulsion on the front. This much-appreciated printing paper was withdrawn after some years because of inadequate sales, not because of any difficulties with resolution.

Admittedly, the structures through which the light has to pass before reaching the photoreceptors are different in the retina from the fibers of polycarbonate of which this printing "paper" was made. However, the same type of reasoning applies—wrongly in the case of the paper, and therefore I suggest it is wrong for the retina. Those who claim our retinas are of inferior design are probably not aware of the facts, which, of course, supersede any vague

theoretical reasoning. Their assumption is refuted by the proven good resolution of Agfachrome Speed.

Moreover, our vision system includes not only the eye but also the brain, and is active as illustrated simply by the fact that the "blind spot" is not normally apparent to us. It is therefore reasonable to assume that any difficulty inherent in looking through the capillaries and nerves may be actively combated by neural corrective mechanisms that may not be yet well known.

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## More Dialogue Desired on Origin Models

In response to the editorial "Beyond the Edge?" (*PSCF* 53, no. 1 [March 2001]: 1), I am writing to encourage *PSCF* to seek and include more articles that are more procreationist. As a "special creation-young universe-worldwide flood" origin belief/model proponent, I find so much "strong anticreation put-down" writing hard to read. The view, "Theistic Evolution: Enough Already," (*PSCF* 53, no. 1 [March 2001]: 5-6) and article, "A Time and a Place for Noah" (*PSCF* 53, no. 1 [March 2001]: 24-40) were a breath of fresh air.

There are only two origin beliefs/models with several sub-beliefs/models. I realize that creationist ASA was taken over, shortly after its founding, by theistic evolutionists/progressive creationists; however *PSCF* needs to balance the evolution origin bias with more creation origin bias. The scientific method does not and cannot offer a proof for either of the two primary origin beliefs/models. Our challenge is to objectively determine which origin belief/model offers the superior explanation/prediction power for origin observations research data and modeling outcomes.

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## Response to Allan Harvey, "On Natural Explanations"

It's better to be disagreed with than to be ignored, so I am grateful to Allan Harvey for his letter (*PSCF* 53 [June 2001]: 139) in response to my note (*PSCF* 53 [March 2001]: 5-6). Like many readers of this journal, I am a Christian academic who desires to appropriately and effectively present the claims of Jesus Christ to my students and colleagues. It is in that context that I raise questions about two issues: (1) the relevance of provincial discussions of theistic evolution to the secular academy; and (2) the importance of communicating clearly in the secular academy when the issue of origins is discussed. Harvey's letter is mainly concerned with the second point.

Harvey feels that my comments denounce theistic evolutionists and imply that they lack "Christian integrity."

He may feel that way (if the shoe fits as they say), but I was merely suggesting that if we want to follow the scriptural injunction to honor God as creator, we must say what we mean when we talk about origins. It is obvious to the readers of this journal that evolution implies much more than a scientific hypothesis. Whether Christians subscribe to special creation or some form of theistic evolution, the critical point is that God created. If we say evolution when we really mean creation, we imply support for the materialistic world view. When Carl Sagan refers to evolution, he does not mean anything close to the idea that God created. If you mean that God created but use a term which implies random processes, then yes, that does demonstrate a lack of integrity. Why would you choose to mislead your audience, if not for the sake of "scientific appearances"? That is precisely the dilemma faced by my colleague in the situation described in my March 2001 article. If he refused to write within the context of evolution (random and purposeless processes), he risked losing the opportunity to write a book chapter, even though the topic had little to do with origins.

I am not suggesting that every reference to origins must be accompanied by a sermon on God's creative and providential acts, but an appropriate reference to the creator or God's design lets my students know about my world view. That encourages Christian students as well as students of other faiths, and creates opportunities to discuss my world view with non-Christian students. I see a profound irony in Christian scientists who, in their churches, actively debunk special creation in favor of theistic evolution, but casually refer to evolution in the classroom. Evolution is one of those wagon words which carries a metric tonne of philosophical assumptions, so it behooves us to put the term in context. The only and very simple point I am trying to make is that Christian academics ought to use terms which set them apart from secular humanism and scientific materialism. I personally know many Christian faculty on my campus, but last week when I asked a group of 120 Christian students if they had ever had a Christian professor, only six hands were raised. I take this to mean that there a lot of Christian faculty who are active in their churches but remain invisible on campus. With respect to the question of origins, let me describe how this works in my experience.

I am a food scientist with interests in dairy technology. I think one could derive something like the anthropic principal based only on the intricate physical, chemical, and biochemical interactions that determine the physical stability of milk. It would be completely inconsistent with my faith and dishonoring to the Scriptures for me to tell my students that this fantastic biological fluid came into existence by random processes. That is exactly what many of my students would assume if I referred to the evolution of milk composition and structure. My experience is that students appreciate my candor when I refer to creation or God's design rather than evolution. They appreciate my comfort with expressing my beliefs. Now, back to Harvey's letter.

Harvey considers the "absurdity that would result if this view is taken to its logical conclusion." He asks if atmospheric scientists are lacking Christian integrity when they discuss the weather in naturalistic terms. The rhetorical answer is "of course not," but Harvey is comparing

apples and oranges. The physical/chemical aspects of atmospheric science can be discussed without raising any confusion about world views and metaphysical presuppositions. I don't see too much space devoted in this journal to scientific and Christian perspectives on atmospheric science, but evolution is discussed constantly because it comes loaded with metaphysical presuppositions and social implications.

Regarding Harvey's comments about my "God of the gaps" error, I am accustomed to hearing this phrase used to silence all objections to theistic evolution, so I am grateful to David Snoke for his article "In favor of God-of-the-gaps reasoning" (*PSCF* 53 [September 2001]: 153). Of course, the biblical perspective is that God fills all the gaps; he created and remains actively involved with his creation. To glorify God for his providential and creative acts is a dominant theme throughout the Scriptures. The question is not if but how he created. Theistic evolutionists prefer to believe that he created according to some facsimile of Darwin's theory. That paradigm feels more comfortable in the context of the secular scientific community where few dare to challenge Darwin's emperor status, but in my view, the emperor's clothes are increasingly transparent. With sincere respect to theistic evolutionists, I think the ongoing effort to squeeze the *Origin of Species* out of the first few chapters of Genesis is a futile exercise.

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## Humans and Consciousness

William Struthers in "Defining Consciousness: Christian and Psychological Perspectives" (*PSCF* 53 [June 2001]: 102-6) deals with the difficult question of the nature of human consciousness. This involves the ability to separate "me" from "not me" to, perhaps, its being the central processor of information that attempts to make sense of our inner and outer experiences.

The study of human beings encompasses all sorts of disciplines—cognitive science, neuroscience, philosophy, psychology, etc. However, although the existential object under study is the same, *viz.* humans, yet the subject matter of each discipline involved is totally different. This difference determines, for instance, the nature of the evidence to which each kind of knowledge appeals. Also, one ought not to equate a person's use of reason to know, which can be applied to non-scientific as well as to scientific studies, with the pursuit of knowledge solely with the aid of the scientific method.

A Christian perspective considers a human being to be body/mind/soul; whereas to science a human being may be viewed only as mind/body and mind further reduced to brain. Note, however, that John Eccles says: "It [ego' or 'self'] is essential to the concept each of us has of being a self," and he adds, "in the religious sense it corresponds to the soul."<sup>1</sup> Accordingly, consciousness cannot be determined or measured with physical devices and so it is not

the subject matter of science. Only the nonphysical self in humans can detect consciousness.

The scientific attempt to relate the function of consciousness to the ability to enhance survival and procreation considers only the aspect of history consistent with evolutionary thoughts. One ought to distinguish historical science, e.g., cosmology, evolutionary theory, etc., from physics. The former is more akin to forensic science and deals only with unique events; whereas physics is the prototype of experimental science. Of course, the introduction of history into the study of the nature of consciousness brings forth the fundamental role that miracles play in the Christian world view.

C. S. Lewis clearly indicates that the notion of miracles requires a clear and unequivocal understanding of what Nature is.<sup>2</sup> It should be remarked that the subject matter of science is data collected by physical devices. In physics, knowing is based on evidence obtained via the interactions of particles/fields. If something cannot, in principle, be measured by physical devices, then that something is outside the purview of science. This gives a clear demarcation of what science is and what it is not. This definition of science is what requires that the evidentiary data of the historical sciences must be collectible by physical devices.

The essence of consciousness, the ability to know self, is not something that can be detected with the aid of physical devices. Therefore, the study of consciousness cannot be limited to the methods of sciences. A human being is the "detector" of his or her own self and so a human being is in a sort of space with both physical and nonphysical dimensions. The latter is what C. S. Lewis calls "Supernature." Conceptual thought, free will, moral autonomy, the notion of God, etc. are all unique to humans and cannot be reduced to the purely physical. Of course, different levels of conscious experience are related to brain-states but self cannot be reduced to such physical states. It is analogous to electrical charge that must always be accompanied by mass but cannot be reduced to it.

## Notes

<sup>1</sup>W. H. Thorpe, *Purpose in a World of Chance* (London: Oxford University Press, 1978), 81.

<sup>2</sup>C. S. Lewis, *Miracles* (New York: The Macmillan Company, 1947), 10.

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## "AGOG versus GOG"

Stimulated by the article by David Snoke entitled "In favor of God-of-the-gaps reasoning," (*PSCF* 53, no. 3 [September 2001]: 152) I think I must declare I am AGOG and think that GOG and MAGOG are not good enough.

Let me start to explain with two quotations from C. A. Coulson, onetime holder of the Rouse Ball Chair at Oxford University (from *Science and Christian Belief*, London: OUP, 1955). The first is from a letter of Isaac Newton to the master of his college at Cambridge, Trinity. He says: "The

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diurnal rotations of the planets could not be derived from gravity, but required a divine arm to impress it on them" (p. 20). The contrast was that the theory of gravitation was able to explain the orbital motion of the planets around the sun.

Pointing to gaps in our scientific understanding and suggesting that religion explained these was described by Coulson as the "most serious and wasteful of our errors" (p. 20), the errors of Christians (who were scientists). I don't know if he was the first to use the phrase "God of the gaps" (p. 20) but I think this next quote sums up the matter, why GOG will not do, "Either God is in the whole of Nature, with no gaps, or He's not there at all" (p. 22). However, I do not believe Coulson's version of GOG was actually considered by Snoke.

What Snoke's useful essay does is show us clearly two mistakes that appear to be very common among Christians including those who are scientists.

The first mistake is to suppose that there is only one valid explanation for anything. In general this supposition is false. If I enter a room and see a kettle boiling, and ask, "Why is the kettle boiling?" some joker there might give me the scientific explanation, but what I was hoping for was the more informative explanation, "because I'm making tea." The arguments presented against AGOG use this false supposition.

The second mistake in thinking is to use God as an explanatory tool, to use him (taking his name in vain?) "to scratch our mental itches," as I once heard the late Donald MacKay describe this action. If we believe in God, as revealed in the Scriptures and mediated to us by the Spirit of the living Christ, then this particular God is the explanation of everything, and therefore, cannot be the explanation of gaps in our understanding.

I agree with Snoke that the existence of gaps indicates inadequacies in our theories or models. Such gaps should be examined. But I am arguing that the existence of the God of Jesus Christ is not a theory or model, but the basis for our living and thinking. I claim that this exchange I am having with him points to gaps of a different sort, gaps in our concepts of God; such gaps, however, have nothing to do with the existence or nature of God.

It is everyone's experience, I imagine, as it has been mine, that my conception of God undergoes change, as a result of his doing things I did not expect (predict), but that I could, after the fact, recognize as his working. These failures of prediction lead me to revise my conception. This process is also experienced normally in my relations with other persons. It is what you might expect if the God we trust is personal, as we claim.

So I am AGOG; against GOG, which stands for mistaken Christian understanding, and against MAGOG, which is our use of God for our magical purposes of control.

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## Abandon GOG Arguments

David Snoke's "In Favor of God-of-the-Gaps Reasoning" (PSCF 53, no. 3 [September 2001]: 152) may or may not be, as he suggests, "heretical" but it is wrong. It neglects basic theological questions, and the attempt to present the God of the Gaps (GOG) as a scientific theory has several flaws.

To begin with, the paper does not consider serious theological objections that can be made to this approach. GOG seems to assume that God is either the type of deity who insists on showing off and getting credit for what happens in the world, or a god who would create a universe that is in a sense incomplete, that has not been endowed with full functional integrity, or both. (Such a god might contrive to get attention by leaving gaps in creation.) One may, of course, argue that this is an accurate representation of God's character but such a claim is highly problematic from a Christian standpoint, as I have argued several times in this journal.<sup>1</sup> The God of whom it is said "Truly, you are a God who hides himself" (Is. 45:18) and whose mark is the cross is not the one who is proclaimed by GOG arguments.

The hiddenness of God does not, however, mean that God is inactive. Traditional Christian views of providence have held that God is at work in everything that happens in the world. GOG arguments, on the other hand, draw attention away from divine activity in the things that we are able to understand and encourage people to think of God as a kind of specialist who intervenes in the universe sporadically only to do a few things that science will not be able to explain.

In brief, Snoke has taken no notice of the arguments of Bonhoeffer, whose reflections on the subject have been one of the most influential challenges to GOG reasoning. Some attention to Bonhoeffer's statement that "We are to find God in what we know, not in what we don't know" and its grounding in the theology of the cross would have given the article some theological substance.<sup>2</sup>

So much for the issues with which Snoke does not deal. The situation is not much better with the arguments he does make.

It's true that it is legitimate, in discussing a scientific theory, to point out its "gaps," the things that it doesn't explain. Pointing out a defect in theory A, however, is not the same thing as supporting rival theory B. But there are deeper problems here.

Snoke's application of this procedure to help in deciding between the rival "theories" that there is a God and that there isn't is mistaken. "There is a God" and "There is no God" should not be thought of as scientific theories but, in the present context, as philosophical meta-theories. "There is a God" provides one answer to the limit question, "Why does a universe exist?" a question that the atheist may simply have to ignore. But GOG does not contribute anything useful to an attempt to understand details of the world which is given.

When presented as a scientific theory, GOG means making the statement "God did it" about phenomena which remain unexplained for a sufficient length of time. No Christian who holds the traditional belief that in an ultimate sense God does *everything* will argue with this,

though he or she will point out that God's activity is not restricted to those aspects of the world. But if God acts in the gaps through lawful natural processes then those gaps can in principle be filled by scientific investigation of those processes, so that GOG is superfluous. If, on the other hand, God acts in the gaps directly, without the mediation of natural processes, then GOG amounts to the erection of a STOP sign for scientific investigation when particularly puzzling phenomena are discovered. So much for explanatory power!

GOG, contrary to Snoke's belief, has no predictive power. The idea that God fills the gaps that science can't explain doesn't "predict" that there are any gaps, let alone the character of the gaps that may exist at any given stage of scientific development. The claim that "exquisite fine tuning" is an example of "successful prediction" is false. Who, before attention was drawn to the anthropic coincidences by Brandon Carter and others in the past thirty years, ever "predicted" from GOG that the electromagnetic and nuclear interactions had just the right strengths to enable heavy elements to be built up in stellar interiors?

God of the gaps arguments should be abandoned. They are of no value for serious theology or serious science.

## Notes

<sup>1</sup>E.g., George L. Murphy, "Chiasmic Cosmology and Creation's Functional Integrity," *Perspectives on Science and Christian Faith* 53, no. 1 (March 2001): 7.

<sup>2</sup>Dietrich Bonhoeffer, *Letters and Papers from Prison*, enlarged edition (New York: Macmillan, 1972), 311, 360-1.

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## Does God Choose Among Hidden Options? A response to Peter Rüst

I wish to thank Peter Rüst for his thoughts on "Creative Providence in Biology" (*PSCF* 53, no. 3 [September 2001]: 179-83). The question on which he focused is one that continues to perplex many of us who seek to integrate our Christian belief system with our scientific understanding of the universe. To put the question in my own words, *In the context of what we have come to know via the natural sciences about the character of the universe and of its formational history, how can we best articulate our understanding of divine action—both creative and providential?*

I shall begin my response by saying that I believe that we do need to re-articulate our concept of divine action. I have a high respect for the theological tradition of my Calvinist heritage, but the theology that I was taught—like the theology taught to the vast majority of Christians today—was framed in the conceptual vocabulary and thought patterns of centuries long past. My own theological heritage clearly bears the marks of having been crafted within the framework of a late-medieval world picture—geocentric in both its physical structure and its focus of attention, unaware of the multi-level (quarks to quasars) structure of the universe, unaware of its formational his-

tory and its astounding array of formational capabilities, and unable to imagine that we would someday have empirical access to that history and to the creaturely processes that have contributed to it.

This inherited world picture includes a conceptual vocabulary for speech about divine action. Most of us were presented with a picture of God as an all-powerful, transcendent, person-like being who was both able and willing to engage in *supernatural intervention*—particular acts in which the continuity of the creaturely cause/effect system was interrupted and superseded by coercive divine action. I say "coercive" not to imply any lack of loving motivation but to denote divine action that forces creatures to act in ways contrary to or beyond what they could otherwise have done. Traditional portraits of the creation's formational history often made liberal use of the supernatural intervention motif. *Episodic creationism*, for instance, envisions divine creative action in a way that places great emphasis on the idea that new structures and life forms were actualized, not by creatures using their God-given formational capabilities, but by the direct form-conferring action of the Creator. Relics of these traditional portraits remain in use today—museum pieces now grandly framed with gilded claims of empirical support.

As Rüst noted, I have long sought to portray both the creation and God's creative action with a vision that is founded on the historic Christian doctrine of creation but crafted in the conceptual vocabulary of *this* day. The conceptual vocabularies of centuries past can no longer be treated as if they remained adequate in this era. We should no longer be content simply to repeat things exactly as they were said in the sixteenth century, or in the first century. It is no longer adequate simply to *say* what they *said*—be they medieval theologians or biblical writers. Instead, we must, I believe, *do* what they *did*. We, like our predecessors, must experience God's presence in the world about us and craft our portraits of divine action in the conceptual vocabulary of our own time and place.

In that spirit I have tried to introduce a few new terms into our speech about the creation and about God's creative action. I have, for instance, suggested that the creation was gifted from the outset with *functional integrity*—a wholeness of being that eliminated the need for gap-bridging interventions to compensate for formational capabilities that the Creator may have initially withheld from it.<sup>1</sup> In the same spirit, I have suggested that the creation is aptly and accurately described by the *Robust Formational Economy Principle*—an affirmation that the creation was fully equipped by God with all of the resources, potentialities, and formational capabilities that would be needed for the creaturely system to actualize every type of physical structure and every form of living organism that has appeared in the course of time.<sup>2</sup>

I have freely admitted that I cannot *prove* these statements in the narrow logical sense, but I find these concepts to be both theologically attractive and scientifically warranted. They are theologically attractive to me in part because they provide the occasion to celebrate both God's *creativity* (in conceptualizing a formational economy sufficiently robust to make evolutionary development possible) and God's *generosity* (in giving such wholeness/integrity of being to the creation). In the arena of science, this vision of a universe having a robust formational

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economy has accumulated a track record of being a remarkably fruitful foundation for essentially all scientific theorizing about the formational history of the universe and of a diverse array of structures/forms within it.

However, as already hinted, this concept of a creation fully-gifted from the beginning with a robust set of formational capabilities does have a noteworthy implication regarding the character of divine creative action—no form-conferring interventions need be performed. With no “capability gaps” to bridge, no coercive divine action is required to actualize any type of physical structure or life form. The creation itself would have been given the requisite resources to accomplish the Creator’s intentions for its formational history. In this vision, the signature of the Creator is seen, not in what the creation *cannot* do (and must be compensated for), but in what the creation *can* do (with its generously provided capabilities).<sup>3</sup> The divine action of creating is not concentrated in a few occasions of *form-conferring intervention*, but in the *giving of being*—equally essential at every moment of time.

But is God’s action of giving the universe its being at all times sufficient for the creation’s evolutionary development? Is there no need for God to perform additional particular acts (whether we call them creative or providential does not concern me at the moment) to assemble at least some of the creatures that have appeared in time? On this question the Christian community is divided. Episodic creationists hold fast to the judgment that the creation’s formational economy is *not* sufficiently robust to accomplish the feats of self-assembly that the sciences incorporate into their theorizing. Episodes of form-conferring intervention are deemed by modern creationists to be essential for the formation of all manner of things, from terrestrial planets to bacterial flagella.

However, if the creation is gifted with functional integrity, as I have suggested, then form-conferring divine interventions are not necessary. Some critics have feared that I have thereby excluded all divine action from the universe, that I have effectively become a deist. But such an exclusion has never been my intention, and I have no plans to move in that direction. Suggesting that *one* form of divine action is unnecessary does not at all imply that *all* forms of divine action must be rejected. The question remains, however: How might we now speak of divine creative action in a universe characterized by functional integrity?

One possibility that I have suggested is to speak of God’s non-coercive action in the biblical language of divine *blessing*—God acting in such a way as to encourage or ensure that the outcome of creaturely action will be generally fruitful.<sup>4</sup> Genesis 1:22 and 1:28, for instance, could be taken to suggest that the fruitfulness of animal and human life may be seen as evidence of God’s blessing.<sup>5</sup> This is not the sort of action that lends itself to inclusion in a scientific model for animal or human reproduction.<sup>6</sup> God’s blessing is not just another causal factor to be included alongside of creaturely causal factors. No, I envision God’s blessing as the enabling and constructive presence of God that manifests itself continuously in all of the remarkable things that creatures accomplish.

*Process theology* has invested a great deal of effort in developing a language for speaking of divine action that is

effective but non-coercive.<sup>7</sup> Its vision of *naturalistic theism* rejects all forms of supernatural intervention that interrupts or overpowers the system of creaturely causes and effects. At the same time, it postulates that divine action is an essential aspect of every process and event that occurs. Divine action is not confined to occasional episodes of irruptive intervention; divine activity permeates the world of our daily experience. Yet this ubiquitous divine activity is never coercive; it does not force any creature to do anything. Like the human action of *persuasion*, divine action (within limits that follow from the character of God and of the God/world relationship) can be effective in stimulating the desired outcome without forcibly violating the object of its influence.

Naturalistic theism would, I believe, accept my characterization of the universe as having functional integrity and as being endowed with a robust formational economy. And it would agree, I believe, that the system of natural causes and effects are sufficient to account fully for all that has occurred in the universe’s formational history. But it also makes what I consider to be a noteworthy contribution—a vastly enriched concept of what is “natural.” The whole array of *natural* processes are considered by naturalistic theism to be permeated with *divine* influence—not overpowering intervention, but ubiquitous and *persuasive* action that within limits, is, effective. Whereas traditional supernaturalism emphasized the radical distinction between the Creator and the creation (a distinction that opens up the possibility of God coercively intervening in it), process theology is more comfortable with the kind of intimate relationship of Creator and the creation that is envisioned by panentheism—the world is *in* God, but God is *more than* the world.

In the context of these considerations, what does Rüst propose? If I have correctly understood, he is saying that even if the creation is gifted with functional integrity, one needs to postulate additional divine action (Rüst calls it “creative providence”) to account for the formational history of the universe, at least for the formation of living organisms. He says: “Van Till’s view of creation’s functional integrity for the development of the universe may be essentially correct—in the physical realm. The emergence of biological information, however, cannot be dealt with in the same manner” (p. 179).

What’s the problem? On the basis of a number of considerations Rüst concludes that biological information could *not* have emerged “spontaneously” or “autonomously,” that is, by creaturely action alone. In essence, Rüst judges that the possibility space of creaturely forms is far too large for the creation to have discovered and actualized the genetic portion of it in the time available and with the exploratory capabilities with which it was endowed. The emergence and evolution of life, in Rüst’s judgment, could have come about only as a consequence of supplementary divine action.

What kind of supplementary action? In agreement with both process theology and my own proposition regarding the creation’s robust formational economy, Rüst opts against the idea of coercive interventions. He says: “... [M]iraculous interventions are not to be expected on theological grounds, but autonomous events of transastronomical improbabilities are scientifically unbelievable” (p. 180). So, no form-conferring interventions are expected, says Rüst,



but yet God must do *something* or the wealth of potential life forms will drown in the sea of "transastronomical improbabilities." Where I have suggested the language of divine *blessing*, and where process theologians have developed a metaphysical system in which to articulate a rich concept of God's *persuasive* action, Rüst introduces the idea of *hidden options* from which God might purposefully choose in order to effect a desired outcome.

Given the character of the universe, it seems that there are many instances of processes for which several outcomes are possible, but for which the particular outcome is not predictable. Following some process or event, the final state of the system is, we say, "underdetermined" by all that can be known about the initial state. This lack of knowledge is not temporary, a problem that might be overcome with further study, but is inherent in the nature of the universe. But the outcome of one of these "events" might be crucial to the formation of the first life form or to the pathway of evolutionary development. How is it that the outcome of the creation's evolutionary development is as remarkably fruitful as it appears to be? Is it evidence of divine blessing, as I have suggested? Is it the outcome of divine persuasion, as process theology proposes?

Rüst's suggestion is that God *chooses* particular outcomes from among the various options that are open. This action of choosing from available options, says Rüst, introduces new *information* into the situation and might account for the development of information-rich biotic systems that have been actualized against the highly discouraging odds of infinitesimal probabilities.

Rüst is not the only person to argue that the creation's formational processes must be supplemented by divine action of some sort. In fact, it is a remarkably common theme in Christianity today. Young-earth episodic creationism, for instance, cites a lack of sufficient time and purported degenerative effects of the Second Law of Thermodynamics in support of its arguments against the feasibility of evolution. And the standard claim of the Intelligent Design movement is that they can argue from empirical evidence to the conclusion that particular biotic systems could not possibly have come to be formed by natural means alone. Therefore, say some ID advocates, these systems must have been assembled, at least for the first time, by the form-conferring action of some non-natural agent (usually presumed to be God).

I must confess that I find these claims (including those supplied by Rüst) about the purported shortcomings of the creation's formational economy less than convincing. For example, attempts to estimate the probability of actualizing some particular molecule or some more complex biotic structure can be made only if one knows, in considerable detail, *all* possible formational pathways to that outcome and *all* environmental factors that might affect the success of those formational processes. I find it highly unlikely that we know enough to make the numerical calculation of these probabilities with sufficient accuracy to have any meaning whatsoever. Ironically, of course, I cannot provide a numerical estimate of this likelihood, but the history of science does provide a useful illustration of what I have in mind.

Astronomers long considered the stark and harsh environment of space to be so inhospitable to the formation of

molecules that there was little or no effort expended to search for them. A few relatively simple molecules like hydrogen ( $H_2$ ), carbon monoxide ( $CO$ ) and water ( $H_2O$ ) were known to exist in gaseous interstellar clouds, but surely there was no chance for larger and more complex molecules to form in these cold, low density clouds. Right? Organic molecules assembled in frigid, dark interstellar nebulae? No way! And complex biomolecules like the amino acids needed for living organisms? Not a chance!

Wrong, wrong, and wrong again! Astronomers had vastly underestimated the formational capabilities of atoms and molecules and had failed to consider an important category of formational processes. In the last three decades, astronomers have discovered approximately one thousand large molecular cloud complexes within the Milky Way Galaxy. These molecular clouds contain numerous species of molecules, some of them astoundingly complex, far more complex than had been expected. The actual formational economy of atoms and molecules is far more robust than astronomers and chemists had first imagined. Molecular clouds, cold and rarified by earthly standards, evidently provide all the resources and environmental conditions needed to make possible the formation of more than one hundred known molecules. Among these are several organic molecules relevant to life, including formic acid ( $HCOOH$ ), acetic acid ( $CH_3COOH$ ), ethyl alcohol ( $CH_3CH_2OH$ ), and glycolaldehyde ( $HOCH_2COH$ ), an 8-atom sugar molecule. Furthermore, given the observation of a number of closely related biomolecules, there is warranted optimism for the eventual observation of the amino acid glycine ( $NH_2CH_2COOH$ ), one of the building blocks of protein molecules essential to life on earth.<sup>8</sup>

Against the background of such episodes in the history of science, I am inclined toward the judgment that our failure to understand how certain molecular or biotic structures could have been assembled for the first time is an indication, not of missing capabilities or low probabilities, but of the limited power of human imagination. I could be wrong, but "that's the horse I'm betting on."

For a couple of reasons, I also find myself uneasy about Rüst's proposition that God routinely acts to overcome improbability barriers by choosing the particular outcomes of processes or events. First, why would these key probability values be so low to begin with? For anyone who, like Rüst, sees the universe as a creation that was given being by God from nothing, there seems to be only one answer: God must have designed the formational economy of the creation to include these low probability values so that acts of divine choice among hidden options would have to be performed at a later time. Thus, the need for Rüst's proposition of *divine choices* among hidden options arises in essentially the same manner as the purported need for acts of *divine intervention*, whether of the young-earth creationist or the intelligent design variety — God designed the creation's formational economy in such a way as to necessitate some form of compensatory action at a later time. For theological considerations, I am uncomfortable with this "withhold now, compensate later" concept of divine creative action.

My second concern, also theological in character, has to do with the way in which Rüst's "hidden options" proposal functions as a form of *occasionalism*, a perspective (attributed to Nicolas Malebranche) that denies true cause-

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effect relationships in the creaturely world. Creaturely action is not real because one creaturely state is merely the occasion for God's directly bringing about the next creaturely state. Divine action is the real cause of things; creaturely cause-effect relationships are no more than appearances. Rüst may be correct in saying that the exercise of divine choice that he proposes does not constitute a special creation or a supernatural intervention in the strong sense of coercing a creaturely system to do something *contrary to or beyond* its creaturely capabilities. Rüst's proposal does offer, it seems, a picture of divine action somewhat different from the usual episodic creationist concept of divine intervention. Nonetheless, I remain uncomfortable with the occasionalist flavor of his picture in which particular outcomes are entirely determined by divine choice. As viewed from the outside, events in which God exercised such a choice would look like purely creaturely events because there would be no violation of any normal creaturely behavior pattern. Yet the particular outcome would have been effectively determined by divine selection. *Authentic* creaturely action has, by the controlling action of divine choice, been replaced by *apparent* creaturely action. In the limit, God becomes a divine Puppeteer.

Finally, does Rüst's proposal successfully avoid the pitfalls of the familiar god-of-the-gaps strategy? In part, but not wholly. Rüst does not introduce divine action as the means to bridge a capability gap in the creation's formational economy in the same way in which episodic creationism ordinarily does. Nonetheless, Rüst does posit a shortcoming in the creation's formational economy that must be compensated for by divine action. Even though the requisite capabilities may be present, the probabilities for their successful use are, in Rüst's judgment, far too low. So, while Rüst does not call for God to leap across capability gaps, it would appear that he does call for God to *jump over improbability hurdles*. The difference between gaps and hurdles strikes me as too little and too subtle. Whether certain formational capabilities are missing, or merely ineffectual, God is called upon to compensate for what the creation lacks.

## Notes

<sup>1</sup>For a development of the idea of *functional integrity*, see my essay, "Basil, Augustine, and the Doctrine of Creation's Functional Integrity," *Science and Christian Belief* 8, no. 1 (April 1996): 21-38. For a critique of a perspective that rejects this idea, see my chapter, "Intelligent Design: The Celebration of Gifts Withheld?" in *Darwinism Defeated? The Johnson-Lamoureux Debate on Biological Origins* by Denis O. Lamoureux, Phillip E. Johnson, et al. (Vancouver: Regent College Publishing, 1999), 81-90.

<sup>2</sup>The Robust Formational Economy Principle is discussed in several of my writings: (a) "The Fully Gifted Creation" published as a chapter in *Three Views on Creation and Evolution*, ed. J. P. Moreland and John Mark Reynolds (Grand Rapids, MI: Zondervan Publishing House, 1999), 161-247, (b) "Science & Christian Theology as Partners in Theorizing" published as a chapter in *Science & Christianity: Four Views*, ed. Richard Carlson (Downers Grove, IL: InterVarsity Press, 2000), 196-236, and (c) "The Creation: Intelligently Designed or Optimally Equipped?" published in *Theology Today* (October 1998): 344-64.

<sup>3</sup>Howard J. Van Till, "What Good is Stardust?" published in *Christianity Today* (August 6, 2001): 52-6.

<sup>4</sup>See *Three Views on Creation and Evolution*, 189-90.

<sup>5</sup>However, I find no merit in Rüst's extension of this, by appeal to Psalm 104:29-30 and Matthew 10:29, to mean that God "arranges births and deaths of individual animals."

<sup>6</sup>Perhaps the temptation to include divine action as an element in scientific theorizing is a consequence of thinking too narrowly of divine action in the traditional vocabulary of supernatural intervention.

<sup>7</sup>The following two books by David Ray Griffin would provide excellent introductions to process theology and its engagement with the natural sciences: *Reenchantment Without Supernaturalism: A Process Philosophy of Religion* (Ithaca: Cornell University Press, 2001) and *Religion and Scientific Naturalism: Overcoming the Conflicts* (Albany: SUNY Press, 2000).

<sup>8</sup>A news report on the glycolaldehyde observation can be found at the website for the National Radio Astronomy Observatory <[www.aoc.nrao.edu/pr/sugar.html](http://www.aoc.nrao.edu/pr/sugar.html)>. A list of 110 observed molecules and information regarding glycine can be found in the review essay, Lewis E. Snyder, "The Search for Interstellar Glycine," *Origins of Life and Evolution of the Biosphere* 27 (1997): 115-33.

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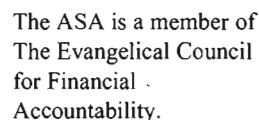
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