# PERSPECTIVES on Science and Christian Faith

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***In this issue . . .***



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

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*Perspectives on Science and Christian Faith*




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

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

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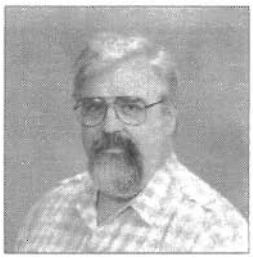

# Beginning and Ending: Controversy and Dialogue

In the early 1960s as a pre-teenager, I remember the anxiousness I felt when I heard a prominent evangelist proclaim that Christ will surely return before or at the turn of the calendar from 1999 to 2000. The evangelist affirmed the clarity of the Scriptures and the discernment of the times as strong evidences of his prophecy. At that time our little congregation was in dialogue over eschatology—the Premillennialists versus the Amillennialists. No one espoused Postmillennialism, but we had the token "Pan-millennialists" who irreverently said that they believed "it would just all pan out." While the discussions were intense and peppered with supportive biblical texts and contemporary illustrations, they were also amicable, realizing that our understanding of God's method and timetable reflect human interpretation.

In this issue, we encounter a similar dialogue—not over our ending, but over our beginning. The comparison of "natural world events" with Scripture fuels the discussion. How did the world begin? What is the evidence for Divine doing? Within the American Scientific Affiliation, much of the debate for the last couple of years has focused either on the pros and cons of two positions: Howard Van Till's idea of a "Robust Formational Economy Principle" (RFEP) or "Intelligent Design" (ID) as advocated by William Dembski, Michael Behe, and others.

In the following Dialogue section, Mark Discher initiates a discussion by challenging some of the critiques Howard Van Till has made concerning ID. Then Howard Van Till responds to Mark by affirming RFEP as the superior model when comparing the merits of RFEP and ID. Finally in concluding this dialogue stage, Mark responds again to Howard suggesting some problems remain with RFEP.

In the Articles section, other authors contribute to the origin discussion. The case study by Tim Johnson and Karl Giberson suggests that teaching evolution in the public school system neither undermines traditional religious values nor promotes atheistic naturalism. Richard Thornhill conjectures that historical evidence demonstrates a parallel development of intelligent design and Darwinian evolution views. In the Communications section, Gordon Mills uses an example in biochemistry to defend intelligent design. Finally a Young Scientist, John Bracht, raises the information issue as a problematic one for Darwinianism.

You are invited to contribute to the next stage of this dialogue by submitting your Letter to the Editor as a follow-up to one of the issues raised by any of these authors.

Primogenial reading,
**Roman J. Miller**, *Editor*

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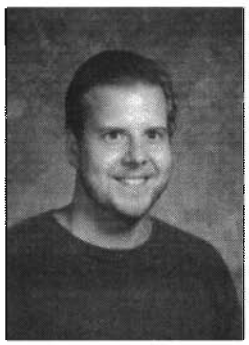
# Van Till and Intelligent Design



*For some time, Howard Van Till has been critical of the Intelligent Design (ID) movement. Van Till claims,* inter alia, *that proponents of ID misuse Scripture, and that ID theory reduces to "folk science." Van Till proposes instead his Robust Formational Economy Principle (RFEP), the idea that creation has within it from the beginning the wherewithal to bring about the emergence of all biological forms and complexities which have existed, do exist, and will exist. I try to show that, while ID may end up being incorrect and something like the RFEP may be correct, Van Till's arguments against ID have not yet carried the day. I challenge Van Till's a priori approach to science and suggest that ID cannot be judged correct or incorrect prior to empirical confirmation or disconfirmation. To make the claim that the laws of nature can and have produced all of the complexity of biological organisms is a philosophical presupposition which forecloses on the possibility that an empirical analysis of the data might suggest otherwise. On this score, ID seems to employ a superior scientific method than the one employed by those advocating the RFEP. It is an empirical investigation of the data which must be allowed to either confirm or disconfirm a scientific theory, not an a priori theoretical assumption.*

*I challenge Van Till's a priori approach to science and suggest that Intelligent Design cannot be judged correct or incorrect prior to empirical confirmation or disconfirmation.*

Howard Van Till has been critical of the Intelligent Design (ID) movement for some time. On Van Till's account, the warfare metaphor between science and religion continues because, on the one hand, naturalists assert that every formational "gap" in the history of the universe which gets closed makes the idea of God ever more otiose, while theists, on the other hand, react to the closing of these gaps by searching for further "gaps" which they contend cannot be closed. Van Till rightly holds that the warfare theme between science and religion is fought predominantly on biological turf.

The dwindling of gaps, and especially the anti-theistic taunts of the likes of Richard Dawkins and Peter Atkins that often accompanies the closing of gaps, motivates some theists to search for new gaps which, given present scientific understanding, appear to be unbridgeable by natural means alone. Such theists often claim that the need for extra-natural explanation at the point of these gaps both vindicates theism and defeats naturalism. Van Till calls this desire to find gaps in the formational economy of the universe "episodic creationism (EC)." Episodic creationists, whether they believe the earth to be thousands of years old (young earth) or billions of years old (old earth), are those who hold that God intervened in stages during the history of the universe to bring about the fullness of creation.

As opposed to this episodic creationist perspective, Van Till proposes his own theory, the Robust Formational Economy Principle (RFEP), the idea that the universe has been "fully gifted" *from the beginning* to bring about all of the "emergence" within it, including all manner of biological complexity, consciousness, and human intellect. While Van Till believes that the robust formational economy of the universe requires an intelligent designer, the activity of this intelligent designer is presumed to be remote; all of the work was completed at the inception of the universe. The ID community, on other hand, allows for proximate intelligent causation, the idea that the designer may have been at work at various points in the history of the universe and not just at its inception. This makes ID a species of EC.

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Van Till believes that all species of episodic creationism, including ID, are instances of "folk science," illegitimate and prejudiced science that, rather than seeking actual scientific truth, seeks primarily to have its own worldview assumptions confirmed; in the case of ID, the worldview assumptions which grow out of a certain reading of the Bible.

In this paper,[1] I shall attempt to show that (1) Van Till's leveling of the charge of "folk science" against ID may reduce to *ad hominem;* (2) allegedly scientific projects motivated by EC are not, for that reason, necessarily slated to be unfruitful scientifically; and (3) Van Till's specific criticisms of ID are, so far, less than decisive.

## Intelligent Design and the Bible

As we have seen, Van Till contends that ID is just another form of episodic creationism (EC), the idea that God has created the world in stages and did not "fully gift" the world from the beginning. Whether one believes in a young earth or an old earth, if one believes that creation has taken place in discrete stages, one is an episodic creationist. Van Till seems to suggest that all forms of episodic creationism are motivated by an erroneous concept of the character of Scripture, and in particular, by a certain controversial reading of the Genesis narrative.[2]

Van Till, I think, is too quick in holding that *all* claims on behalf of episodic creationism *derive* from the Bible. Indeed, most IDers explicitly eschew deriving any scientific conclusions at all from Genesis or any other sacred text. For example, ID prime mover Phillip Johnson writes:

> [T]he first priority for critics of scientific materialism is to state the critique of materialism and naturalism in language that the intellectual community can recognize as legitimate. In the world of the university *it is not legitimate to set up the Bible as authority against the evidence of scientific observation,* but it is very legitimate to show that people who claim to be basing their ideology on observation or neutral reasoning are actually proceeding on the basis of powerful hidden assumptions.[3]

Thus, the leader of the ID movement *explicitly rejects* using Scripture as a *reason* for denying Darwinian evolution in a scientific debate. As an allegedly scientific project, ID wishes to use only the same "evidence of scientific observation" which is available to the non-ID scientist. For the IDer, the debate—at least in theory—has to do with *how the scientific data themselves are best interpreted,* not with the veracity of some reading of Genesis.

Having said this, I concede that Van Till may be technically correct in his suspicion that it is a certain reading of the Genesis narrative, and perhaps other Scriptures, which may be *motivating* ID proponents to make their case. But what, one might ask, is wrong with that? I do not find this to be problematic.[4] Let's imagine a philosopher who is *motivated* to find and to make rational philosophical arguments for moral objectivism and against moral relativism because he believes, on the basis of his religious commitments and religious texts, that moral objectivism is true and moral relativism is false. The basis of his motivation to argue the way he does, by itself, does nothing to diminish the *quality of the arguments themselves.* His arguments must be judged on their own merits *qua* philosophical arguments, irrespective of what might be motivating him to argue for a particular position. Similarly, we would not think it licit for an atheist to discount the beauty or quality of, say, Bach's or Handel's music just because it happens to be *motivated* by Christianity and Judeo-Christian texts. So we should not think that work done by an ID scientist is illicit just because it is *motivated* by religious commitments and texts. Just as Bach's or Handel's music must be judged *on its own merits* qua *music,* so *the ID scientist's science must be judged on its own merits* qua *science.*

*While the scientific hypothesis of the ID movement may be motivated by IDers' understanding of, and commitment to, the Bible, that motivation does not make a scientific hypothesis any less amenable to being either confirmed or disconfirmed by the data.*

Now, this is where ID can fail. But, if and when it does fail, it must be shown to be inadequate on genuine scientific grounds, and not merely judged to be inadequate *a priori* because many of its champions are motivated by their particular reading of Scripture, *viz.,* an episodic creationist reading. If, say, the text of Genesis were itself being put forward as evidence for scientific conclusions, then I think Van Till would be right to cry foul. *But that is the very thing Johnson and the majority of the ID movement consciously want to avoid doing.* So, it seems inappropriate to bring the Bible into the debate when IDers want no such thing. If we can assume that IDers are sincere, the debate for the IDer has nothing *directly* to do with the Bible. For them, it is a scientific debate which is to be settled on the basis of "the evidence of scientific observation," and not on the basis of some reading of Genesis or any other religious text. While the scientific hypothesis of the ID movement may be *motivated* by IDers' understanding of, and commitment to, the Bible, that motivation does not



*Van Till should avoid taking ID to task on the basis of its purported relationship to Genesis. To do so implies that science motivated by religious worldview convictions is therefore necessarily bad science.*

make a scientific hypothesis any less amenable to being either confirmed or disconfirmed by the data.

This being the case, Van Till's objection that "[w]ere it not for beliefs rooted in the reading of the Genesis creation narratives as *chronicles*, there would be no (*very* little) episodic creationism in the Christian community today" seems to miss the point.[5] Perhaps it is true that the majority of episodic creationists are motivated to hold their views as a result of their understanding of the character of Scripture and their particular reading of the Genesis narrative, but that does not make their views *ipso facto* false or unfit to be fruitful scientifically. All sorts of beliefs and experiences have served to inspire scientific discovery and theory-formation, including dreams, warfare, the influence of spouses, indigestion, and religious beliefs. Mary Midgley writes:

> [Thomas] Wright's Christian faith not only did not hamper his reasoning, but actually helped him to reach what are now accepted as sound scientific conclusions.

Midgley goes on to say:

> Both Faraday and Clerk Maxwell were exceptionally devout men, active members of strongly Protestant Churches. Faraday ... did not discuss his beliefs in scientific contexts, but Maxwell made it clear that his religion had been a great help to him in forming his theories. (Would the notion of Maxwell's Demon have occurred to somebody with a different upbringing?) The forging of the modern understanding of electricity owed nothing to atheism.[6]

So, even if biblical and religious beliefs are the motivating impulses behind ID science, that does nothing to show that the science itself is incapable of being interesting or fruitful. The science has to be judged on its own merits.

In short, Van Till should avoid taking ID to task on the basis of its purported relationship to Genesis. To do so implies that science motivated by religious worldview convictions is therefore necessarily bad science. That simply does not follow logically, nor has it been the case historically.

## Intelligent Design and Folk Science

Having suggested that all episodic creationists, IDers included, have been led astray by an inadequate understanding of the book of Genesis, Van Till does acknowledge:

> "It is not impossible, of course, that some proponents of these [episodic creationist] movements believe that they are engaged in *open-ended* and *unbiased* scientific research."

The implication here, however, seems to be that while this remains a *logical* possibility, it is not very likely. Nonetheless, Van Till does concede that "[t]he ID movement ... eschews reference to the biblical text and asks to be considered [as and evaluated as] a purely *scientific* enterprise." However, Van Till, with genuinely admirable candor, admits:

> My own candidly stated judgment, however, is that these [EC] movements are much closer to being enterprises dedicated to the task of providing empirical warrant for an episodic creationist *folk science*.[7]

For his definition of folk science, Van Till follows Jerome Ravetz. According to Ravetz, folk science is that "part of a general world-view or ideology which is given special articulation so that it may provide comfort and reassurance in the face of the crucial uncertainties of the world of experience." With respect to ID, Van Till himself defines a folk science as

> a set of beliefs about the natural (creaturely) world—beliefs whose primary function is to provide reassurance that other worldview beliefs, already in place, are OK (that is, they remain credible even in the face of substantial criticism from the professional sciences).[8]

In plain language, folk science is biased science. It seeks not the truth, but to have its prejudices confirmed.

Describing an IDer as a "folk" scientist while somehow believing that another scientist who accepts Van Till's RFEP is not engaging in folk science, but in "real" science, looks suspiciously arbitrary. One might ask why should all EC science be labeled "folk" science while RFEP science passes as genuine or legitimate?

Van Till's answer seems to be that it has to do with the sources and quality of warrant of the ECers' beliefs (which, remember, for Van Till includes IDers). He notes that the ECers' sources of warrant for particular beliefs include the following:

1. The received interpretation of revered text.
2. Statements by religious authority figures—pastors, church-school teachers, parents ...
3. Statements by scientific authority figures, especially by Christians trained in science who reinforce the received view.
4. Conclusions based on personal research as a trained scientist who is an active participant in a relevant professional science.[9]

Let us call 1–4 source-of-warrant set A. I can see no reason why these sources in and of themselves discredit an ID scientist. Consider that the sources of warrant for the beliefs of a non-ID scientist might be as follows:

5. The (very different) received interpretation of the (very same?) revered text.
6. Statements by nonreligious, or at least non-ID authority figures—biologists, paleontologists, secular-school teachers, parents ...
7. Statements by scientific authority figures, especially by nonreligious, or at least non-IDers, trained in science who reinforce the received view.
8. Conclusions based on personal research as a trained scientist who is an active participant in a relevant professional science.

Let us call 5–8 source-of-warrant set B. Why is source-set B somehow inherently superior to source-set A? If source-set A results in EC folk science, what makes source-set B *not* folk science? I shall say more about this later.

Apparently wishing to show that ECers are merely importing their bias into the interpretation of the data, Van Till lists "some examples of the fundamental worldview beliefs that episodic creationism might wish to see empirically warranted or reinforced." The list includes:

1. The universe needs a Creator.
2. The Creator's action should be evident to all observers (Rom. 1:20).
3. Today, the empirical natural sciences (if conducted without naturalistic "blinders") should be able to uncover forms of this evidence especially convincing to the modern mind.[10]

Let us call 1–3 hoped-to-be-confirmed-worldview-beliefs set A. I see no reason why hoping to have these worldview beliefs confirmed should, by itself, discredit an ID scientist.[11] Consider that the hoped-to-be-confirmed worldview beliefs of a non- or anti-ID scientist might be as follows:

4. The universe does not need a Creator.
5. There are no observable actions of any purported Creator.
6. Today, the empirical natural sciences (if conducted without EC or ID "blinders") should be able to uncover naturalistic mechanisms especially convincing to the modern mind.

Let us call 4–6 hoped-to-be-confirmed-worldview-beliefs set B. Why should we think that set B is inherently scientifically superior to set A? Why are naturalistic hoped-for worldview assumptions "science" while EC hoped-for worldview assumptions are "folk science"? Should we really think that EC scientists are discredited because they are "motivated by worldview beliefs rooted in biblical and theological commitments" while supposing that non- or anti-EC scientists are vindicated because they are motivated by worldview beliefs rooted in secularism, materialism, or naturalism which rules out *a priori* any intelligent proximate causation? This, it seems to me, comes close to being mere bias. There is no compelling argument here to show the scientific superiority of one over the other.

## Cautions Regarding the Presumed Truth of the RFEP

The reason, it would appear, that source-of-warrant set B and hoped-to-be-confirmed-worldview-beliefs set B are deemed superior to their counterparts, according to Van Till, is because this is what scientists *presume* to be the case. Van Till writes:

> So what do scientists ordinarily *presume* about the universe's formational economy? ... I think we all know how nearly all professional scientists ... would answer this question. Scientific theorizing regarding the formational history of the universe ... proceeds on the *presumed* applicability of what I have come to call the robust formational economy principle. For the sake of scientific theorizing we *assume* that the formational economy of the universe is sufficiently robust to account for the actualization in time of all of the types of physical/material structures and all forms of life that have ever existed.[12]

Van Till goes on to admit that "[t]hat *presupposed* principle is almost never stated explicitly ..." Why is this assumed scientific principle "almost never stated explicitly" by scientists? "Why is it taken for granted and not repeatedly held up for reexamination?" Van Till's answer is as follows: "For essentially the same reason, I believe, that the heliocentric structure of the solar system is no longer brought up for scrutiny in the way that it was in the time of Galileo."[13]



*An open and honest search for the truth about the physical world, ... entails that scientists remain open to the possibility that their fundamental principles, theories, and assumptions may need revision.*

This is a very curious reason for Van Till to offer for the truth of the RFEP and the falsity of EC. It was in fact an *a priori* assumption that the earth was at the center of the universe which generated opposition to heliocentrism. Scientists "presumed" and "assumed" geocentrism until it became virtually incorrigible that heliocentrism was the best way to account for the data.

If it is not already obvious, I am suggesting that Van Till and others who hold methodological naturalism as an *a priori* principle parallel more closely the geocentrists than the heliocentrists. But genuine science, it seems to me, is an attempt to get a true picture of the world by means of empirical investigation; it is not a set of foregone conclusions based on nonnegotiable *a priori* assumptions and presumptions. An open and honest search for the truth about the physical world, in other words, entails that scientists remain open to the possibility that their fundamental principles, theories, and assumptions may need revision.

Having said this, Van Till would be warranted in urging that methodological naturalism in the past has been extraordinarily fruitful scientifically. But so was Newtonian physics. Just because something has been extraordinarily fruitful thus far does not entail that it is the last word. Someone operating with a truly scientific spirit must always be open to the possibility that his or her present theory, no matter how powerful and fruitful it has been thus far, may need to be revised in the future in the face of compelling evidence.

Of course, I am not advocating that scientists be open to theory revision "at the drop of a hat." It would be unhelpful and unwise if scientists discarded powerful, accepted theories in the face of any and all evidence which seemed to contradict them. Michael Polanyi writes:

> It is the normal practice of scientists to ignore evidence which appears incompatible with the accepted system of scientific knowledge, in the hope that it will eventually prove false or irrelevant. The wise neglect of such evidence prevents scientific laboratories from being plunged forever into a turmoil of incoherent and futile efforts to verify false allegations.[14]

So there is something to be said for presupposing, in the face of apparently contradictory evidence, that the generally accepted scientific theory is correct and will eventually explain the apparently contradictory data.

However, this necessary presumption in favor of the regnant theory must not be allowed to topple over into a dogma which, in principle, is incontrovertible, for it is always a possibility that some purported counter-evidence to a theory may actually be legitimate and genuine. If this is not recognized, major crimes against the acquisition of scientific knowledge may end up being perpetrated by scientists themselves.

At what point then should alleged counter-evidence be viewed as a *bona fide* defeater of the dominant theory? Polanyi continues: "[T]here is, unfortunately, no rule by which to avoid the risk of occasionally disregarding ... true evidence which conflicts ... with the current teachings of science." The reason for this is because the question of precisely when it is appropriate to discard the present theory as inadequate is not itself a scientific question; it is an evaluative one. It is—as are all judgment calls of this sort—an indeterminate and unspecifiable judgment call on the part of the scientist (or scientific community). Thus, there is a very real danger that true and legitimate counter-evidence will be dismissed on account of the scientist's commitment to reigning theories, presuppositions, and assumptions. As an example of this, Polanyi describes the initial resistance of the scientific community to the reality of meteorites. He writes:

> During the eighteenth century, the French Academy of Science stubbornly denied the evidence for the fall of meteorites, which seemed massively obvious to everybody else. Their opposition to the superstitious beliefs which a popular tradition attached to such heavenly intervention blinded them to the facts in question.[15]

There is an important lesson germane to the topic at hand that we can learn from Polanyi's meteorite example. He develops the example further:

> Ordinary people were convinced of the fall of a meteorite when an incandescent mass struck the earth with a crash of thunder a few yards away, and they

tended to attach supernatural significance to it. The scientific committees of the French Academy disliked this interpretation so much that they managed, during the whole of the eighteenth century, to explain the facts away to their own satisfaction.[16] It was again scientific scepticism which brushed aside all the instances of hypnotic phenomena occurring in the form of miraculous cures and spellbinding, and which—even in the face of the systematic demonstrations of hypnosis by Mesmer and his successors—denied for another century after Mesmer's first appearance the reality of hypnotic phenomena. When the medical profession ignored such palpable facts as the painless amputation of human limbs, performed before their own eyes in hundreds of successive cases, they acted in a spirit of scepticism, convinced they were defending science against imposture. We regard these acts of scepticism as unreasonable and indeed preposterous today, for we no longer consider the falling of meteorites or the practice of mesmerism to be incompatible with the scientific world view. But other doubts, which we now sustain as reasonable on the grounds of our own scientific world view, have once more only our beliefs in this view to warrant them. Some of these doubts may turn out one day to be as wanton, as bigoted and dogmatic as those of which we have now been cured.[17]

Although I am willing to concede that something like Van Till's RFEP may well turn out to be correct, I do, taking Polanyi's warning seriously, want to leave *some* room for the possibility that it might not be correct. Again, if it is appropriate to take Polanyi's cautionary tale to be instructive, I would also encourage Van Till (and all scientists) to leave room for the possibility that it might be incorrect. It is crucial that scientists remember that their strongly held assumptions, theories, and presuppositions may, at some point, prove inadequate or incorrect and stand in need of reconsideration and revision.

So, does Van Till leave room for the possibility that his RFEP may be incorrect? Yes, but it is not clear that he leaves sufficient room; it is not clear that he takes very seriously the possibility that the RFEP could ever be shown to be false or inadequate. Concerning his judgment that it *is* correct he writes: "[I]t is a judgment that I have made with confidence."[18] Given that Van Till is a physicist and astronomer, the recent "anthropic" discoveries in cosmology would understandably enable him to make this judgment "with confidence" with respect to his area of specialty. What is somewhat more surprising is the ease with which Van Till extrapolates this confidence in the RFEP to biotic evolution. He declares:

> I believe that this striking success in the physical sciences provides very strong encouragement for the assumption that the RFE principle would be equally warranted in theorizing about the formational history of life forms.[19]
>
> My own choice strongly favors the concept of a creation optimally gifted by the Creator with a robust and gapless formational economy—yes, even robust enough to make possible the evolutionary continuity envisioned by cosmologists and biologists.[20]
>
> [G]iven my high expectations regarding the wealth of self-organizational and transformational gifts the Creator has given to the creation, I am not at all surprised to hear the confidence that biologists have come to have in the scientific concept of biotic evolution and the RFE principle that it presumes to be applicable.[21]
>
> In the context of theorizing about the formational history of the universe, contemporary natural science ordinarily *presumes* that these gaps in our knowledge could, in principle, be filled at some time in the future. The scientific community *fully expects* that further research will provide the basis for more adequate and comprehensive theories regarding the formational history of the universe and the life forms that inhabit it. *One of the most basic—but seldomly explicitly stated—presuppositions* of the natural sciences, especially relevant to the formulation of theories regarding the formational history of the universe, is that the formational economy of the universe is sufficiently robust to make possible the actualization of all inanimate structures and all forms of life that have ever appeared in the course of time. I call this proposition the robust formational economy principle. In my judgment, it is ... *one of the most fundamental presuppositions of the natural sciences.*[22]

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*Van Till has enormous assurance of the truth of the RFEP and tremendous confidence that it will be adequate to the task of accounting for all of the universe's complex structures, including those in biology.*

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The extraordinary confidence expressed in these claims concerning the truth of the RFEP and the potential of the scientific community to provide an "adequate and comprehensive" explanation of the "formational history of the universe" borders on credulity. It brings to mind Mary Midgley's comment on a not too dissimilar panegyric by Peter Atkins. She says:

> It is worthwhile to remember [these kinds of remarks] when we come across the frequently held opinion that hard-headed incredulity is a central part



> of the scientific character. For scientists, as for anybody else, incredulity is bound to be selective ... Claims like these are chiefly interesting as proofs of what I have called a faith. They have, I think, very little to do with their official subject-matter—with any real question about the content and prospects of science itself."[23]

Clearly Van Till has enormous assurance of the truth of the RFEP and tremendous confidence that it will be adequate to the task of accounting for all of the universe's complex structures, including those in biology.

*I think questions can and should be raised concerning the appropriateness of a scientific methodology which does not take seriously the possibility that EC [episodic creationism] could be true.*

But is it appropriate to display this much confidence in a theory prior to its actually being confirmed empirically? Given that scientists are supposed to be open to what empirical investigation reveals, Van Till looks dangerously poised to commit something like the "meteorite fallacy" in Polanyi's example above. The confidence of his rhetoric indicates that for him the truth of the RFEP is virtually a foregone conclusion. This notwithstanding, Van Till does acknowledge the theoretical possibility that the RFEP may be falsified. (Indeed, if he did not, the theory would fail on the Popperian account to qualify as a *scientific* theory.) He writes:

> Among the requirements that intellectual humility would impose is this one: an unqualified answer, whether yes or no [to the question as to whether the creation's formational economy is sufficiently robust to make possible the actualization of all of the physical/material structures and all of the life forms that have ever come to be actualized in the course of the creation's formational history], is not humanly achievable because we will never know all of the elements in the creation's formational economy.[24]

Some comments regarding this claim are in order. First, the assertion that "we will never know all of the elements in the creation's formational economy," while most likely true, is itself a philosophical assumption and not a scientific fact. This assumption itself can easily be taken as a reason for denying ontological gaps in the formational economy. It favors a yes answer to the question as to whether the universe's formational economy is maximally robust; it suggests that if we *did* know everything (or at least enough) the particular gap(s) in question would disappear. But this itself is an assumption which merely begs a very important question.

Second, it is hard to believe that Van Till takes seriously the possibility that the RFEP may actually turn out to be false. While giving a paper entitled "If the Creation is Equipped to Evolve, Is God a Deist?" at the 2001 annual meeting of the American Scientific Affiliation, Van Till made the comment that his belief in the RFEP was a "bet." He claimed that he believed it more probably true than false, but not certain. However, Van Till's attempt to mitigate his commitment to the RFEP rings hollow—unless it is a common practice of Van Till's to label all theories that he thinks more probably false than true "folk science." The employment of such a scorchingly derogatory term to EC betrays Van Till's virtually absolute assurance that the RFEP is correct (true).

I think questions can and should be raised concerning the appropriateness of a scientific methodology which does not take seriously the possibility that EC could be true. Someone with Van Till's assurance that the RFEP is correct surely is going either to miss, ignore, or attribute to ignorance whatever evidence could be adduced in favor of a proximate intelligent cause. After all, we do not, nor will we ever, "know all of the elements in the creation's formational economy."[25]

## Van Till's Critique of Intelligent Design

Now let us move to Van Till's explicit critique of ID. He lists six specific objections.[26] I shall treat them in order.

First, Van Till claims that ID is "unable or unwilling to give a candid and public definition of the very term that names the movement ... I cannot begin to evaluate the claim [that X was intelligently designed] until I know what you mean when you say that 'X was intelligently designed.'" In short, Van Till is wanting IDers to give a clear and precise definition of what constitutes something being intelligently designed. This is a well-aimed objection in principle, because it is important that terms be defined as clearly

as possible, especially when much turns on them. Van Till writes:

> [T]here is an intolerable (and, I presume, intentional) ambiguity in the way in which proponents of ID use the very word that names their movement—"design." In modern usage, design is an act of mind—the conceptualization of something for the accomplishment of a purpose. Wholly distinct from this mindful and purposeful action of design is the additional action of actualizing what was first designed—the formation of parts and/or the assembly of component parts into a system that functions to accomplish the original purpose. This action of forming/assembling is not mind-like but hand-like. In other words, forming/assembling is an act of intervention.
>
> For years I have been asking the proponents of ID to make the necessary distinction between the mind-like action of design ... and the hand-like action of forming/assembling. That distinction must be made before anyone can begin to evaluate the standard claim that "we have positive empirical evidence that X must have been intelligently designed." One must know whether one is evaluating evidence that something was (a) thoughtfully conceptualized, or (b) formed/assembled by non-natural means.[27]

I think this point must be conceded to Van Till. I do not believe that the proponents of ID have offered a clear explication of the mechanism by which proximate intelligent causation is effected. But then, I wonder how forceful this objection to ID actually is. If the concern here is that ID has not (yet) given adequate theoretical explanation for how biological organisms, which have been conceptually designed, are constructed, then the first thing which must be said in defense of ID is that it is a fledgling field and cannot be expected to have every theoretical aspect of all that it entails fully worked out at this stage. It is appropriate for Van Till to raise this issue for ID proponents to consider, but to demand that a newly developing science have in hand a complete and comprehensive theoretical framework is unreasonable. IDers are sufficiently busy at present making the preliminary case that proximate intelligent causation is discernible in nature; if and when that is successfully shown, problems of construction, of which ID proponent William Dembski, for example, is aware, can be undertaken.[28]

Furthermore, *if* the thrust of this objection is to lend credibility to the RFEP by means of suggesting that it is implausible that a nonmaterial designer could causally interact with matter, then it might be worth pointing out that Van Till himself believes that this is possible, since he is a theist and presumably believes that God (a nonmaterial substance) created the material world. Therefore, even his own position cannot escape this objection. Van Till must acknowledge that a nonmaterial substance can causally interact with matter, because this must have taken place at least once at the initial creation of physical reality.

Van Till's primary worry seems to be that to invoke a proximate, intelligent, hand-like cause in the assemblage of matter will carry the IDer too far from the Creator of Christian theology. That is to say, it may leave the IDer with something "uncomfortably close to Plato's Demiurge (Artisan/Craftsman), who could do little more than to impose form on recalcitrant/incapable matter."[29] But I do not find this objection convincing for at least two reasons. First, it may be logically impossible to infuse matter at the inception of the universe with the formational capabilities required to bring about, say, complex, morally aware beings such as us, who are free of will. It may be logically impossible because to bring about such beings requires *information*, and information may well be *ontologically distinct* from matter and the laws that govern matter. Information might exist with a whole different kind of being altogether. If this is the case, then it is a logical requirement that the information somehow be connected or attached to matter because the information is not itself the same thing as matter. If this is logically necessary, then this is how God would have had to have operated, since in orthodox Christian theology even God cannot do the logically impossible. It may, then, be logically necessary that information requires something like, to use Van Till's phrase, "extra-natural assembly."

*Van Till's primary worry seems to be that to invoke a proximate, intelligent, hand-like cause in the assemblage of matter will carry the IDer too far from the Creator of Christian theology.*

Second, even if such extra-natural assembly is not necessary logically, even if matter could have been somehow "gifted" at the big bang with the potential to possess all the information necessary for beings like us eventually to come into existence, that would not *constrain* God, who is perfectly free, to do it that way. Even if it is the case that God *could* have given the universe a robust formational economy, it is also true that, being perfectly free, he may have chosen not to do so; he may have chosen to create episodically, and that not at all on account of him being a hapless, constrained Demiurge. Of course, this raises the theological question as to *why* God might have chosen to create episodically; why would God want to intervene along the way assuming that he could have done all of his creating at once at the outset? I think some possible answers might be either that it is intrinsically good that



*If we are describing the world properly, our explanations can only be as simple as the world actually is. How simple the world is cannot be determined a priori, however, but must be determined empirically.*

God continually interacts creatively with a world he loves, or that evidence of proximate intelligent causation might induce certain attitudes within us that are good for us to have. If it is not possible to front load particular kinds of information, and/or if an answer such as the ones I have briefly suggested can be given to make intelligible God's creating episodically, then Van Till's first objection to ID has not won the day.

Van Till's second objection to ID involves his claim that the proponents of ID labor under the misapprehension that something must either be due to natural processes or ID, but they ignore the possibility that "Creation's system of 'natural' processes [may] be intelligently designed." In other words, natural processes themselves may have been intelligently designed remotely at the beginning to unfold the way they have so that there is no need for any proximate intelligent causation during this unfolding process. (This intelligently designed system of natural processes, of course, is the RFEP). Van Till objects that IDers do not take into account the possibility of the RFEP.

This objection might prompt ID advocates to clarify their conception of design. For example, it is true that Dembski's Explanatory Filter (EF) tends to leave one with the impression that design can only be inferred after chance and necessity (i.e., after chance and the laws of nature) are first ruled out as explanations. To wit, Van Till seems correct in insisting that the very laws of nature themselves are designed, that the universal and constant laws of the universe are intelligently caused. Therefore, it would seem appropriate that ID proponents make it explicit that proximate intelligent causation, the kind of intelligent causation which the EF is meant to identify, is not logically incompatible with remote intelligent causation, the kind of intelligent causation which Van Till champions with his RFEP. The IDer, in other words, need not deny *remote* intelligent causation when the evidence points to something like the RFEP, but this does not rule out the possibility that the evidence in at least some instances, such as in the Cambrian explosion of phyla or the bonding between nucleotide bases along the message-bearing spine of the DNA helix, is pointing to the conclusion that there also has been *proximate* intelligent causation along the way. IDers should make it clear that proximate and remote intelligent causation are not logically incompatible, and that just because something is not designed in the first sense does not entail that it has not been designed in the second sense. IDers do not deny that in many instances something like the RFEP has been at work; they only assert that in some other instances the evidence suggests proximate intelligent causation as well. Thus, this second of Van Till's objections seems to be an attempt to pin IDers on the horns of a false dilemma; either all design is remote, or all design is proximate—which will it be? Nothing, however, prevents IDers from responding: "Sometimes it is the one, sometimes the other."

It is understandable that Van Till finds it uncomfortable to bring in a supplemental causal power only on some occasions. To do so is perhaps less parsimonious and elegant than to attribute all design to remote causes. However, good science is empirical. Since logic does not make the remote and proximate intelligent causation mutually exclusive of one another, an IDer could very well invoke either one or the other as is called for by the particular case in question *if* that is what the data calls for. In this way, we would be *allowing the data to determine which cases, if any, are which,* and not making an *a priori* determination on the basis of a philosophical commitment that *all* cases must be either one or the other. After all, if we are describing the world properly, our explanations can only be as simple as the world actually is. How simple the world is cannot be determined *a priori,* however, but must be determined empirically.

What we have just said connects closely with Van Till's third objection, which has to do with the Explanatory Filter (EF). Here Van Till claims that the EF does not pay adequate attention to the role of such things as "emergence" in the universe. According to Van Till, the universe has enormous "potentiality space" to throw up all sorts of curious and complex things. The EF, he holds, does not allow sufficiently for all of this potential emergence to come about by means of "emergent capabilities, contingencies, and feedback mechanisms."[30]

Here the IDer merely has to point out that Van Till is assuming *a priori* that *all* of this

potential for emergence in the universe exists. However, it is neither logically necessary nor self-evidently true that this is the case. IDers *may* be able to make a convincing case that a complex system required proximate intelligent causation. If ID succeeds in making this case, then ID may have contributed something significant to science. If, on the other hand, ID fails to make this case, then ID itself has failed and should be relegated to the dustbin of failed scientific projects. The important point is this: the possibility that ID may be onto something should not be ruled out *a priori*. As open and liberal-minded seekers of the truth, we should give ID a chance and see what comes of it.

Fourth, Van Till worries that IDers are calling us to celebrate instances where the processes within the universe are not fully self-sufficient, instances where the universe is not, to use Van Till's phrase, "fully gifted." IDers, Van Till fears, seek out instances where the RFEP seems insufficient and then celebrate these "gaps" in the universe's formational economy.

The ID response to this is likely to be: What is wrong with that? If the gaps *really are there*, then what is wrong with acknowledging that to be the case? What IDers appear to be "celebrating," if anything, is the greatness of the mind of the being(s) who designed the complex systems which (purportedly) require proximate intelligent causation. (This, of course, would not preclude them from also celebrating those systems and entities which can be accounted for by means of remote intelligent causation.) After all, Van Till himself also wants to celebrate the activity of an intelligent designer, though he denies the need for *proximate* intelligent causation and assumes that all intelligent causation is *remote*. But there does not seem to be any good reason to think that celebrating one is inherently licit while celebrating the other is necessarily illicit.

Van Till's fifth objection to ID centers on his claim that IDers have an inconsistent attitude toward the RFEP. Sometimes they seem to celebrate a gapless formational economy, as in cosmological fine-tuning; at other times, they seem to emphasize gaps, as in certain biochemical complexities and the complexities of DNA. Van Till seems to want to ask IDers, "Which is it: a remote intelligent cause or a proximate intelligent cause?"

This issue already has been addressed under the third objection. Suffice it to say here that the IDer can be claiming to be humble and open before the data, *allowing them* to determine which explanation best fits them. In the case of cosmological fine-tuning, IDers seem to believe that something more akin to the RFEP (remote intelligent causation) seems to be true (accurate, correct, most plausible). In the case of microbiology and DNA, however, they seem to believe that proximate intelligent causation is the best (most probably correct, most plausible, most accurate) explanation.[31] What the IDer will reject here is Van Till's insistence that *all* of the data be classified as either all one or the other. The IDer will allow the data to speak for themselves without being forced to fit into one or the other preordained category.[32]

Finally, Van Till accuses ID of being equivalent to what he calls "punctuated naturalism." Punctuated naturalism involves the notion that IDers often characterize natural processes as "'undirected,' 'purposeless,' 'materialistic,' 'naturalistic,' and the like" while at the same time allowing that "whatever is done by atoms, molecules, etc., is effectively conceded to naturalism." As a result, IDers, because they fail to recognize that "an atheistic worldview" cannot "account for any of the universe's formational or operational capabilities," falsely conclude that "the universe's naturalistic formation must [therefore] be punctuated by occasional episodes of 'ID.'"[33]

*For Van Till, all design has been front-loaded into Creation's system of "natural" processes. Consequently, there is no reason to look for evidence of proximate intelligent causation in nature.*

This objection to ID cannot possibly be right. If ID proponents really did believe that "whatever is done by atoms, molecules, etc." is "undirected" or "purposeless," then Van Till could not possibly have accused them in his previous objection of having an inconsistent attitude toward the RFEP. Recall that Van Till's fifth objection was to point out that IDers sometimes invoke something like the RFEP and then, at other times, invoke proximate intelligent causation. But how could IDers ever invoke anything akin to the RFEP (remote intelligent causation), such as Van Till himself acknowledges they do when appropriating cosmological fine-tuning arguments, if they really were "punctuated naturalists" who thought that "whatever is done by atoms, molecules, etc." is "undirected" and "purposeless"? Clearly, then, IDers are not "punctuated naturalists."

## Conclusion

Van Till's critique of ID is so far less than fully persuasive. Although Van Till would agree with proponents of ID that God is the Creator and Sustainer of the cosmos and that philosophical materialism or naturalism is thereby false, he contends against ID that theists (in particular, the Christian community) should lay claim to the RFEP *as the sole locus* of evidence for the activity of a designer. For Van Till, all design has been front-loaded into Creation's system of "natural" processes. Consequently, there is no reason to



look for evidence of proximate intelligent causation in nature. However, it is not clear that adopting an *a priori* methodological principle that makes proximate intelligent causation virtually impossible is the best way for science to proceed (perhaps especially when being conducted by theists). Whether or not Creation has been adequately "gifted" at its inception[34] to actualize all of the complex systems which it encompasses is not a question that can ever be settled definitively, and therefore the possibility of proximate intelligent causation should not be ruled out in principle at the outset. While Van Till is correct to emphasize that Creation's formational economy, especially in the realm of cosmological fine-tuning, is evidence of design and should be embraced by design advocates (as we have seen that it is), he inappropriately forecloses on the possibility that there may be empirical warrant for proximate intelligent causation as well. ID may be incorrect, and something like the RFEP may end up being correct, but it seems to me that we cannot be confident of this until we have given ID a fair chance to make its case.[35] ✯

*While Van Till is correct to emphasize that Creation's formational economy ... is evidence of design and should be embraced by design advocates ..., he inappropriately forecloses on the possibility that there may be empirical warrant for proximate intelligent causation as well.*

## Notes

[1]An earlier version of this paper was read at the 2001 Annual Meeting of the American Scientific Affiliation in Manhattan, Kansas. I wish to thank the participants of that conference for their helpful feedback and comments. I especially wish to thank Howard Van Till for the friendly comments and helpful suggestions he offered to me at that meeting.

[2]This point was made in his lecture, "Biblical Creation Narratives, Folk Science, & Natural Theology," at the Oxford/Templeton Seminar Series on Science and Religion at Oxford University on 1 August 2000. Here Van Till claimed: first, that ECers fail to distinguish conceptually between the idea that the Bible has been inspired by God and the assertion that it was written by God; second, that ECers neglect the influence of the Bible's historical and cultural context; third, that they treat inspiration as a shortcut to bits of information known to God alone, and, finally, that they idolize the Bible as a collection of inerrant statements which are held to be beyond human critique.

A number of quotations in this paper are taken from the overheads used in Van Till's "Biblical Creation Narratives" lecture. It should be understood, however, that content from a lecture is often meant to be stimulating and provocative, and it does not, therefore, necessarily represent the author's final, considered position on a given matter in the same way that a formal, polished, published piece of work does. Consequently, I do not view the lecture material as reflecting Van Till's last word on the matter, but merely as a sketch of interesting and provocative publicly presented ideas with which it might prove fruitful to interact. I engage with Van Till's lecture ideas in that spirit, and it is in that same spirit that I make my replies.

[3]Phillip Johnson, "The Wedge," *Touchstone* (July/August 1999): 23. Emphasis mine. It is true that when talking with Christians who share his assumptions, Johnson seems to believe that unbiased science will confirm his EC reading of the Bible. But Johnson nonetheless is aware that this *a priori* assumption must be confirmed by scientific observation and must not itself be put forward as evidence in a *scientific* debate.

[4]Van Till himself grants that "[r]eligious commitments frequently serve as a stimulus for a scientist to select and carry out a particular program of research" in "The Character of Contemporary Natural Science" in *Portraits of Creation*, ed. Howard Van Till, et al. (Grand Rapids: Eerdmans, 1990), 148.

[5]Quotation from the overheads of "Biblical Creation Narratives." Emphases Van Till's.

[6]Mary Midgley, *Science as Salvation* (New York: Routledge, 1992), 167. For further testimonies of instances where Christian faith has been influential in assisting scientific discoveries, see John Hedley Brooke, *Science and Religion* (Cambridge: Cambridge University Press, 1991), chaps. 1 and 6; and Del Ratzsch, *Nature, Design and Science* (Albany, NY: State University of NY Press, 2001), esp. pp. 139–40.

[7]VanTill, "Biblical Creation Narratives," emphases his.

[8]Ibid.

[9]Ibid.

[10]Ibid.

[11]Van Till would like to see (1) confirmed. That is the point of his RFEP.

[12]Howard Van Till, "Partnership: Science & Christian Theology As Partners" in *Science and Christianity: Four Views*, ed. Richard F. Carlson (Downers Grove: InterVarsity, 2000), 216 (emphasis mine).

[13]Ibid.

[14]Michael Polanyi, *Personal Knowledge* (Chicago: University of Chicago Press, 1958), 138.

[15]Ibid.

[16]F. Paneth writes: "Scientists in other countries were anxious not to be considered as backward compared with their famous colleagues in Paris," which explains why "many public museums threw away whatever they possessed of these precious meteorites: it happened in Germany, Denmark, Switzerland, Italy and Austria" in "Science and Miracles" in *Durham University Journal* 10 (1948–9): 9, quoted by Polanyi, *Personal Knowledge*, 138, n. 2.

[17]Polanyi, *Personal Knowledge*, 274–5.

[18]Carlson, *Science and Christianity*, 233.

[19]Ibid., p. 232.

[20]Howard Van Till, "Creation: Intelligently Designed or Optimally Gifted" in *Theology Today* (1998): 364 (emphases mine).

[21]Carlson, *Science and Christianity*, 233.

[22]Van Till, "Creation: Intelligently Designed or Optimally Gifted," 351 (emphases mine).

[23]Midgley, *Science as Salvation*, 89–90.

[24]Carlson, *Science and Christianity*, 231.

[25]Van Till frequently appeals to present ignorance as a way of maintaining assurance that, in the face of current gaps, the RFEP will eventually be vindicated with further knowledge and so therefore there is no need to invoke a proximate intelligent

cause to "close" the gaps. The language he uses to express this is in terms of "epistemological gaps" not (necessarily) entailing "ontological gaps" (see Van Till, "The Creation: Intelligently Designed or Optimally Equipped," 356–7 and ——, "Partnership: Science and Christian Theology as Partners in Theorizing," 231 *et passim*.) However, I have been told by ID proponents that this is a misunderstanding of, and misuse of, the design inference. The point of the design inference, when used correctly, is supposed to be that it makes the best sense of the data, of what we know; it is not meant to be a default position which is to be taken in the absence of knowledge. Just as in a murder trial a jury convicts someone on the basis of the evidence, so one infers design on the basis of the evidence. The jury does not reach its verdict on account of what it does not know, but on account of what it does know, on account of the evidence. Whether or not this is a distinction without a difference, I am not certain.

[26]These are taken directly from the overheads of the "Biblical Creation Narratives" lecture.

[27]Howard Van Till, "Robust Formational Possibilities," http://listserv.omni-list.com.

[28]William Dembski, "Intelligent Design Coming Clean," http://listserv.omni-list.com.

[29]Quotation from the overheads of "Biblical Creation Narratives."

[30]Ibid.

[31]Stephen C. Meyer, for example, argues exactly this in "A Qualified Agreement Response" in Carlson, *Science and Christianity*.

[32]Van Till complains:

> Here then is the puzzling ambivalence. In his reflections on the cosmological fine-tuning of the universe, Meyer's conclusion of the need for ID is based on an appeal to the remarkable features (special values of cosmological parameters) that the universe *does* exhibit ... Meyer argues, in essence, that if the RFE principle is *true*, then ID is also true. But in his reflection on the character of *biological* structures, the argument seems based on an appeal to certain features (specified formational capabilities) that the universe *does not* exhibit. In essence (sic) Meyer appeals to biological examples to argue that if the RFE principle is *false*, then ID must be true. Putting these two arguments side by side, it looks like the old trick line "heads I win, tails you lose" ("A Partnership Response" in Carlson, *Science and Christianity*, 194, emphases his).

Interestingly, this argument can be turned on Van Till. Jean Pond does exactly this when she writes:

> I think there are problems with Christian ownership of the RFE principle. Are we saying that (1) if the RFE principle is true, theists win, and (2) if the RFE principle is not true ..., the naturalists win? The latter doesn't work, since the requirement for periodic supernatural interventions negates naturalism. So we are faced with claiming that theists win either way, which hardly seems sporting.
>
> I can imagine a proponent of naturalism raising his or her hand and saying, "Excuse me? Are you saying that (1) if we can't explain how the vertebrate eye evolved, that is evidence for God, and (2) if we *can* explain how the vertebrate eye evolved, that is even better evidence for God? Is there *any* evidence that you would accept as arguing against the existence of God?" ("An Independence Response" in Carlson, *Science and Christianity*, 244, emphases hers).

[33]From Van Till, "Biblical Creation Narratives."

[34]It is important to remember that all agree that creation has been "fully gifted." The disagreement turns on *when* the gifting takes place. Van Till claims that all the gifts were given at the beginning; IDers claim that some gifts were given along the way. But no one in the discussion denies that God has fully gifted the universe.

[35]While the RFEP presumes that there are no gaps in the universes formational economy, those who champion proximate intelligent causation might be supposed to presume that there are such gaps. Neither of these presumptions, however, should be dogmatically held *a priori*. Whether or not there are gaps in the creation's formational economy is an open question, and it can only be settled by empirical investigation.



# Is the Creation a "Right Stuff" Universe?

*Does the universe, the creation to which God has given being, have the requisite resources, capabilities and potentialities (the "right stuff") to actualize – without need for supplementary acts of form-conferring divine intervention – every kind of physical structure and biological organism that has ever appeared in the universe's formational history? Yes, say proponents of a fully-gifted creation perspective. No, say advocates of Intelligent Design and other forms of episodic creationism. The relative merits of these two views, along with the manner in which proponents argue their cases, are the focus of concern in this overview.*

*By the formational economy of the universe, I mean the set of all of the universe's resources ..., formational capabilities ..., and potentialities ... that have contributed to the formational history of the universe.*

At the invitation of the *PSCF* Editor, I have prepared this paper to accompany Mark Discher's essay, "Van Till and Intelligent Design." I did not, however, provide a point by point rebuttal of that essay because the "work" most frequently cited by Discher is not anything that I have published, but a set of notes that I used as the basis for a lecture. Unfortunately, Discher was not present at that lecture and did not benefit from the discussion that, by design, it stimulated. Readers who are genuinely interested in what I have written regarding the relative merits of a fully-gifted creation approach and the strategy of the Intelligent Design (ID) movement will find the relevant references in the question and answer overview that follows.

## Questions and Answers on the Central Issues

### 1. What is the RFEP?

The peculiar acronym RFEP stands for the *Robust Formational Economy Principle*. By the *formational economy* of the universe, I mean the set of all of the universe's *resources* (such as its elementary particles and their modes of interaction), *formational capabilities* (such as the capabilities of atoms to form molecules), and *potentialities* (such as all possible molecular configurations) that have contributed to the formational history of the universe. To say that the universe satisfies the RFE Principle is to posit that the formational economy of the universe is sufficiently robust (amply equipped) to make possible—without need for supplementary acts of form-conferring divine intervention—the actualization of every category of physical structure and biological organism that has ever appeared in the universe's formational history.

Stated slightly differently, a universe that satisfied the RFE Principle would have *no gaps in its formational economy*. Nothing would be missing from the universe's resources, capabilities, or potentialities that would prevent it from actualizing (assembling by the exercise of its formational capabilities) any type of physical structure (like a planet or a protein) or any type of organism that has appeared in the course of time. The RFE Principle is a postulate regarding the character of the universe, not a claim for completeness or certainty in our knowledge of it.[1]

Readers who find the acronym RFEP burdensome may wish to think of it in the less formal terminology of a "right stuff universe principle" that says, in effect, the universe has "the right stuff" to make possible something as remarkable as an uninterrupted evolutionary development of physical structures and life forms.[2]

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## 2. If the universe satisfies the RFEP, is divine creative action thereby excluded or somehow made "remote"?

Not at all. The RFEP (or the *right stuff universe principle*) says nothing either for or against the reality of divine action in the universe. For Christians the question is not, "Does God act in the creation?" By both conviction and experience, we profess that God does act in the world and in our lives. No, the question at issue here is, "What is the character of the creation in which God acts?" That's the question to which the RFEP proposes an answer.

Now, if the creation has the particular character described by the RFEP—that is, if the *creation* is a *right stuff universe*—then we would infer that divine creative action of the *form-conferring intervention type* is not necessary to effect the Creator's will for the universe's formational history. The RFEP is silent, however, on all other questions regarding divine action. Divine action in any category other than form-conferring intervention may be as close (proximate) and intimate as one's theology posits.

Some critics have expressed the concern that the absence of gaps in the creation's formational economy effectively confines divine action to the remote past and stands in the way of God's continuing action in the creation. I am baffled by that fear. As far as I know, historic Christian theology has never posited that God is able and/or willing to act only within gaps in the creation's formational or operational economies. That being the case, then the absence of such gaps presents no theological loss whatsoever.[3]

## 3. Why does the scientific community judge that the universe satisfies the RFEP?

The vast majority of scientific investigation, especially of the universe's formational history, is conducted in the context of a working assumption that the universe does indeed possess a robust formational economy—that all manner of physical structures and life forms have been actualized in time by the employment of the universe's formational capabilities to organize its resources into new configurations that were potentially achievable from the beginning. How did this approach come about? On what basis did the scientific community come to accept the RFEP as a working principle?

Many Christian critics have charged that this situation is nothing other than a clear indication that the "scientific establishment" (whatever that means) has sold its soul to a God-denying, naturalistic world view. In my judgment, such a charge is both profoundly inaccurate and grossly unfair. Maximal naturalism (the view that Nature is all there is, and it needs no Creator to give it being) has no substantive claim to ownership of the RFEP and Christians seriously err, I believe, when they reject the RFEP in the fear that accepting it would weaken their apologetic engagement with atheism.[4]

Is the scientific community's acceptance of the RFEP then merely a convenient presupposition "pulled out of thin air"? Certainly not. On the contrary, *it is a reasonable judgment reached on the basis of the cumulative experience of the natural sciences.* Three centuries ago geology could seriously entertain the theory that a global flood within human history—initiated and directed by supernatural intervention—contributed in a major way to the formation of numerous terrestrial features. However, in the face of both empirical and theoretical considerations, the enterprise of *flood geology* based on that concept failed to provide adequate explanations of actual geological data and was abandoned because of its scientific inadequacy.[5]

*The vast majority of scientific investigation, especially of the universe's formational history, is conducted in the context of a working assumption that the universe does indeed possess a robust formational economy ...*

Similarly, there was a time (from approximately mid-eighteenth to mid-nineteenth century) when biology could seriously entertain the theory that each *species* (later revised to *genus*, then *order*) was independently formed by the direct action of a Creator. But this concept of *special creation*—a working biological theory rooted more deeply in Platonic idealism than in biblical or theological requirements—failed to hold up under the weight of empirical evidence.[6] In light of the observational evidence gathered by Darwin and many others, the scientific community came to the realization that the theory of special creation failed to provide adequate explanations for the biological data and, like flood geology a century earlier, had to be abandoned for its scientific shortcomings.

In both geology and biology, scientific theories in which occasional episodes of supernatural, form-conferring intervention played a central role were given full opportunity for scientific success, but they failed nonetheless. In contrast, theories founded on the premise of the RFEP were demonstrated to be far more fruitful in accounting for an immensely broad range of empirical data. Similar experiences could be recounted in the arenas of astronomy and cosmology in their endeavors to craft theories pertaining to the formational histories of stars, planets, galaxies, the elements, and even space itself. The RFEP is now generally accepted by the scientific community, not out of an anti-theistic prejudice or by arbitrary presupposition, but as the outcome of an extended historical process of evaluating



scientific theories and the meta-scientific principles (like the RFEP) on which specific theories are built.

### 4. Why do I judge that the creation is a right stuff universe?

Having summarized what I believe to be the principal reason why the scientific community judges the RFEP to be a faithful statement about the character of the universe, I want to comment briefly on why I am personally inclined to make a similar judgment—why I judge the *creation* to be a *right stuff universe.*

*My theological perspective leads me to experience everything that the universe is, everything that the universe is capable of doing, and everything that the universe is capable of forming as a manifestation of the Creator's unfathomable creativity ... and unlimited generosity ...*

First, the concept of a creation that is robustly equipped with every physical resource, every formational capability, and every configurational potentiality that would be needed to accomplish the Creator's will for the actualization of all manner of creaturely forms resonates with my theological inclinations. My theological perspective leads me to experience everything that the universe *is*, everything that the universe is capable of *doing*, and everything that the universe is capable of *forming* as a manifestation of the Creator's unfathomable *creativity* (in conceptualizing the remarkable character of the universe) and unlimited *generosity* (in giving such fullness of being to the universe).

I emphasize this because I think Christians often have tended to look for evidence of God's creative work in the wrong places. There is, for instance, a tradition of positing a need for divine creative work in circumstances that we do not (yet) fully understand. *Flood geology* looked to the concept of a supernaturally supervised global flood to explain certain puzzling geological formations, such as marine sediments exposed high in mountainous regions. *Special creation* sought to explain the actualization of each fundamental kind of life form by appeal to a set of independent, form-conferring, divine interventions.[7] In these and many other instances, episodes of extraordinary divine action were posited in part as a means to solve what first appeared to be mysteries for which no "natural" explanations could be found, or even imagined. In the absence of knowledge regarding the processes of mountain building, extraordinary divine action could be posited as the explanation for high altitude marine deposits. In the absence of knowledge regarding genetic variation and differential survival rates, form-conferring divine action could be posited as the explanation for biological diversity and adaptation.

I have grown increasingly uncomfortable with this line of thought. In each case, divine action is brought in as a means of compensating for something the creation was not equipped to do—building mountains, carving canyons, or actualizing new species. In each case, the Creator's action serves to fill in for what the creation *cannot* do. But if the universe is a creation, and if everything the creation *is*, and everything the creation is capable of *doing* and *forming* is a "gift of being" given to it by the Creator, then I believe that we should be inclined to have high expectations regarding what the creation *can* do.[8] If every resource, capability and potentiality is the Creator's gift to the creation's being, then I am inclined to see the Creator in everything that the creation *can* do and to celebrate each of those gifts as a manifestation of the Creator's creativity and generosity.[9]

A second reason for my judging that the *creation* is a *right stuff universe* is that I find myself in agreement with the consensus of scientific judgment on the warrant for taking the RFEP as a faithful description of the universe. I make no claim that it can be proved in the narrow logical sense. No particular scientific theory—and certainly no broad meta-scientific principle like the RFEP—can be proved in this restricted sense. With the scientific community, I am making a judgment call and I have no hesitancy to say so. However, it is a judgment call made, not in a vacuum, but against the background of centuries of scientific experience.

In my recent letter to *PSCF*, I called attention to an episode in which astronomers had vastly underestimated the formational capabilities of atoms to form complex molecules in the cold, low density environment of interstellar clouds.[10] I then commented:

> 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 capabil-

> ities or low probabilities, but of the limited power of human imagination. I could be wrong, but "that's the horse I'm betting on."

As in all scientific judgments, I am open to being shown wrong; but until I see arguments far more convincing than I have seen so far, I am happy to express this judgment candidly. Other Christians have a right to disagree with my evaluation, but it would be a shameful misrepresentation of the truth for them to dismiss the RFE Principle as nothing more than the product of obdurate naturalistic prejudice or to declare that they *know*, or have *empirically demonstrated*, the RFEP to be false.

## 5. What is episodic creationism?

I use *episodic creationism* in place of the more familiar term, *special creationism*. As I noted earlier, *special creation* refers to the once held biological theory that each *species* was independently formed by direct divine action. I use the adjective *episodic* in place of *special* (1) because the relationship of the words *special* and *species* seems largely forgotten, and (2) because of the increasing emphasis placed on positing occasional *episodes* of supernatural, form-conferring intervention. The episodic character of occasional form-conferring interventions contrasts with the continuity of formational processes (usually denoted as *evolution*) now envisioned by modern science.

What is the source of this concept? In the present context, I believe that we have ample warrant for positing that the primary *motivation* for holding an episodic creationist picture of divine creative action (whether of the young-earth or old-earth variety) is the belief that the Bible teaches it, especially in Genesis 1. I would not say that *all* claims made on behalf of episodic creationism derive from the Bible. Numerous appeals to empirical science have been made in support of a concept of this general character, but the concept itself derives from a particular reading of the biblical text and a conviction regarding the correctness of this reading. Of course, the fact that a belief is religiously motivated has no necessary implications regarding its credibility in relation to scientific considerations.

## 6. What is folk science?

Several years ago, some of my colleagues and I employed the term "folk science" in our evaluation of episodic creationism, especially of the young-earth, "creation science" variety.[11] Drawing primarily from the work of Jerome Ravetz, we defined *folk science* as *a set of beliefs about the natural (creaturely) world, beliefs whose primary function is to provide comfort and reassurance that other worldview beliefs – already in place – remain credible, even in the face of substantial criticism from the professional sciences.*

Folk science differs from professional natural science (in its ideal form) in a number of ways, but especially in the matter of motivation. The motivation for professional science should be none other than to learn true things about the character of the world. Working assumptions may be necessary for methodological purposes, but openness to their modification or even refutation is the ideal attitude. This includes, of course, the possibility that even long established and confidently held meta-scientific principles like the RFEP may some day fail. As noted earlier, I would be surprised to see that happen, but I cannot rule it out as a theoretical possibility.

*Folk science has a different primary motivation – the affirmation of worldview beliefs already in place. ... [It] is inherently vulnerable to the effects of prejudice in scientific theory evaluation.*

Folk science has a different primary motivation – the affirmation of worldview beliefs already in place. If the worldview beliefs are correct, this motivation could conceivably be beneficial to one's scientific endeavors. But I am afraid that instances of such benefit are quite rare. Folk science is inherently vulnerable to the effects of prejudice in scientific theory evaluation. In *Science Held Hostage* and *Portraits of Creation*, we evaluated creation science as the folk science of young-earth episodic creationism and documented a number of instances in which scientific theory evaluation had been seriously compromised by the desire to affirm religiously motivated beliefs already in place.[12]

## 7. Are the particular theories of episodic creationist folk science necessarily suspect?

No, the designation of *folk science* speaks only to matters of motivation and does not entail either the truth or falsehood of specific theories. However, folk science is especially vulnerable to the temptation of building a case for a predetermined conclusion. As Robert E. Snow noted:

> There is nothing inherently disreputable about folk science, but folk sciences bear watching because of the intellectual and religious mischief they may produce. Folk science provides a standing invitation to the unwary to confuse science with religion ... or to allow the religious perspectives present in the folk science to feed back into the scientific world to distort its development. It is just this latter process that creation scientists say has allowed evolutionism to derail much of modern science, while many who object to creation science repay the compliment in their dismissal of creationist claims as thinly veiled religious advocacy.[13]

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*To the extent that the Intelligent Design movement is motivated by the desire to provide scientific warrant for its version of episodic creationism, it also functions in large part as a folk science enterprise.*

## 8. Where does Intelligent Design (ID) fit into this picture?

The Intelligent Design movement has attracted a great deal of attention since the publication of Phillip Johnson's *Darwin on Trial*.[14] Key works published by other ID advocates since that time include Michael Behe's *Darwin's Black Box* and William Dembski's *The Design Inference*.[15] Paraphrased as succinctly as possible, the following is what I take to be the ID movement's most basic claim in the arena of biology: *We have indisputable empirical evidence that some biotic system X (where X could be a part of an organism, a whole organism, or even the entire system of life on earth) could not possibly have been assembled – at least not for the first time – by purely natural means (whether by regularity or chance). Therefore, X must have been intelligently designed.* In other words, the RFE Principle is *not* considered to be a faithful description of the character of the universe. The formational economy of the universe (its menu of natural resources, capabilities, and potentialities) is *not* considered to be adequate to account for the formation of certain biotic structures. Some non-natural action (called acts of "intelligent design") must, it is claimed, supplement natural processes in order to accomplish certain formational feats that natural action alone presumably could not.

Having argued against the possibility of the "natural" formation of certain biotic systems, what model for extra-natural action does ID offer in its place? No specific models have been proposed, only the broadly stated conclusion that these novel biotic configurations must have been brought about by the action of some non-natural, intelligent agent. However, if all *natural* agencies have actually been demonstrated to be inadequate to the task of actualizing certain biotic configurations, then we are left, it seems to me, with only *supernatural* agents to do the job.[16] Although any candid specification of the identity of that extra-natural agent is strategically avoided in most of their literature, it is clear that the majority of ID proponents have in mind the Creator-God of the Judeo-Christian religion.[17] It is this divine "Intelligent Agent" who is presumed to have performed occasional form-conferring interventions to actualize certain biotic structures that the creation's inadequate formational economy was unable to actualize.

In other words, *the Intelligent Design proposal is a variant strain of episodic creationism.* As Dembski's expressed it: "... to reject fully naturalistic evolution is to accept some form of creation broadly construed, that is, the belief that God or some intelligent designer is responsible for life."[18] Furthermore, to the extent that the Intelligent Design movement is motivated by the desire to provide scientific warrant for its version of episodic creationism, *it also functions in large part as a folk science enterprise*.[19] Once again, that does not categorically eliminate the possibility that its conclusions could be correct, but it does remind us of the serious pitfalls faced by any science-like enterprise motivated by the desire to affirm religious worldview beliefs already in place.[20]

## 9. What is my evaluation of ID?

In a number of publications, I have offered my evaluation of claims made by the chief advocates of Intelligent Design.[21] The following, adapted and condensed from a published review, is a sample of my criticism of Dembski's book, *The Design Inference*.[22]

> An event occurs. How can its occurrence be explained? According to Dembski, "Whenever explaining an event, we must choose from three competing modes of explanation. These are *regularity*, *chance*, and *design*" (p. 36). Dembski presents these three causal categories as both *mutually exclusive* and *exhaustive*, a very striking claim.
>
> At first sight, this "trichotomy rule," as Dembski calls it, appears radically unrealistic. Are there really only three possible modes of explanation for the set of *all* events? How can this possibly be? The answer: *by definition*. The third category in Dembski's list, *design*, is simply *defined* to be *neither regularity nor chance*. "To attribute an event to design is to say that it cannot reasonably be referred to either regularity or chance" (p. 36).
>
> Following this strategy, one might just as well say that all objects are colored either red, blue, or green, where "green" is defined to be "neither red nor blue." The design mode of explanation appears, at first, to be none other than the familiar "none of the above" option found on a multiple choice quiz.

In place of the label, *designed*, one could presumably have used a light-hearted neologism like "muff-nordled." However, it becomes clear in the course of the book that the "design" label is intended to take on a much more restricted operative meaning. The word "design," like "green," has a prior meaning whose influence is not easily suppressed.

So, why call this third catchall category by the name "design" in place of "none of the above" or "muff-nordled"? Because, says Dembski: "In practice, when we eliminate regularity and chance, we typically do end up with an intelligent agent. Thus in practice, to infer design is typically to end up with a 'designer' in the classical sense" (p. 36). As a historical example, Dembski offers the case of planetary motion. In Newton's (mistaken) judgment, planetary orbits were inherently unstable and would need occasional adjustments by the direct intervention of God. In Dembski's words: "... for Newton the proper mode of explanation for the dynamics of the solar system, though partially appealing to his laws of mechanics, also included an appeal to design, with design here taking the form of supernatural intervention" (p. 39). Thus the choice of "design" as the label for the catch-all remainder category was clearly not arbitrary for Dembski, but was intended to convey a judgment (one that I find to be faulty) regarding the character of most events placed in that category.

The range of what constitutes an "event" in Dembski's analytical scheme is enormous—the single flip of a coin, the rolling of a pair of dice, the opening of a bank safe by dialing the correct combination, the stable orbital motion of planets, even *the occurrence of life on planet Earth*. Nonetheless, any event from such a diverse pool of events can, says Dembski, be run through his "Explanatory Filter"—an algorithm for determining the appropriate mode of causal explanation. Those events that cannot reasonably be placed in either the *regularity* or *chance* categories are then, by process of elimination, attributed to *design*.

What is the connection between design and intelligent agency? Dembski gives very inconsistent signals on this key question. In the book's epilogue, Dembski presents the connection as being very tenuous and open to varied possibilities. "In Chapter 2," he says, "we defined design as the set-theoretic complement of the disjunction regularity or chance. Nothing in this definition entails a causal story, much less an intelligent agent, much less still a supernatural or occult power. Taken in its most fundamental sense, the word *design* signifies a *pattern* or *blueprint*. ... Frequently the reason an event conforms to a pattern is because an intelligent agent arranged it so. ... There is no reason, however, to turn this common occurrence into a metaphysical first principle" (pp. 226–7).

But this strategic disclaimer is flatly contradicted by several statements made elsewhere in the book. For instance, early in the book Dembski informs us that "... in practice, to infer design is not simply to eliminate regularity and chance, but to detect the activity of an intelligent agent. Though defined as a negation, design delivers much more than a negation. ... There is an intimate connection between design and intelligent agency ..." (p. 62). Stated even more directly: "It's now clear why the Explanatory Filter is so well suited for recognizing intelligent agency: for the Explanatory Filter to infer design coincides with how we recognize intelligent agency generally" (p. 66).

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*To be "intelligently designed" is, by implication, to be* both *conceptualized for a purpose,* and *assembled/formed by the action of an extra-natural agent.*

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What does Dembski here mean by "design" and "intelligent agency"? What exactly does it mean to be designed?[23] What does an intelligent agent do? "The principal characteristic of intelligent agency," says Dembski, "is *directed contingency*, or what we call *choice*. ... Intelligent agency always entails discrimination, choosing certain things and ruling out others" (p. 62). As an example, Dembski asks the reader to consider two events in which ink is applied to paper. In one case, the ink is accidentally spilled onto the paper from a bottle. In the other case, a person writes a message on the paper with a fountain pen. Upon encountering the two pieces of inked paper and seeking causal explanations for the observed distribution of ink, it is clear, notes Dembski, that only one case demands an appeal to the action of an intelligent agent. The written message required a discriminating choice. The blotch of spilled ink did not.

Yes, but is a *discriminating choice* all that was required? Clearly not, and this is crucial to our present concern. *The intelligent agent also had to effect that choice.* He or she had to take pen in hand and write the chosen message. In Dembski's example, and implicit in other literature of the Intelligent Design movement as well, *the "design" action of an intelligent agent is two-fold.* First, the mind of the agent must thoughtfully conceptualize something (what Dembski refers to as making a discriminating choice). But then the intelligent agent (or Intelligent Designer) must

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perform an *additional act* in order to *effect* what was first conceptualized or chosen. The agent in the inked paper example had to place the pen in contact with the paper and coerce it to move in a prescribed pattern. *Mind-action had to be followed by hand-action.* Since the materials at hand—pen, ink, and paper—did not possess the requisite capabilities to form a written message, the agent had to act directly to *force* a particular event to occur. To understand the essence of contemporary appeals to design, especially "Intelligent Design," it is essential for us to see that the action in question is *two* actions, not one. Although most proponents of ID have chosen not to say so candidly, to be "intelligently designed" is, by implication, to be *both* conceptualized for a purpose, *and* assembled/formed by the action of an extra-natural agent.

*The real question before us is, "Given this universe, with its vast menu of formational resources, capabilities and potentialities, is the eventual formation of some system of life feasible?" And the real answer is, "Only God knows."*

One of the *events* that Dembski subjects to his Explanatory Filter is the one at the heart of our current concern—*life has occurred on planet Earth.*[24] What mode of explanation for that event would the filter select as most appropriate? The first step of Dembski's filtering algorithm is to determine whether or not this event falls in the category of *regularity*. But the term *regularity* is, I believe, quite misleading. The real question here is not about some simple, deterministic, law-like regularity, but about the general *feasibility* of some outcome—whether it is the sort of event that could well happen in the context of all natural factors relevant to it.[25] The real question before us is, "Given this universe, with its vast menu of formational resources, capabilities and potentialities, is the eventual formation of some system of life feasible?" And the real answer is, "Only God knows." William A. Dembski does not *know*. Michael J. Behe does not *know*. Phillip E. Johnson does not *know*.[26] Nobody *knows*. The best we can do is to make an informed judgment and say so honestly.

Earlier I stated my reasons for judging that the creation was fully gifted by its creative and generous Creator with the formational resources, capabilities, and potentialities to make the actualization of life on some planet highly probable.[27] I also freely acknowledged this to be an *informed judgment* rather than something that could be *proved* by computing a numerical value for the probability that life is an expectable consequence of the creation's robust formational economy. At the same time, however, it should be clear to everyone that Dembski must, with equal honesty, admit that he is in no better position than I to compute that probability value, unless he wishes to claim God-like omniscience. Furthermore, the only way that Dembski could claim *empirical* support for categorically excluding the event *life has occurred on planet Earth* from the causal mode *regularity* (more accurately, *natural feasibility*) would be to repeat billions of years of cosmic history numerous times and to show that life would never occur without episodes of form-conferring intervention.

With regard to the event *life occurred on planet Earth,* Dembski's Explanatory Filter fails already at its first node. And, given its failure at the first node, there is no warrant for proceeding to the consideration of chance or design.[28] The specific question that cannot be answered at the first node is none other than the one we posed earlier: "Does the universe have a robust formational economy?" Dembski has every right to express his personal belief or judgment that the creation is not a right stuff universe, but *he has no warrant whatsoever for asserting that he has empirically demonstrated that to be the case.* As I see it, Dembski has demonstrated nothing more than the inclination to make highly exaggerated claims about the effectiveness of his Explanatory Filter algorithm.

People who prefer to believe that life could arise in this universe only as the outcome of irruptive, form-imposing acts by an intelligent agent (presumably God, in this case) will, I believe, just have to say so. There would be nothing wrong with the proponents of ID, or of any other form of episodic creationism, doing just that with candor. In fact, it would provide "ID theorists" with the ideal occasion for placing all of their theological and philosophical cards on the table where any interested observer could give these worldview commitments the thoughtful evaluation that they deserve. ✯

## Notes

[1]The *gaps* to which I refer in this paragraph are formed not merely by missing knowledge (knowledge gaps) but by missing formational capabilities (capability gaps).

[2]One could also propose that the universe has the right stuff to actualize all life forms, not *sequentially* as in evolution, but *concurrently* as suggested by

Augustine, but there appears to be no scientific merit in that proposal. For further discussion on this see my essay, "Basil, Augustine, and the Doctrine of Creation's Functional Integrity," *Science and Christian Belief* 8, no. 1 (April 1996): 21–38.

[3]For additional remarks on the topic of divine action in the creation, see my letter of response to Peter Rüst in *Perspectives on Science and Christian Faith* 54, no. 1 (March 2002): 67, along with a number of references provided there.

[4]See my comments on "Who Owns the Robust Formational Economy Principle?" in *Science & Christianity: Four Views*, ed. Richard F. Carlson (Downers Grove, IL: InterVarsity Press, 2000), 217–20.

[5]Davis A. Young, *The Biblical Flood: A Case Study of the Church's Response to Extrabiblical Evidence* (Grand Rapids, MI: Wm. B. Eerdmans Publishing Company, 1995).

[6]Richard P. Aulie, "Evolution and Creation: Historical Aspects of the Controversy," *Proceedings of the American Philosophical Society* 127, no. 6 (1983): 418–62.

[7]____, "The Doctrine of Special Creation," *American Biology Teacher* (April & May 1972): 11–23.

[8]Note carefully that the "gifts" I am talking about here are not particular *structures* that could be inserted at any time, but *resources, capabilities* and *potentialities* that must be present from the beginning if they are to function as required. Some commentators have characterized my approach as one that posits a universe in which design or information was "front-loaded" at the beginning. That terminology, however, is foreign to my articulation of the "fully-gifted creation perspective."

[9]I have developed this line of thought more extensively in a number of places. See, for instance, "The Fully Gifted Creation," published as a chapter in the book, *Three Views on Creation and Evolution*, ed. J. P. Moreland and John Mark Reynolds, (Grand Rapids, MI: Zondervan Publishing House, 1999), 161–247, "Science & Christian Theology as Partners in Theorizing," published as a chapter in the book, *Science & Christianity: Four Views*, ed. Richard Carlson, (Downers Grove, IL: InterVarsity Press, 2000), 196–236, and "Basil, Augustine, and the Doctrine of Creation's Functional Integrity," *Science and Christian Belief* 8, no. 1 (April 1996): 21–38.

[10]See note 3.

[11]See Robert E. Snow's chapter, "A Critique of the Creation Science Movement" in Howard J. Van Till, Robert E. Snow, John H. Stek, and Davis A. Young, *Portraits of Creation: Biblical and Scientific Perspectives on the World's Formation* (Grand Rapids, MI: Wm. B. Eerdmans Publishing Company, 1990). See also Howard J. Van Till, Davis A. Young, and Clarence Menninga, *Science Held Hostage: What's Wrong with Creation Science* AND *Evolutionism* (Downers Grove, IL: InterVarsity Press, 1988).

[12]It should be noted that we also criticized several scientists who, especially when writing for the general public, also practiced a form of folk science when they distorted science in the service of warranting their naturalistic world views.

[13]Robert E. Snow, *Portraits of Creation*, p. 188.

[14]Phillip E. Johnson, *Darwin on Trial* (Downers Grove, IL: InterVarsity Press, 1999).

[15]Michael J. Behe, *Darwin's Black Box: The Biochemical Challenge to Evolution* (New York: The Free Press, 1996) and William A. Dembski, *The Design Inference: Eliminating Chance Through Small Probabilities* (Cambridge: Cambridge University Press, 1998).

[16]One does find in the ID literature occasional references to the possibility that extraterrestrial agents might be the intelligent designers, but it is hard to believe that this option is taken seriously by most advocates of the ID perspective. Furthermore, the question, "Were the extraterrestrial agents intelligently designed?" soon pops up.

[17]See William A. Dembski, *Intelligent Design: The Bridge Between Science & Theology* (Downers Grove, IL: InterVarsity Press, 1999).

[18]Ibid., 115.

[19]One trait that I see as characteristic of folk science literature is the prevalence of exaggerated claims for the certainty and significance of its conclusions. In this light, consider Dembski's confidence that "... it will be intelligent design's reinstatement of design within biology that will be the undoing of naturalism in Western culture" in *Intelligent Design*, p. 14, and Behe's declaration that "The observation of the intelligent design of life is as momentous as the observation that the earth goes around the sun or that disease is caused by bacteria or that radiation is emitted in quanta" in *Darwin's Black Box*, p. 233.

[20]For an informed commentary on the ID movement's motivation and agenda for action, see the essay by Barbara Forrest, "The Wedge at Work: How Intelligent Design Creationism Is Wedging Its Way into the Cultural and Academic Mainstream," in *Intelligent Design Creationism and Its Critics*, ed. by Robert T. Pennock (Cambridge, MA: MIT Press, 2002), 5–53. The term "folk science" is not used by Forrest, but its motivational dynamic appears on nearly every page of this essay. For instance, in reference to the ID movement Johnson is quoted as saying, "This isn't really, and never has been, a debate about science ... It's about religion and philosophy" (p. 30).

[21]See my essays, "Is the Creation's Formational Economy Incomplete? A Response to Jay Wesley Richards," *Philosophia Christi* 4, no. 1 (2002): 113–8; "Intelligent Design: The Celebration of Gifts Withheld?" published as a chapter in the book, *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; and "The Creation: Intelligently Designed or Optimally Equipped?" in *Theology Today* (October 1998): 344–64, and reprinted in *Intelligent Design Creationism and Its Critics*, 487–512. Some relevant discussion can also be found in most of the references listed in note 9.

[22]Howard J. Van Till, "Does Intelligent Design Have a Chance?" *Zygon* 34, no. 4 (December 1999): 667–75.

[23]Behe's answer to this question implies that to be designed means to be assembled (at least for the first time) by some non-natural means. "The laws of nature can organize matter ... The most relevant laws are those of biological reproduction, mutation and natural selection. If a biological structure can be explained in terms of those natural laws, then we cannot conclude that it was designed" in *Darwin's Black Box*, p. 203.

[24]I infer that by "life" Dembski here means living creatures of any type at any time.

[25]In some theological systems, "natural" could include not only the system of all creaturely factors but also non-coercive divine action as an effective factor. For a brief discussion on this, see my letter in *Perspectives on Science and Christian Faith* 54, no. 1 (March 2002): 67, especially the comments on divine *blessing* and divine *persuasion*.

[26]According to Johnson, "We *know* that the Darwinian mechanism doesn't work and that complex biological systems *never* were put together by the accumulation of random mutations through natural selection," *Defeating Darwinism by Opening Minds* (Downers Grove, IL: InterVarsity Press, 1997), 94 (emphasis added).

[27]Discher has characterized this as a proposal for "remote intelligent causation." I find this label wholly unacceptable (1) because I see nothing "remote" about this divine action, and (2) because most ID literature maintains a strategic ambiguity regarding the effective equivalence of *intelligent causation* and *supernatural intervention* in the arena of biology.

[28]For the sake of argument, however, suppose a person made the tentative assumption that the universe does *not* have a robust formational economy. Suppose also that Dembski is correct in arguing that no form of life could be assembled by the chance arrival of all of its atomic and molecular constituents. The only conclusion that could be logically drawn from this is that, *if* the universe does not satisfy the RFEP, *then* episodes of form-conferring divine intervention seem essential for the formation of life on planet Earth. But we already knew that. In regard to the event *life occurred on planet Earth*, the "design" outcome of Dembski's Explanatory Filter is assured by the initial *choice* to declare natural causes inadequate at the first node. The extensive and laborious discussion in ID literature about "complex specified information" and "irreducible complexity" serves, at best, only to rule out "pure chance" at the remaining nodes.

**Dialogue: Reply**

*Is Howard Van Till's Response to "Van Till and Intelligent Design" a "Right Stuff" Response?*

# Is Howard Van Till's Response to "Van Till and Intelligent Design" a "Right Stuff" Response?

*Van Till commits a grave error in reasoning. He twice engages in what philosophers call committing the fallacy of making a "hasty generalization."*

In reply to Howard Van Till's response, "Is the Creation a 'Right Stuff' Universe?" I shall make five major points as briefly and as clearly as I can. First, Van Till states that he will not provide a point by point rebuttal of my article, "Van Till and Intelligent Design," because the "work" most frequently cited by me is not anything that he has published. Van Till encourages "readers who are genuinely interested in what I have written regarding ... the ID movement [to] find the relevant references [to my published views] in [what] follows" (p. 232).

On this, let me make three short subpoints: (1) In my essay, I do refer to Van Till's published works; (2) If I have misunderstood or misconstrued Van Till, then he should say so. That, it seems to me, would be reason to give a point by point rebuttal, not a reason to neglect to do so; and (3) Based on what Van Till has written in response, it looks as though I understand him just fine, since he mostly repeats what I have reported in my essay.

Second, Van Till commits an error in reasoning. He twice engages in what philosophers call committing the fallacy of making a "hasty generalization." The first instance of this fallacy involves Van Till's rightly noting that the RFEP (or something very like it) has been extremely scientifically fruitful for a number of centuries now. However, because of its previous successes, he mistakenly concludes that it will be ultimately successful in explaining every "type of organism that has appeared in the course of time" (p. 232). For Van Till, this "is a judgment call made, not in a vacuum, but against the background of centuries of scientific experience" (p. 234).

Fine. But by the same reasoning, one could just as easily (or perhaps even more easily, given the number of centuries this problem has plagued philosophers and scientists) conclude that the RFEP must be wrong (false, incorrect) because after all this time we still do not have the foggiest idea of how matter and the laws of physics can account for the crudest of conscious experiences. In other words, one could reason, as Van Till does, that the RFEP must likely be true because it has been successful in the recent scientific centuries in accounting for x, y and z. But, one also could argue that the RFEP must likely be false, because throughout the centuries, it has been unsuccessful in accounting for so many of the "organisms that have appeared in the course of time," viz., organisms that have consciousness.

The second instance of Van Till's commission of this fallacy involves failures of the so-called folk scientists to identify "gaps" in the formational economy. In geology, astronomy, and biology, for example, it was once thought that divine intervention played a role. Subsequent scientific analysis and theorizing, however, have eliminated the need to invoke such "divine tweaking." Since invoking the divine was rendered otiose in the past, Van Till assumes it too will be in the future with respect to ID.

But consider another situation. What do we say to a teenager with a half-dozen or so failed romantic relationships when he or she

cries in despair, "It'll never work out. I'll never get married!" Just because it has not worked out yet does not mean that it will not work out in the future. To think so is a fallacy. Now, Van Till is correct to point out here that it is a game of odds, a question of making a sound wager. But, as I pointed out in my essay, the successes historically of the scientists with theistic worldview assumptions vs. the successes of scientists with nontheistic worldview assumptions does not compel me to wager against the scientist with theistic worldview assumptions. Despite some popular misconceptions, theism historically has been quite good for the advancement of science. If the RFEP is, in fact, false and ID shows it to be so, that would constitute advancement in scientific knowledge. And at a minimum, if it is impossible for Van Till and others like him to be supportive of ID, then why not at least just leave IDers alone to see what they might come up with?

> Third, on page 236, Van Till writes:
> Having argued against the possibility of the "natural" formation of certain biotic systems, what model for extra-natural action does ID offer in its place? No specific models have been proposed, only the broadly stated conclusion that these novel biotic configurations must have been brought about by some non-natural, intelligent agent. However, if all natural agencies have actually been demonstrated to be inadequate to the task of actualizing certain biotic configurations, then we are left, it seems to me, with only *supernatural* agents to do the job.

This would be precisely why those who are averse to theism would be motivated to see ID fail. If it succeeds, their precious, deeply held worldview assumptions are shattered – unless they take the almost comical way out as the great scientist Francis Crick did after he and James Watson discovered the mind-boggling complexity of DNA, and posited that such intricate biotic structures were designed by space aliens.

Fourth, Crick could see that DNA was designed. He could detect design, although he could not give a very satisfactory account of its mechanism. So why does Van Till continue to demand that IDers give a detailed account of the "hand-like" mechanism of the design in biotic structures before they can declare that the structures were designed? It is simply not true that one has to know the precise mechanism that did the designing in order to see that something is designed. Imagine, for example, that a spaceship lands on earth and out of it pops an alien who holds up a magnificent, intricate object that resembles something like the insides of a computer. I need not know either the designer or the mechanism of its design in order to know that it was designed. Therefore, not being able (yet) to give an account of the mechanism of design in biotic structures does not abrogate ID's claim that certain such structures were designed.

Finally, let me make a comment about "folk science." If I understand Van Till correctly, a folk scientist is basically any scientist who engages in a scientific experiment in order to have a belief he or she holds about the world confirmed. If that is the case, then every scientist is a folk scientist. For what it means for me as a scientist to have a hypothesis is precisely to "guess" that the world is like this (or not like this, if the hypothesis in question is meant to rule out some possibility). That is why I will try a particular experiment rather than any of the virtually infinite number of other experiments I can imagine performing. In other words, in conducting any scientific experiment, I must first have some kind of belief about what the world is like before I do the experiment in order to have that belief either confirmed or disconfirmed. The idea that there are scientists who perform experiments in a vacuum without any prior commitments about what the world is like is a myth. It is simply mistaken.

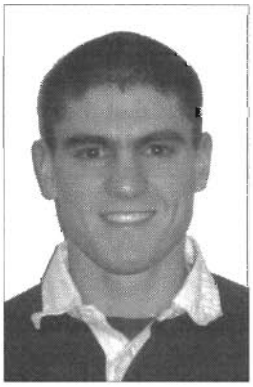
*Why does Van Till continue to demand that IDers give a detailed account of the "hand-like" mechanism of the design in biotic structures before they can declare that the structures were designed? It is simply not true that one has to know the precise mechanism that did the designing in order to see that something is designed.*

In conclusion, while space does not permit a point by point rebuttal of "Is the Creation a 'Right Stuff' Universe?" I hope it is clear that I have attempted to understand, analyze, and evaluate Van Till's ideas earnestly and critique them head-on. ✯

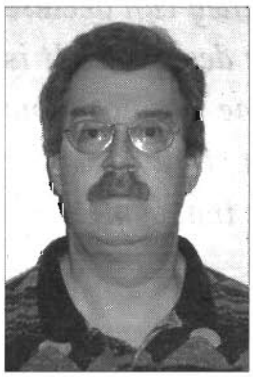


# The Teaching of Evolution in Public School

## A Case Study Analysis



**Timothy R. Johnson**



**Karl Giberson**

*Some of the more aggressive critics of evolution charge that it is being taught in America's public schools in a way that undermines traditional religious values and promotes atheistic naturalism. We examine this claim in some detail by looking carefully at the public school curriculum in one city. Research involved investigation of language used in the textbooks and mandated curricular goals, as well as extensive interviews of a number of teachers in elementary, middle, and high schools. Our research indicates that there is no basis for this claim.*

As readers of this journal are fully aware, the teaching of evolution in public schools remains as controversial as ever within American culture. Claims are made by critics that evolution is, at best, an inadequate scientific speculation being taught as fact and, at worst, an extension of philosophical naturalism/atheism. Some charge that evolution comes disguised as science and is smuggled into public schools, where it serves to undermine traditional religious belief. More strident foes of evolution even argue that evolution is taught in such a way that it undermines morality and values in general and is a contributor to rising levels of crime, juvenile delinquency, homosexuality, and so forth. Lerner writes:

> Such believers hold, moreover, that teaching the biological relationship of humans to other animals inevitably undermines any possible moral or ethical teaching. If, they argue, humans are "only animals" they will "act like animals" (whatever that means). Teaching evolution thus leads to such broadly diverse social phenomena as atheism, communism, socialism, nazism, inflation, homosexuality, women's liberation, sex education, teenage sex, abortion, pornography, family breakdown, school shootings, crime, alcoholism, and drug addiction, to name a few.[1]

Phillip Johnson, for example, one of the most strident critics of evolution today and no stranger to this journal, has suggested the following:

> ... the intellectual elite in America believe that God is dead. In consequence they think that reason starts with the assumption that nature is all there is and that a mindless evolutionary process absolutely must be our true creator. The common people aren't so sure of that, and some of them are very sure that God is alive.[2]

The purpose of this paper is to investigate the role that evolution plays in the curriculum of the Quincy, Massachusetts, public school system. Quincy was selected partly for practical reasons, and partly because we believe that its demographics suggest that it is not likely to be a school system where evolution is "soft-pedaled" in any way or unduly influenced by any significant local anti-evolutionary constituencies.

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**Karl Giberson**, *ASA member, is editor of* Research News and Opportunities in Science and Theology *and professor of physics at Eastern Nazarene College in Quincy, MA. He has a Ph.D. in physics from Rice University. Giberson has written many articles and two books on science and religion,* Worlds Apart *(1993) and* Species of Origins: America's Search for a Creation Story *(2002, with Donald Yerxa.) He lives in Hingham, MA, with his wife Myrna and two daughters, whom he enjoys coaching in basketball and softball. Karl can be contacted by email at rnews@enc.edu*

Through a combination of interviews and examination of textbooks and other curricular materials, we have developed an analysis of the extent to which evolution is taught in Grades K–12 and of the particular strategies used by the various instructors. We have not been able, of course, to examine exhaustively the entirety of the curricular materials nor talk at length with every teacher. We do believe, however, that we have done enough so that our conclusions are representative and accurately reflect the general circumstances surrounding the teaching of evolution in the public schools of Quincy, Massachusetts.

## Demographics

Located on the south shore of Boston, the city of Quincy is a largely blue-collar community; the population numbers about 88,000 with a significant minority of Asians, around 16,000.[3] There are twelve elementary schools, five middle schools, and two high schools. The city is predominantly Roman Catholic and contains very few non-Christian religious communities. The population that would identify themselves as "evangelical" is also very small.

We approached this problem from the bottom up, starting with an examination of curricular material used in the elementary schools, followed by discussions with the elementary school teachers. Next we looked at the middle school curriculum and talked to the teachers in the middle school. We finished with a more careful analysis of the high school science curriculum and some broadly based interviews with high school teachers who focus primarily on biology, and thus have to deal with the challenges of teaching evolution.

This paper reports on the result of our study and provides a useful window into a topic of great importance and controversy. It also offers the reader a chance to compare the charges of the critics of evolution with a particular slice of our public education system.

## Quincy Public Schools "Design for Learning"

The Quincy Public School System seeks to develop persons who stand out as "self-fulfilling individuals, citizens, and workers in a world that empowers all peoples to enrich their lives and the lives of others."[4] The goal of the faculty is to educate children in an environment most conducive to learning and to produce life-long learners. The final product should be people who will contribute significantly to society.

The curriculum development staff for learning in science and technology articulate a specific rationale for science. They write:

> The study of science as an intellectual and social endeavor—the application of human intelligence to figuring out how the world works—should have a prominent place in any curriculum that has science literacy as one of its aims.
>
> Acquiring scientific knowledge about how the world works does not necessarily lead to an understanding of how science itself works, and neither does knowledge of philosophy and sociology of science alone lead to a scientific understanding of the world. The challenge for educators is to weave these different aspects of science together so that they reinforce one another.[5]

### Elementary Schools

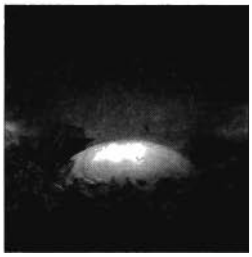
*Quincy Public Schools Elementary Learning Standards*

The science standards for Quincy elementary schools seek to provide children with scientific knowledge and a way of learning that will serve as a firm foundation for more complex material that will come in the middle and high schools. The learning process is naturally progressive and instruction builds continually on earlier material. As students advance, foundational knowledge is reinforced and supports more difficult material. While the curriculum contains traditional facts and theories, the main goal is to instill a desire for learning. Students are encouraged to solve problems and make decisions based on what they know— to master, in an introductory way, the "scientific method."

*The science standards for Quincy elementary schools seek to provide children with scientific knowledge and a way of learning that will serve as a firm foundation for more complex material that will come in the middle and high schools.*

The curriculum for the elementary and middle schools was developed over four years, starting in 1997 with summer workshops. Instructors met during the summer, after school, and on Saturdays. Past rationale was examined and benchmarks were developed for a new curriculum. Special attention was given to the vocabulary of the new curriculum to insure that learning standards were clear and logical.[6]

Learning standards in the Science and Technology/Engineering Curriculum Framework are outlined clearly and organized within the appropriate domains of science, which include earth science, life science, and physical science. Standards also are broken down by grade level. For instance, children in grades K–2 are expected to observe



# Article

*The Teaching of Evolution in Public School: A Case Study Analysis*

*In the elementary schools, the word evolution is not even mentioned because the elementary level is considered too early for children to dig into complex scientific topics. ... One elementary school principal also suggests that parents would not be comfortable with evolution being taught.*

and describe familiar objects and events by identifying details, similarities, and differences. They are to make predictions based on their past experiences with particular materials or objects; suggest and describe ideas; and describe how, why, and what would happen if these objects were placed in different situations. Later students will apply this knowledge in understanding more difficult material. For example, after observing that the moon looks a little different every day, but the same again every four weeks, children can dig deeper and learn reasons why this happens. Eventually students will come to learn about the rotation of the earth and the all-important numbers 23.5, 186,000, and 93,000,000. They will know what makes light reflect off the moon, why the same side of the moon always faces the earth, whether the moon is rising or falling, and what it will look like the next day.

There are no specific texts assigned for science in the elementary schools. Teachers are free to use sources they deem appropriate. For example, an experienced teacher at Beechwood Knoll elementary school uses a text titled *Cell Wars* by Dr. Fran Balkwill to provide an interesting way for her students to learn about the cells of the human body.[7] Other teachers share materials or use resources such as the Internet, library, or other information providers.

In the elementary schools, the word evolution is not even mentioned because the elementary level is considered too early for children to dig into complex scientific topics. Many children have never encountered any science, and that is taken into account when presenting unfamiliar material. One elementary school principal also suggests that parents would not be comfortable with evolution being taught.

## Middle School

Evolution enters Quincy classrooms in the middle school (grades 6–8). Like the elementary schools, the middle schools have no prescribed texts, freeing (or forcing) teachers to choose their own instructional materials, which often includes popular textbooks. The teachers, however, do have a curriculum framework and year-end "expectations guide." Our research was done with the help of the principal and science teachers from the seventh and eighth grades at Atlantic Middle School, which is typical of the other Quincy middle schools.

The middle school curriculum builds on the foundations laid in the earlier grades. Teachers are expected to follow the curriculum framework. Middle school students, e.g., continue to learn more about the cell and how cells work together to form a living organism. Students study specialized tissues, organs, and systems. Teachers demonstrate how these systems work together to ensure the successful functioning of the organism. Teachers also are expected to show how organisms interact in ecosystems, which are described as changing over time in response to physical conditions or interactions among organisms. Changes may be the result of predictable succession or the result of catastrophes, e.g., volcanic eruption or ice storms.

The year-end expectations are clearly outlined, listing all of the questions students should be able to answer within each particular domain of science after completing each grade level. Sixth grade students are to understand concepts about ecology, ecosystems, and organisms; the characteristics of living things and cells; and the classification of living things. For example, students must be able to state three basic concepts of cell theory, introduce phases of mitosis, and give examples of single cell and multicellular organisms. Evolution is not formally introduced, mainly because students do not yet have adequate background knowledge.

All this changes when students reach the seventh grade, where 38% of the science year-end expectations are directly related to evolution.[8] Atlantic Middle School uses a set of colorful and current texts by Prentice Hall called *Science Explorer*. Evolutionary subject matter is found within "Cells and Heredity" in a chapter titled "Changes Over Time." This chapter introduces Charles Darwin, the fossil record, and various proposed evidences for evolution.

*Science Explorer* surveys much of evolution but does not discuss human evolution, suggesting only that organisms change over time. Even when comparing early stages of development, the text avoids comparing other species to humans. For example, it says: "Turtles (left), chickens (center), and rats (right) look similar during the earliest

stages of development. These similarities provide evidence that these three animals evolved from a common ancestor."[9]

The text gives the age of the earth as 4.6 billion years, backed up with supporting evidence. There is no suggestion that the earth was the result of a random event. It says:

> The formation of the Earth marks the beginning of Precambrian Time. The first living things, which were bacteria, appeared in seas 3.5 billion years ago. Algae and fungi evolved 1 billion years ago. The earliest animals appeared 600 million years ago.[10]

While incompatible with young-earth creationist interpretations of Genesis, the text makes no explicit reference to religious beliefs that have been challenged by these conclusions.

*All this changes when students reach the seventh grade, where 38% of the science year-end expectations are directly related to evolution.*

In addition to the text, teachers are free to use additional sources of information. One seventh grade science teacher told us, "I don't cover much more than what is in the book, except a few days with the *Dawn of Man* video produced by The Learning Channel."[11] This is one teacher's attempt to expose the students to human evolution before they encounter it in higher grades. The Learning Channel describes the *Dawn of Man* as follows:

> Five million years ago began the greatest story of all: how we came to be. Scene by scene, the astonishing drama of our history unfolds. Witness gripping reenactments of turning points in human prehistory like the invasion of Neanderthal Europe by our African ancestors. Experience the pain, fear, love and joy of early man in an extraordinary and unforgettable adventure that leads to a deeper understanding of ourselves as human beings.[12]

Having been produced for a different audience than public school students, and one for whom grand and controversial claims are less likely to be challenged, the presentation of the *Dawn of Man* is less restrained and more likely to upset students.

In the eighth grade, students begin to study living things in depth with less material on evolution. Students are expected, however, to be able to explain the theories of cell origin. The curriculum includes an introduction to heredity and reproduction, which asks the student, for example, to define genetics, explain the significance of dominant and recessive genes, and explain how variations in offspring can result from the same two parents, which leads to variation in populations of the same species. According to one teacher, "The point in the eighth grade is to continue to introduce them to basic terminology without confusing them so that they will be able to go further with it in grade nine."[13]

Since seventh grade is where the student first encounters evolution and receives a foundation which will be expanded on in high school, it is critical to note how the information is presented, particularly concerning the *mechanism* for the evolutionary process, which is generally understood apart from the supposed *reality* of the evolutionary process. Phillip Johnson says:

> Given that only a small minority of Americans believe the central finding of biology—"that human beings (and all the other species) have slowly evolved by natural processes from a succession of more ancient beings with no divine intervention needed along the way"—how should our educational system deal with this important instance of disagreement between the experts and the people?
>
> One way would be to treat the doubts of the people with respect, to bring them out in the open and to deal with them rationally. The opposite way is to tell the people that all doubts about naturalistic evolution are inherently absurd, that they should believe in the orthodox theory because the experts agree that it is correct, and that their silly misgivings will be allowed no hearing in public education.
>
> American educators have chosen the second path ...[14]

It is important to note that the curriculum in Quincy (and we suspect elsewhere) focuses primarily on evolutionary *change over time* and not on proposed *mechanisms* for the evolutionary process. This is a theme that we have observed at every grade level, particularly at the high school level where the instruction of evolution is more focused. This is a critical distinction that must be maintained to properly assess any possible philosophical or theological implications of the presentation of evolution.

## High School

### *Evolution within the Text*

Most of our research was conducted at the high school level where the teaching of evolution is concentrated. Six different textbooks are used in North Quincy's High School biology classes, each of them corresponding to different levels of biology instruction, with college bound students taking advanced courses. The information in the textbooks, however, is very similar; advanced biology courses simply move at a faster rate.

We began by assessing the textbooks, noting comparisons and differences, the language used in each, various



*The [biology high school textbooks] simply do not, at least in any overt way, describe life as the result of mindless natural forces, an issue that many critics of evolution like Phillip Johnson believe is at the heart of the problem in teaching evolution in public schools in America.*

rhetorical emphases and so on. One thing was immediately apparent: the texts simply do not, at least in any overt way, describe life as the result of mindless natural forces, an issue that many critics of evolution like Phillip Johnson believe is at the heart of the problem in teaching evolution in public schools in America. Johnson, for example, has stated:

> I don't know what new theories the future may bring, but I think I know where the revolution will start. It will start with the realization that life is not the product of mindless natural forces. Life was designed.[15]

Regarding the origin of life, the textbooks indicate restraint in their claims. One textbook states:

> While scientists cannot disprove the hypothesis that life originated naturally and spontaneously little is known about what actually happened. Many different scenarios seem possible, and several contradictory ones have solid support from experiments.[16]

The teachers at North Quincy High School present alternative scenarios and some even include, as a part of regular class discussion, the possibility that life is a creation of God!

One veteran biology and anthropology teacher believes that there is room for creation to play a role in the origin of life as evolution is taught in the classroom; she presents creation as a possible mechanism for the origin of life. She notes that, in her eighteen years as head of the science department, there have been absolutely no complaints from parents concerning the subject. In fact, parents are often happy with the way the material is presented.[17]

On the origin of life, the other textbooks continue to use the same sort of restrained rhetoric. One textbook states: "How these elements present in the atmosphere could have formed simple organic compounds important to life is a challenging scientific puzzle."[18] One biology teacher, unconcerned about the uncertainty in the text, states simply, "My goal is to get children to think."[19] Regardless of students' religious backgrounds, this teacher wants them to think critically about the information in the text and form their own ideas after learning as much of the science as they can. Neither here nor elsewhere, did we encounter any teachers to whom it seemed of critical importance that students jump blindly onto the evolutionary bandwagon.

As for the specific information in the text itself, the authors leave enough room for religious students to continue in their belief that God was actively involved throughout the evolutionary process, although such a belief is not explicitly mentioned. All of the science high school textbooks used in Quincy provide introductions to Charles Darwin. Johnson and Raven write:

> When the Beagle sailed on December 27, 1831, most scientists and nonscientists thought that each species was a divine creation, unchanging and existing as it was originally created ... But scientists had begun to appreciate that traditional views of divine creation could not explain the kinds and distributions of fossils that had been found. Some scientists tried to explain their observations by changing traditional explanations of creation while others (including Darwin's own grandfather) proposed various mechanisms to explain how evolution occurs.[20]

The text goes on to show that Darwin not only made observations but also provided a mechanism—natural selection—by which he thought that the whole process worked. Familiar, if questionable, examples are used, such as short-necked giraffes die and long-necked giraffes prosper.

One text describes Darwin's evidence as "compelling" and accepted by biologists around the world.[21] Most scientists agree, says the text, that "all organisms living today evolved from earlier, simpler life forms."[22]

The real controversy, however, does not lie primarily within evolutionary theory itself, given that evolution in its simplest form is being defined simply as "change over time." The real controversy lies in the mechanism of *how* evolution occurs. These particular textbooks refrain from taking this controversial issue head on, opting instead for generalizations. For example, one textbook states:

> Evolution theory is the foundation on which the rest of biological science is built. In fact, the biologist Theodore

> Dobzhansky once wrote that nothing in biology makes sense except in the light of evolution. Much research in genetics, ecology, and medicine is based on evolutionary theory.[23]

Another textbook states: "Evolution is a fact, organisms have changed over time."[24]

One twelve-year veteran teacher makes the same distinction as well, agreeing with Dobzhansky that evolution is the most important theory in biology. He says: "It is a unifying theory that ties together all aspects of biology."[25] He recalls a classroom incident when a student from a fundamentalist background attempted to provoke a confrontation by stating: "I hope you're not going to teach evolution." With a smile, the teacher effectively defused the situation by replying, "I hope you're not going to learn science."[26] We suspect that such personal and idiosyncratic strategies are in use in almost every classroom where evolution is taught.

One text acknowledges "because most fossil skeletons are far from complete, these scientists must make inferences from subtle clues."[27] In general, the texts are doing their best to provide scientific information and insight into the *process* of science, and taking care not to communicate unsupported material as fact.

## Freedom of Teachers within the Classroom

As in the middle schools, the high school teachers have considerable autonomy in the classroom, exercising control over both the depth of coverage and how material is presented. Mary Young says that in her eighteen years as science department head, she recalls only one teacher opting not to present creation as a possible mechanism for evolution. It is her judgment that teachers, at least those at North Quincy High School, demonstrate considerable sensitivity in how evolution is presented to students with religious backgrounds. She says:

> Science teachers also need to respect the religious faith of their pupils and ought not bridle when parents and clergymen (and other teachers) explain to children that what they're learning in science class is not the whole story. Educating children, after all, entails a lot more than ensuring that they learn science. The school curriculum, too, includes more than science. If it neglects the powerful role of religious faith in human history and contemporary culture, it is not doing a good job of educating its students.[28]

This is exactly why creation and religion are touched upon in Quincy High Schools; faculty seek to offer students a complete, well-rounded education, devoid of distracting and unnecessary controversy.

Young believes that there needs to be more communication within America's churches about how Christians should interpret evolutionary theory. In Young's classroom, evolution is taught in a way that does not exclude God. "God could have used evolution or the big bang, maybe that is the way He 'created.'"[29] Again, evolution is not taught dogmatically.

Other teachers use creative ways to get students to think about evolution and the origin of life. Steve Brenner has been teaching biology at North Quincy High School for twenty-eight years and enjoys covering the subject of evolution because it opens doors to students' creative ideas. Brenner challenges his students to write papers defending their view of evolution, creation, or another theory. Students are given a week to research and explore a particular theory regarding the origin of life. At the end of the week, they present papers detailing their research and conclusions.

*Teachers demonstrate considerable sensitivity in how evolution is presented to students with religious backgrounds.*

Brenner encourages a healthy skepticism among his students, encouraging them to avoid simply accepting everything they read. His students must think for themselves. Brenner seeks to give students as much science as he can without forcing them to accept theories that cannot be proven as fact. He says: "I've observed Carl Sagan presenting certain aspects of evolution as fact; this shouldn't be done."[30] Brenner also discusses creation as a theory in his classroom.

Not all teachers are quite so willing to include discussion of creation in their classrooms, yet they are sensitive to their students' backgrounds. One teacher makes a careful distinction between a theory and a belief, which he believes is critical. He says: "A theory arises as a result of huge amounts of data that almost always point to a specific solution. Creationism is not a theory, it is a belief."[31] With regard to the mechanism for evolution, he offers a number of different possibilities and, although he excludes creation, he is self-consciously careful not to give evolution a purposeless or meaningless tone.

Catherine Smith, head of the science department at Quincy's other high school has been teaching for over thirty-three years. Smith is a graduate of a Catholic college and believes in God, but she does not believe it is necessary to present creation within her classes as a possible explanation for the origin of life. "Evolution is not a belief system, it is a theory," she suggests, which is why "special attention is given to evolution in the classroom and creation is not addressed."[32] Smith recalls but one concern from an outside source in all her years as a teacher regarding the way in which evolution was being presented. One



of her students brought up evolution in a Sunday school class, and Smith received a call from the minister shortly after. He was simply interested in the way evolution was being taught and was satisfied by the response he received.

## Conclusion

The Quincy public school system, like that of any city of comparable size or larger, has a diverse group of teachers with different methods of teaching and views on what is important in the classroom. We could find no evidence that public school teachers in Quincy are exacerbating tensions with students and parents in the way that evolution is presented; indeed, most of them are expending energy in minimizing such tensions.

*We find no support for Phillip Johnson's charge, in* Defeating Darwinism by Opening Minds, *that American educators have chosen to "tell the people that all doubts about naturalistic evolution are inherently absurd ... and that their silly misgivings will be allowed no hearing in public education."*

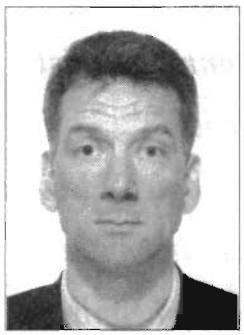
Our experience suggests to us that Quincy public school teachers are appropriately sensitive to the religious backgrounds of their students. We find no support for Phillip Johnson's charge, in *Defeating Darwinism by Opening Minds*, that American educators have chosen to "tell the people that all doubts about naturalistic evolution are inherently absurd ... and that their silly misgivings will be allowed no hearing in public education."[33] Our research within the Quincy public school system indicates exactly the opposite, and we suspect that this inference could be extended to the majority of public school systems in America. Johnson argues further that evolution is taught throughout the United States as a meaningless and purposeless process, leaving no room for God or religion, which is contrary to the faith of almost all Americans. This is simply not true in Quincy, Massachusetts. Neither the texts nor the teachers give the impression that "a mindless evolutionary process absolutely must be our true creator."[34] Most teachers are even content for their students to understand evolution as a possible explanation for "how God created."

The subject of evolution in public schools will continue to be controversial and will need careful attention. However, some of the critics of evolution, particularly Phillip Johnson, have adopted a hyperbolic, aggressive rhetoric suggesting that American educators are engaged in some sort of gigantic conspiracy to undermine traditional religion. If, as our research suggests, this strident claim simply is not true, then it would appear that the conservative critics of evolution are fighting an imaginary foe. This is unfortunate.✯

## Notes

[1]L. S. Lerner, *Good Science, Bad Science: Teaching Evolution in the States* (The Thomas B. Fordham Foundation, Sept. 2000).
[2]P. E. Johnson, *Defeating Darwinism by Opening Minds* (Downers Grove, IL: InterVarsity Press, 1997), 22.
[3]Internet Source: http://www.quincyonline.com/
[4]Curriculum Development Committee, "Design for Learning: Science," (curriculum standards, Quincy, MA, 2000), iv.
[5]Ibid., viii.
[6]Dr. J. Ditullio, interview by T. R. Johnson, Quincy, MA, March 2001.
[7]F. Balkwill, *Cell Wars* (Minneapolis: Carolrhoda Books, Inc., 1990).
[8]Curriculum Development Committee, "Design for Learning: Science," A-14.
[9]D. Cronkite, *Science Explorer* (Upper Saddle River, NJ: Prentice Hall, Inc., 2000), 161.
[10]Ibid., 156.
[11]D. Glynn, personal email, May 2001.
[12]Internet Source: http://shopping.discovery.com/product/1115-1411-175190.html
[13]D. Glynn, interview by T. R. Johnson, Quincy, MA, March 2001.
[14]Johnson, *Defeating Darwinism by Opening Minds*, 49.
[15]Ibid., 67.
[16]G. B. Johnson and R. H. Raven, *Biology: Principles and Explorations* (Austin: Holt, Rinehart, & Winston, Inc., 2001), 257.
[17]M. Young, interview by T. R. Johnson, North Quincy High School, Quincy, MA, April 2001.
[18]A. Towle, *Modern Biology* (Austin: Holt, Rinehart, and Winston, Inc., 1989), 209.
[19]S. Brenner, interview by T. R. Johnson, North Quincy High School, Quincy, MA, April 2001.
[20]G. B. Johnson and R. H. Raven, *Biology: Principles and Explorations*, 277.
[21]G. B. Johnson, *Biology: Visualizing Life* (Austin, TX: Holt, Rinehart, and Winston, Inc., 1998), 173.
[22]G. B. Johnson and R. H. Raven, *Biology: Principles and Explorations*, 283.
[23]K. R. Miller and J. Levine, *Biology*, 5th ed. (Upper Saddle River, NJ: Prentice Hall, Inc., 2000), 305.
[24]Ibid.
[25]R. Whitehouse, interview by T. R. Johnson, North Quincy High School, Quincy, MA, April 2001.
[26]Ibid.
[27]A. Towle, *Modern Biology*, 255.
[28]L. S. Lerner, *Good Science, Bad Science: Teaching Evolution in the States*, Sept. 2000.
[29]M. Young, interview.
[30]S. Brenner, interview.
[31]R. Whitehouse, interview.
[32]C. Smith, interview by T. R. Johnson, Quincy High School, Quincy, MA, May 2001.
[33]Johnson, *Defeating Darwinism by Opening Minds*, 49.
[34]Ibid., 22.

# The Historical Relationship Between Darwinism and the Biological Design Argument



*It is often held that the argument from biological design (ABD) was valid and almost universally accepted before Darwin, that it was the most important rational ground for theism, and that it was invalidated by Darwinism. However, this is wrong. The history of the ABD ran parallel with those of evolutionary theories, with Lamarck having published in 1801 and Paley in 1802. Evolutionary theories and the ABD were alternative responses to empirical evidence that (1) spontaneous generation does not occur, and (2) new species have arisen in geological history. The main reason why evolution was seldom hypothesized before 1796 was probably that materialism was tenable otherwise.*

Many parts of the world have witnessed a decline in theistic belief since the nineteenth century. Often this is thought to be associated with science. In particular, an influential school of thought holds that Darwinism has undermined theism by invalidating the argument from biological design (ABD), which is the argument that organisms are so complex (that is, they have "some quality, specifiable in advance, that is highly unlikely to have been acquired by random chance alone"[1]) that they must have been designed by a conscious agent, who must be God. There are other forms of the argument from design, applying to the cosmos, for example, but this article is concerned solely with the ABD.

I term the belief that Darwinism has undermined theism the "Dawkins Model" after its most influential current advocate, the evolutionary biologist Richard Dawkins. The main tenets of this model are:

1. Theism and the ABD were almost universally accepted before Darwin.

   Almost everybody throughout history, up to the second half of the nineteenth century, has firmly believed in ... the Conscious Designer theory.[2]

2. Theism was and is accepted primarily because of the ABD (unless for entirely nonrational reasons).

   Why do people believe in God? For most people the answer is still some version of the ancient Argument from Design ... we cannot fail to be struck by the obvious resemblance of living organs to the carefully planned designs of human engineers ... These beautiful, complex, intricate, and obviously purpose-built structures must have had their own designer, their own watchmaker—God.[3]

   The "Argument from [biological] Design" [is] always the most influential of the arguments for the existence of a God.[4]

3. The ABD was valid before Darwin.

   Throughout most of history, it [the ABD] must have seemed utterly convincing, self-evidently true.[5]

4. The ABD was invalidated by Darwin.

   And yet, as the result of one of the most astonishing intellectual revolutions in history, we now know that it [the ABD] is wrong, or at least superfluous. We now know that the order and apparent purposefulness of the living world has come about through an entirely different process, a process that works without

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the need for any designer and one that is a consequence of basically very simple laws of physics. This is the process of evolution by natural selection.[6]

The aim of this article is to examine the validity of the Dawkins Model. Tenets 1–3 above are discussed in the next three sections. Then the history of evolutionary theories and their relationships with materialism and theism are investigated, covering tenet 4 and related issues.

To help us understand this material, several definitions are required. They are:

*Design*: The quality pertaining to a structure that is generated in accordance with a conscious plan or concept, and on the basis of conscious volition.

*God*: An extracosmic conscious agent who is unitary, benevolent toward humans, and chronologically and ontologically ultimate.

*Evolution*: Biological descent in which intergenerational differences are very much smaller than interspecific ones, except when the direct results of interspecific hybridization.

*Lamarckian evolution*: Design-free evolution in which the frequency of heritable changes is higher when functionally advantageous.

*Darwinian evolution*: Non-Lamarckian design-free evolution in which selection is the sole means by which heritable changes are accumulated to form functional structures. This is a wide definition, covering a number of heterodoxies.

*Darwinism*: The doctrine that all organisms arose from nonliving matter solely by Darwinian evolution.

*Paleontological novelty*: The doctrine that different fossil-forming species appeared on earth for the first time in different geological eras.

*Even among nonmaterialist beliefs, biological design has not been overwhelmingly accepted outside Judaism and its derivatives. It was often a minority position in Greco-Roman and Indian thought, and always has been unusual in East Asia.*

## Was the ABD universally accepted before Darwin?

Dawkins states that almost everybody before 1859 firmly believed in the conscious designer as an explanation for the origin of biological structures.[7] This claim can be broken down into two claims: (1) almost everyone believed in a conscious designer, and (2) almost everyone believed in a conscious designer because they needed an explanation for biological complexity (i.e., they believed in the conscious designer *theory*). Let us examine the first claim.

### 1. Almost Everyone Believed in a Conscious Designer

The statement that there was almost universal belief in biological design before 1859 is transparently false. We never will know how many nonliterate materialists there have been, but literary materialism has arisen at least three times in three areas. They are:

1. *Greece.* Modern Western materialism is derived, via various seventeenth- and eighteenth-century thinkers, from Democritus, Epicurus, and Lucretius.

2. *India.* The Charvakas were one of the three non-Veda-accepting schools in the fifth century BC,[8] and their thought always has been influential, with the seventh-century philosopher Jayarasi Bhatta having been particularly important.[9]

3. *China.* Hsün Tzu exerted a formative influence on Confucianism.[10] Wang Chung has also had recurrent episodes of popularity.[11]

Materialism probably seldom has been numerically important. However, even among nonmaterialist beliefs, biological design has not been overwhelmingly accepted outside Judaism and its derivatives. It was often a minority position in Greco-Roman and Indian thought, and always has been unusual in East Asia. Dawkins appears to exclude the Asian civilizations, which is most of the world's population, from his category of "almost everybody."[12]

In conclusion, disbelief in a designer is ancient, common, and widespread. At the very least, therefore, it should be questioned whether the existence of such was always "self-evidently true" before 1859. Now let us examine Dawkins's second claim.

### 2. Almost Everyone Believed in the Conscious Designer Theory

The ABD has been very far from universally accepted by believers in biological design. Indeed, with a few partial exceptions (see Appendix), the ABD was not formulated until the late seventeenth century. It is noteworthy that it was not formulated by Anselm or

Thomas Aquinas, Maimonides, or ibn Sina, the great intellectual defenders of medieval Catholicism, Judaism, and Islam, respectively.

The first full-blown formulation of the ABD was probably that of the theologian John Wilkins in 1672:

> And the failing in any one of these [Members], would cause an irregularity of the Body, and in many of them, such as would be very notorious ... Now to imagine, that all these things, according to their several kinds, could be brought into this regular Frame and Order, to which such an infinite number of Intentions are required, without the Contrivance of some wise Agent, must needs be irrational in the highest degree.[13]

The Puritan minister and natural historian John Ray greatly expanded Wilkins' argument over the next few decades,[14] and the ABD had a certain amount of influence in the early eighteenth century, being accepted by thinkers such as the *philosophe* and *encyclopédiste* Denis Diderot.[15] However, even then it was not very common, and was rarely formulated in detail before its most famous exposition by William Paley in 1802.[16]

The historical unimportance of the ABD is exemplified by two eighteenth-century works. In David Hume's *Dialogues Concerning Natural Religion*, a long-winded refutation of the argument from cosmological design, only a single paragraph is concerned with the ABD.[17] In Moreau de Maupertuis' *Essay de cosmologie*, one of the most detailed versions of the argument from cosmological design ever, the ABD is only suggested in order to be rejected.[18]

## Was the ABD the only rational ground for theism before Darwin?

Philosopher Daniel Dennett, one of Dawkins' strongest intellectual allies, maintains that no rational arguments for theism were presented before the seventeenth century.[19] This is perhaps because he is aware that the ABD was not formulated before that era, and wishes to explain this without acknowledging the fact that it was because it was invalid before then. He suggests, rather vaguely, that the dawn of modern science was responsible for attempts to offer rational arguments for theism. However, this claim is simply false. Alternative arguments for theism formulated before 1600 include the following:

(a) *The argument from cosmological design.* This was formulated by innumerable thinkers, with Thomas Aquinas' fifth "proof" being the best known example.[20]

(b) *Various forms of the first-cause and prime-mover arguments.* These were very popular with thinkers influenced by Aristotle, and the first four "proofs" of Aquinas are the best known examples.[21]

(c) *Anselm's ontological argument.*[22]

(d) *Pascal's wager.* This was formulated centuries before Pascal, by the Muslim philosopher Abu Hamid al Ghazali.[23]

No suggestion is intended that any of these arguments are valid, but they do show that theism did not exist in a purely nonrational sphere until early modern times.

## Was the ABD Valid Before Darwin?

The ABD has two components: (1) the complexity-to-design argument, i.e., the complexity of biological structures is evidence that they were designed; and (2) the design-to-God argument, i.e., their designer must have been God. Let us examine the first component.

Dawkins says that he could not imagine having been an atheist before 1859, and that "Darwin made it possible to be an intellectually fulfilled atheist."[24] Yet, there is no evidence that atheists living before 1859 felt themselves unfulfilled. If Darwinism were disproved today, there would be almost no alternative to accepting biological design. However, it is anachronistic to suppose that this was so before Darwin, as the two non-evolutionary, non-design-based explanations for biological complexity below had wide currency.

### 1. Spontaneous generation

Aristotle taught that many plants and invertebrates, and also some fishes, are generated spontaneously from various organic materials, and also from mud, sand, dew, snow, and fire.[25] The Roman poets Lucretius[26] and Ovid[27] considered this to be stimulated by the rain and sun, whereas Aquinas, in the thirteenth century, thought it due to the influence of the stars.[28] Belief in spontaneous generation seems preposterous to the modern mind, and is not supported by the Bible or the Koran, yet it was unquestioned throughout medieval Christendom and Islam. It was also universally accepted in pre-modern China[29] and India.[30]

Many people accepted the spontaneous generation of small quadrupeds, in addition to Aristotle's examples. For example, Ovid[31] and Augustine[32] believed that frogs were so generated; Pliny believed that salamanders were;[33] and in 1600, Jan-Baptista van Helmont, one of the fathers of modern medicine, published a recipe for generating mice. Furthermore, Aristotle left open the possibility of the spontaneous generation of humans and large quadrupeds in the distant past.[34] Lucretius accepted this possibility as fact, entirely eliminating the problem of the origin of biological complexity, and maintained that when the earth and ether were young, birds' eggs had been generated spontaneously and wombs containing humans and animals had grown on stalks, with the earth producing milk for the babies after birth.[35] This looks very much like a

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*As spontaneous generation was seen as due to vital forces rather than chance, modern creationists' identification of spontaneous generation with the Darwinian origin-of-life hypotheses is mistaken.*

religious belief in Mother Earth, but Lucretius expressly denied that the earth is conscious.[36] Thus, his was not a belief in design. Chu Hsi, the great twelfth-century neo-Confucian systematizer, also explained human origins in terms of spontaneous generation.[37]

John Farley's definition of spontaneous generation as organisms arising "suddenly by chance"[38] is misleading, as generation was seen as a nonrandom, inherent property of matter. For example, Aristotle wrote that "all things are full of soul,"[39] and the eighteenth-century scientist and philosopher Maupertuis wrote: "One can concede to matter a certain level of intelligence, desire, aversion and memory."[40] As spontaneous generation was seen as due to vital forces rather than chance, modern creationists' identification of spontaneous generation with the Darwinian origin-of-life hypotheses is mistaken.

The first time spontaneous generation was tested empirically was in 1668, by Francesco Redi. It was shown that maggots are not generated spontaneously by rotting meat. However, it was only finally refuted with respect to microorganisms in 1861 by Louis Pasteur.[41]

After 1668, Marcello Malpighi and other scientists extended Redi's refutation to various other insects and plants,[42] and the spontaneous generation of all organisms was increasingly rejected by the educated.[43] It was at this time that Wilkins formulated the first full-blown formulation of the ABD (see p. 251). Ray, the expositor of Wilkins' argument, knew that the spontaneous generation of insects had been refuted,[44] and it is illuminating to see the increase in the forcefulness of his argument between 1691 and his death in 1705, as the non-occurrence of spontaneous generation became generally accepted. This acceptance resulted in a great deal of space being given to this theme in the posthumous seventh edition of his *Wisdom of God*.[45] Ray went much further than Redi and Malpighi, arguing that no plants or microorganisms are spontaneously generated.[46] The centrality of this to his argument cannot be overemphasized:

> For if this Point be but cleared, and it be demonstrated that all Creatures are generated univocally by Parents of their own Kind, and that there is no such thing as Spontaneous Generation in the World, one main Prop and Support of Atheism is taken away, and their strongest Hold demolished: they cannot then exemplify their foolish Hypothesis of the Generation of Man and other Animals at first, by the Like of Frogs and Insects at this present Day.[47]

However, in the 1740s, the spontaneous generation hypothesis regained popularity, as a result of its vigorous sponsorship by the Count of Buffon, France's most influential scientist.[48] This popularity culminated in the hypothesis being experimentally "proven" with respect to microorganisms by John Needham in 1748. The spontaneous generation of microorganisms was considered an established fact until well into the nineteenth century. Furthermore, in the 1760s, renewed attention was given to the possible spontaneous generation of macro-organisms,[49] only for this to be firmly rejected again in the late eighteenth century.

### 2. Infinite age

Stephen J. Gould maintains that "deep time" was one of history's three most important scientific discoveries.[50] As Augustine pointed out, however, time's finitude is more crucial than its immensity, and the nonrecognition of this by Westerners is a cultural artefact due to the recent rejection of Genesis.[51] The infinite age of the earth was taught by Aristotle.[52] Furthermore, even the medieval theologians Boethius[53] and Aquinas[54] defended its logical possibility, rejecting it solely on the basis of revelation. Thus, it was always possible for design disbelievers to argue that life or species always had existed.

Fossil evidence for the earth's great age was recognized by Xenophanes[55] and arguably several other Greeks, widely accepted in China[56] and the Islamic world,[57] and debated during the Italian Renaissance.[58] However, until the eighteenth century, the empirical evidence was very limited. In 1795, James Hutton was the first modern European to popularize an empirically-based belief in great age.[59] Hutton actually believed in great but finite age, but his observations, necessitating rejection of a literal understanding of Genesis, offered support for the almost forgotten possibility of infinite age. Hume—perhaps after talking to Hutton, his fellow Edinburgh intellectual—used the fos-

sil evidence of repeated inundations as far as the mountaintops to defend the possible infinite age of the earth, as it meant that civilizations, and even species (over parts of their ranges), could have been repeatedly wiped out.[60] Hume's celebrated argument that extrapolation from order to design is no more valid than from order to animal-like or plant-like reproductive processes seems overrated,[61] as it is little more than an extension of his defense of the possibility of the infinite age of the universe.[62]

To summarize, the dawn of modern geology offered support for a nondesign-based explanation that had lain dormant for centuries. However, the further development of science gradually ruled out this explanation. This involved the elimination of two separate possibilities:

1. *Infinite age of all species.* Hutton argued for paleontological non-novelty. However, during the following decades, it became clear that many fossil species are no longer extant in their present ranges. Furthermore, as a result of global exploration, it became increasingly unlikely that they were present in unexplored areas. Most early nineteenth-century geologists, therefore, accepted paleontological novelty, regardless of whether they explained it in terms of evolution or progressive extinction and re-creation. However, Charles Lyell, the "father of modern geology," rejected this doctrine from 1830 until 1853,[63] and did not finally accept it until 1862.[64]

2. *Infinite age of simple organisms.* The infinite age of life on earth is ruled out by theories of planetogenesis, which were formulated in the eighteenth century by Buffon and Laplace, among others, and were increasingly accepted in the nineteenth century. After acceptance of planetogenesis, it remained possible to argue that life is infinitely old and arrived on earth from elsewhere in the universe. This was put forward several times in the late nineteenth and early twentieth centuries, most persuasively by Svante Arrhenius,[65] but was rarely given serious consideration. The arrival of life from space was most recently defended by the maverick physicists Fred Hoyle and Chandra Wickramasinghe.[66] However, the possibility of infinite age now has been eliminated by the almost universal acceptance of the Big Bang theory.

The above discussion only takes into account empirical evidence. There have been attempts to prove the finite age of the universe on abstract grounds. Such attempts were popular in the seventeenth century, and Ray believed infinite age to be philosophically untenable,[67] which was no doubt one reason why he felt free to formulate an ABD. However, he was not entirely honest in according John Tillotson's[68] and Wilkins'[69] arguments the status of proof, when these theologians themselves saw them only as demonstrations of probability. Furthermore, these arguments were given little credence at earlier and later dates.

One may object that pre-modern philosophers did formulate the arguments from first cause and cosmological design, both of which depend on the assumption of finite age, so the possibility of infinite age cannot have been one of the reasons they did not formulate the ABD. However, before Jean d'Alembert in the 1750s, it was assumed that God has to hold the planets in position. The argument from cosmological design was, therefore, more accurately the argument from cosmological order, with a ruler needed to prevent the universe from falling into chaos. Furthermore, Aquinas, in his first three "proofs,"[70] did not distinguish fully between chronological and ontological arguments, and saw the first cause as being both before all other causes and outside the chronological series,[71] as did Aristotle.[72]

*For most of history, a theory of evolution was not required for rejection of biological design, except among those people in the late seventeenth and early eighteenth centuries who accepted the philosophical disproof of infinite age.*

In response to the previous paragraph, one could object that some thinkers have referred to God to explain not only the origin of organisms but their continuing existence and action, and, therefore, would have been free to formulate an argument from biological order, analogous to the pre-Alembertian argument from cosmological order, and that, in this case, the possibility of infinite age cannot have been one of the reasons they did not formulate such an argument. Ray exemplified such thinkers,[73] although it was not God but a subordinate "intelligent plastick Nature" to which he referred.[74] However, Ray's ideas were not simply archaic but were an aspect of the thought of the Cambridge Platonists, especially Ralph Cudworth,[75] with its fashion for the late-classical neo-Platonists Plotinus and Porphyry, and its rejection of both Cartesianism and Aristotelianism. The possibility of formulating an argument from biological order did not exist, therefore, before the mid-seventeenth century.

Thus, even leaving aside the possibility of spontaneous generation, for most of history, a theory of evolution was not required for the rejection of biological design, except among those people in the late seventeenth and early eighteenth centuries who accepted the philosophical disproof of infinite age.

Let us now examine the second component of the ABD argument: the design-to-God argument. It is very weak.



*In 1748, Needham's "proof" of spontaneous generation inhibited the further development of proto-Darwinian ideas by reclaiming for intellectual respectability the possibility that the spontaneous generation of macro-organisms could occur under certain conditions, and thus making it easier to disbelieve in biological design without recourse to proto-Darwinism.*

Were one to accept biological design, there would still be no compelling reason to suppose the designer(s) to be God, as he/she/they could be non-unitary or unconcerned about or malevolent toward humans. Furthermore, he/she/they could be non-ultimate, being contingent, within his/her/their ontologically higher existence, upon yet ontologically higher being(s), which in turn could be either conscious or unconscious. There would not even be any reason to suppose a finite upper limit to the ontological ladder. Hume made these points with respect to the nature of the designer(s)[76] and the possibility of an infinite ontological regress.[77] He was far from original in this, however, as the Manichees believed the earth to have been designed by a malevolent agent in rebellion against God, and classical Zoroastrians believed it to have had two designers, one malevolent and one benevolent.

Acceptance of the complexity-to-design argument thus does not necessitate acceptance of theism, and neither does it necessitate rejection of materialism, as the designer(s) could have been intracosmic. In the most recent sophisticated formulation of the ABD, Michael Behe admits that the designer(s) could have been extraterrestrials or time-travelers.[78] Furthermore, Dennett says that materialists could accept intervention by extraterrestrials, were there demonstrated to be a case of biological complexity which is inaccessible by Darwinian evolution.[79]

## History of Evolutionary Theories

### Before 1668

The widespread belief that theories of evolution were current in Greco-Roman times is not entirely true. Lucretius' scheme was one of spontaneous generation, and did not involve the transmutation of species.[80] Empedocles envisaged body parts wandering about separately until they joined to form whole animals and humans.[81] Aristotle briefly considered but rejected (for unclear reasons) a proto-Darwinian hypothesis:

> Whenever then all the parts came about just what they would have been if they had come to be for an end, such things survived, being organized spontaneously in a fitting way; whereas those which grew otherwise perished and continue to perish.[82]

Anaximander taught that the first humans were "born from animals of another species" and were "like another animal, namely a fish."[83] However, his other ideas, about humans arising inside fishes, and animals originally having had a prickly bark, sound less like evolution.

Modern commentators, both Chinese and Western, tend to read evolutionary ideas into Taoist thought, especially the *Chuang Tzu*.[84] However, rather than evolution, this describes spontaneous generation,[85] and some Ovidian transformations, such as fish turning into birds[86] and insects giving birth to horses, which then give birth to humans.[87]

### 1668 to 1861

After 1691, the increasingly widespread acceptance that spontaneous generation does not occur bolstered Ray's complexity-to-design argument, and he therefore started to give serious (hostile) consideration to the alternative possibility: a proto-Darwinism hypothesis based on the ideas of Aristotle.[88] This supports the suggestion that it was the availability of nondesign-based alternatives that previously had rendered unnecessary the energetic defense of proto-Darwinian hypotheses. Ray referred to proto-Darwinist ideas as the "Atheists usual Flam," suggesting their, at least, moderate popularity.[89]

In the eighteenth century, Diderot, Maupertuis, and La Mettrie toyed with more sophisticated proto-Darwinian ideas.[90] These were little more than musings, but one wonders whether Darwinism would have been accepted more than a century earlier if spontaneous generation had remained out of favor. It should be noted that Maupertuis' "*Méchanique aveugle*"[91] pre-dated Dawkins' *Blind Watchmaker* by 241 years.

In 1748, Needham's "proof" of spontaneous generation inhibited the further development of proto-Darwinian ideas by reclaiming for intellectual respectability the possibility that the spontaneous generation of macro-organisms could occur under certain conditions, thus making it easier to disbelieve in biological design without recourse to proto-Darwinism. It is essential to note that Needham's "proof" also inhibited the development of the ABD, as is illustrated by the case of Diderot. Before Needham, Diderot accepted the ABD, and

made it clear that it hinged on the refutation of spontaneous generation:

> The great blows that atheism has received have not been at the hand of the metaphysician. The sublime meditations of Malebranche and Descartes were less appropriate for the weakening of materialism than a single observation by Malpighi.[92]

However, in his *Rêve de d'Alembert*, written in the 1760s (although published much later), he espoused materialism.[93] There were proto-evolutionary strains in his thought, and one tends to assume that his deism-to-materialism trajectory was connected with an increasing acceptance of evolution.[94] This is anachronistic, however, and his post-Needham acceptance of spontaneous generation was probably responsible for both his conversion to materialism and his failure to develop his nascent Darwinism.[95]

*At the end of the eighteenth century, ... biological origins once again started to present difficulties for design disbelievers.*

At the end of the eighteenth century, spontaneous generation's post-Needham Indian summer drew to a close, and biological origins once again started to present difficulties for design disbelievers. This led to an era of popularity for the ABD, typified by the writings of Paley,[96] and, at the same time, to the formulation of the first detailed theories of design-free evolution by Erasmus Darwin[97] and Jean-Baptiste de Lamarck.[98] The theories of Lamarck and Erasmus Darwin were genuinely novel, being based on the principle that organisms struggle to improve. This struggle was not necessarily conscious, and the belief that Lamarck's theory was nonmaterialist[99] is a misunderstanding due to the translation of *besoin* as "want," which meant "need" or "lack" in 1801 but had shifted to its modern meaning by 1859.[100]

Lamarck and Erasmus Darwin believed that microorganisms are generated spontaneously whereas macroorganisms are not.[101] This ruled out non-evolutionary nondesign-based origins for higher organisms, and therefore made evolution necessary for rejection of biological design (leaving aside the possibility of infinite age). It also made Lamarckian evolution possible, by providing the initial organisms (no Lamarckian mechanism for the origin of microorganisms has ever been suggested). Lamarck was clear about this motivation, stating that it had recently been shown that only the simplest organisms are spontaneously generated, but that design-free evolution is a form of indirect spontaneous generation.[102]

During the early nineteenth century, there was growing skepticism about the spontaneous generation of microorganisms, presenting design-disbelievers with increasing difficulties. Lamarckian evolution was widely accepted during this era, but it provided no succor, as it required simple initial organisms (the possibility of arrival from space was largely ignored).[103] Therefore, in formulating his theory, Charles Darwin turned back to the older Empedoclean-Aristotelian tradition.[104] His ideas, published just before Pasteur applied the *coup de grace* to spontaneous generation, led to his suggestion that microorganisms arose by chance rather than spontaneous generation.[105]

The discovery of paleontological novelty probably had a much less important role in the development of evolutionary hypotheses, as few atheists defended their beliefs on the grounds of the infinite age of species, preferring spontaneous generation. This was perhaps a simple failure of imagination, as exemplified by Paley's dismissal, without explanation, of the possibility that a watch on a heath may have always lain there.[106] However, the 1830s to 1860s, when Lyell was clinging stubbornly to his belief in paleontological non-novelty, were also the decades when the final rejection of spontaneous generation was underway. One therefore may argue that it was the acceptance of paleontological novelty that prevented design-disbelievers using infinite age as a last-resort explanation, and thus led to their acceptance of evolution.

### Since 1861

After Pasteur, explanations for the origin of simple organisms were limited to design, Darwinism, and arrival from space, with the last being largely disregarded.

The insufficiency of purely Lamarckian evolution as an explanation for higher organisms meant that Occam's razor favored the acceptance of Darwinism. In addition, Lamarckian evolution was largely refuted experimentally in the early twentieth century, and Dawkins rejects it, probably validly, on purely theoretical grounds.[107] "Lamarckism" has recently been defended on the grounds of interspecific gene transfer, the endosymbiotic origins of chloroplasts and mitochondria, and various forms of nongenetic and epinucleic inheritance.[108] However, this is due to an imprecise definition. The expansion of the concept of germ-line to include nongenetic inheritance, and extra- and epinuclear genetic inheritance, brings these phenomena fully within the Darwinian fold.[109]

Finally, acceptance of the Big Bang has ruled out the possibility of the infinite age of microorganisms.

## Conclusions

The Dawkins Model is utterly false, as (1) theism was widely rejected before Darwin, (2) several arguments for



*The ABD and evolutionary theories have parallel histories, and were alternative responses to the same sets of new data. Both became important in the 1790s, when geological, paleontological, and microbiological evidence started to increase both the plausibility of the ABD and design disbelievers' logical requirement for the evolutionary theories.*

theism other than the ABD were in widespread use before Darwin, (3) the ABD was almost never used before the late seventeenth century, and had little influence before Paley, (4) two nondesign-based nonevolutionary explanations for biological complexity were available until the mid-nineteenth century, and (5) even if it were accepted that organisms must have been designed, this would not offer a convincing case for theism. The ABD and evolutionary theories have parallel histories, and were alternative responses to the same sets of new data. Both became important in the 1790s, when geological, paleontological, and microbiological evidence started to increase both the plausibility of the ABD and design disbelievers' logical requirement for the evolutionary theories. The logical necessity for design-disbelievers to believe in Darwinism continued to increase, and had become almost absolute by the 1860s. This is very different from the textbook picture, according to which the ABD was accepted throughout history, with evolution often being suggested but making little headway, until Darwin proposed a workable mechanism, after which evolution was rapidly accepted, resulting in a decline in theistic belief.

The primary significance of this conclusion is its weakening of materialist propaganda. The Dawkins Model is widely assumed in such propaganda, because science has more popular prestige than philosophy, so most people are more liable to be convinced by an argument based on science, and because it enables materialism to be characterized as *modern*, so opponents can be dismissed as reactionaries.

The second significance depends on one's metaphysical position. For convinced materialists, the recognition that evolution is a philosophical red-herring (regardless of whether it is true), and that materialism must be defended on other grounds, should encourage skepticism about Darwinism-derived extra-scientific positions. The importance of this should not be underrated. Social Darwinism is very much alive and slithering, as shown by the popularity of *The Bell Curve*.[110] However, even apart from wickedness of that ilk, the politicocultural agendas of many prominent Darwinists are profoundly illiberal, being hostile to all non-science-based decision making, and are, indeed, oddly analogous to those of the Religious Right.

For everyone else, the above conclusion should encourage a reassessment of the truth of Darwinism. The scientific claims of biblical (or Koranic, etc.) literalists are treated with extreme skepticism, not primarily because of the weakness of their supporting evidence, but because they are derived from metaphysical assumptions. Twenty-first-century materialists are sometimes criticized as being in an analogous situation, as they have little choice but to explain biological complexity in Darwinian terms. However, this criticism involves the confusion of grounds and consequents, as materialism may be derived—although perhaps not validly—from Darwinism, rather than *vice versa*. This article suggests that Darwinism was an effect rather than a cause of materialism. An effect is not the same as a consequent, and Darwinism therefore should not be regarded as directly analogous to literalist creationism. However, if it could be shown that the only ground for Darwinism is as an alternative to design, it would be legitimate to regard it as directly analogous.

## Appendix: Pre-1668 history of the ABD

That the ABD was sometimes formulated before 1668 is a weakness of this thesis. Pre-1668 formulations are therefore examined here. Further investigation is needed to show whether these genuinely militate against this thesis.

Aristotle and Galen formulated arguments resembling the ABD, but it is not certain whether they envisaged a conscious designer. Aristotle frequently made statements about the motives of "nature" (*physis*), such as that it "makes nothing in vain,"[111] but it is not clear whether this should be regarded as other than a figure of speech. Although Aristotle seems to have held quasi-theistic beliefs,[112] the idea that his biological teleology referred to the aims of the designer is now generally rejected.[113] Galen, on the other hand, kept switching between "nature" and "the creator" (*demiourgos*), with no apparent change in thinking, and it therefore appears that the latter was merely a figure of speech.[114] He was explicit in his

rejection of the Judaic beliefs in miracles and creation *ex nihilo*.[115] Design is, in any case, the less central of his two theses, the other being a defense of Aristotle's teaching that all parts of the body are optimal,[116] in opposition to Plato's belief in their imperfection.[117] The question whether biological structures are optimal is independent of that of whether they are designed.

The arguments of the Stoics are more clearly arguments from design, although the designer was probably envisaged as the consciousness of the universe, rather than God. A brief such argument is that of Epictetus.[118] A second is that of Balbus, in Cicero's *De Natura Deorum*. Balbus described beautifully how awe at the living world leads one to appreciate the consciousness of the universe,[119] and at points, his description amounts almost to an argument from biological complexity. It is possible (although admittedly improbable) that Cicero was skeptical about spontaneous generation, as he did not mention it, despite being familiar with Aristotle's biological writings.[120] Furthermore, he wrote that "trees and all such things" reproduce by seeds, all animals reproduce sexually, and fishes produce eggs.[121]

The most unambiguous pre-Christian formulation of the ABD was that of Socrates, as he clearly contrasted design with chance.[122] However, it is not certain that Socrates had considered the possibility of infinite age, because it is often stated that Aristotle was the first Greek to teach this doctrine. Furthermore, although one tends to assume that Aristotle took his ideas about spontaneous generation from universally accepted folk-belief, one factor suggesting that this might not be the case is that Homer seems not to have believed in it.[123] If these suggestions are correct, Socrates, at the beginning of Western intellectual history would have been, oddly, in the same situation with respect to design as we have been since the 1860s.

Probably the only Christian (or Jew or Muslim) before 1668 to formulate the ABD was Henry More, in 1653.[124] His argument was largely based on the utility of plants and animals to humans, rather than their complexity, but the latter type of argument does appear, and he made it clear that he was arguing against organisms arising by chance, commenting that it is no more likely that they could arise without God than that Greek inscriptions could do so. More believed in spontaneous generation, even considering Lucretius' bizarre stalked-womb ideas to be credible, but he was clearly troubled by this possibility, and argued that it must have been providential for both males and females to have been generated while the earth was fecund.[125] His argument is difficult to follow, but he was a Cambridge Platonist, holding that the continued operation of organisms requires conscious intervention[126] (see p. 253). Therefore, his argument may perhaps be looked upon as an argument from biological order rather than design. Furthermore, the possibility of infinite age was widely rejected in the late seventeenth century. ✯

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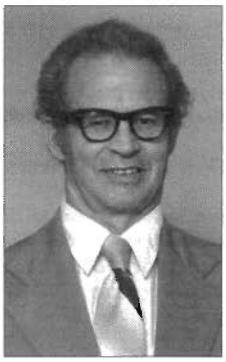
# In Defense of Intelligent Design



*I believe my many years of training and experience [in biochemistry] qualify me to evaluate the scientific evidence [used in the arguments for and against design].*

Authors of two recent books, Kenneth Miller (*Finding Darwin's God*)[1] and Michael Ruse (*Can a Darwinian be a Christian?*),[2] have been very critical of Intelligent Design, and especially of Michael Behe's arguments for design in *Darwin's Black Box*.[3] Many of their criticisms dealt with biochemical aspects of design, where I believe my many years of training and experience qualify me to evaluate the scientific evidence.

**Ancestral descent and evolution.** One of the key components of the Darwinian Theory of Evolution has been the concept of ancestral descent. This concept holds that in the course of evolution, there has been a gradual change from primitive organisms, such as bacteria, to more advanced organisms, such as mammals, and that these changes can be explained by chance events (mutations, gene duplications, etc.).[4] The changes would then be fixed in organisms by natural selection. The ancestral descent concept holds that these changes would be demonstrable both in the structures (morphology) of organisms and in the cellular biochemistry used for fundamental processes, such as the trapping of energy. Ruse and Miller believe that if these latter changes can be accounted for by chance events, they will have struck a severe blow to Behe's principle of irreducible complexity, which he uses to argue for Intelligent Design.

**Tricarboxylic acid cycle and a proton pump.** First let me review the metabolic systems that Miller and Ruse have chosen in their attempt to validate their thesis regarding ancestral descent. In the 1930s, Hans Krebs discovered, through a series of carefully designed experiments, what is now known as the Krebs tricarboxylic acid cycle. This cycle has been shown subsequently to be the most important pathway in vertebrates for converting the potential energy of a number of different nutrient compounds into the readily available energy of adenosine triphosphate (ATP). The mechanism of coupling the oxidative sequences in this pathway to formation of ATP is known as a respiratory chain and involves enzymes known as cytochromes, various cofactors, and a proton pump. Even though the respiratory chain often is considered separately from the tricarboxylic acid cycle in textbooks, within the mitochondria of cells, they are very closely linked in their function. These are indeed two very important systems in vertebrate metabolism. Did these systems and their component enzymes originate in bacteria and evolve by chance into the more complex forms found in mammalian cells? Let us examine what the evidence shows and see if the mammalian system has been shown to have been cobbled together by chance from some bacterial precursor enzymes.

## Their Evidence for Ancestral Descent

**Tricarboxylic acid cycle.** Ruse and Miller both cite a 1996 paper by Melendez-Hevia, et al. on the tricarboxylic acid cycle enzymes,[5] and Miller cites a 1998 paper on the proton pump by Musser and Chan in support of the ancestral descent thesis.[6] In regard to the first of these papers, Ruse notes:

> Yet the cycle did not come out of nowhere. It was cobbled together out of other cellular processes which do other things ... Each one of the bits and pieces of this cycle exists for other purposes and has been co-opted for the new end (p. 115).

**Gordon C. Mills**, *Ph.D., was a professor for many years in the Department of Human Biological Chemistry and Genetics, University of Texas Medical Branch, Galveston. In 1987, he received the Sigma Xi Chapter Sinclair Award for "Humanity, Scholarship, and Research." An ASA fellow, Gordon is presently an active retiree in Florida. Correspondence can be sent to: Gordon C. Mills, 4207 Fleet Landing Blvd., Atlantic Beach, FL 32233.*

Miller is equally enthusiastic in his claim that this research paper supports the hypothesis of ancestral descent. He says:

> The Krebs cycle is a complex biochemical pathway that requires the interlocking, coordinated presence of at least nine enzymes and three cofactors. And a Darwinian explanation for its origin has now been crafted (p. 151).

In this communication, I wish to show that Ruse and Miller are dealing with this topic at a superficial level. When one examines the data closely, their arguments are not adequate to explain their hypothesis. First let me note several types of studies that are essential to Miller's claim of a good "Darwinian explanation" for ancestral descent of the enzymes of the tricarboxylic acid cycle. They are:

1. There would of necessity be strong sequence similarity of each of the enzymes in the cycle and the claimed ancestral enzymes found in bacteria, where the enzymes were functional for other purposes.

2. There would need to be a proposal of some kind of phylogenetic tree showing plausible steps from apparent bacterial ancestral enzymes to the enzymes of a functional Krebs cycle. This would need to be supported by amino acid or DNA similarities.

3. Since Krebs cycle enzymes, when functioning in oxidative metabolism, are found in mitochondria of eukaryotic cells (cells with a nucleus), there would need to be a mechanism for incorporation of the enzymes into the correct structural relationships in the mitochondrial matrix.

4. Since bacterial genes are predominantly found as circular DNA, there would need to be an incorporation of these genes into the chromosomal DNA of the cell nucleus. In a few instances, the ancestral bacterial genes would need to be transferred to the circular DNA of the mitochondria, rather than the cell nucleus.

Melendez-Hevia, et al. do not deal with any of the questions that I have posed, although they do indicate in their second and third stages (p. 294), the necessity of organization for all of the components of the cycle. Organization and regulation are absolutely essential for a functioning Krebs tricarboxylic cycle. The organization and regulatory stage would, of necessity, include incorporation of the various heme enzymes and cofactors that are essential to the trapping of cellular metabolic energy as adenosine triphosphate. With thousands of different species of bacteria for consideration, only one, an anaerobic bacterium, *Desulfotomaculum*, is listed by Melendez-Hevia, et al. by name. A reasonable proposal would surely list possible ancestral bacteria showing that all of their necessary enzymes were gradually incorporated into cells of a single ancestral species.

The major thrust of these authors in this paper is on the types of compounds and the types of reactions involved in the tricarboxylic acid cycle and why the particular reactions are the most appropriate. The authors do not deal with whether these compounds were selected by chance or chosen by a designer. They do make some interesting thermodynamic and kinetic observations about why certain alternative pathways would not have evolved (or have been designed). Their proposed stages (p. 294) in the history of life are interesting, but are unproven. Their proposed "Rules for Designing Metabolic Pathways" (p. 297) are reasonable for any pathway dependent on an evolutionary sequence, but, in most cases, also would apply for a sequence brought about by Intelligent Design.

**A philosophical question.** A most important philosophical question seems to have been overlooked by these authors. Providing an apparently feasible explanation about how something may have happened does not prove that it did happen that way! Sometimes, explanations that appear feasible on the surface can be shown to be quite inadequate when one digs more deeply. Since Melendez-Hevia, et al. did not deal with any of the types of studies that I have suggested, I must consider their studies as failing to provide the "proofs" that are claimed for them by Ruse and Miller.

*Since Melendez-Hevia, et al. did not deal with any of the types of studies that I have suggested, I must consider their studies as failing to provide the "proofs" that are claimed for them by Ruse and Miller.*

Another point needs to be made clear for anyone not familiar with the metabolic details of biochemistry. Interrelationships of different metabolic pathways in biochemistry are common. Amino acid metabolism is closely linked to carbohydrate metabolism and has been taught that way for fifty years or more, so the linking of the metabolism of amino acids to Krebs cycle enzymes is not new. Oftentimes the same enzyme or enzyme complex may be used in linking pathways. Consequently, indications of interrelationships of Krebs cycle enzymes with enzymes of amino acid metabolism is not necessarily an argument that the latter have an ancestral relationship to the Krebs cycle enzymes.

**Proton pump.** Kenneth Miller (*Finding Darwin's God*, pp. 149–50) gives a second illustration of evolution utilizing existing components in the formation of a proton pump. This pump is an important component of a respiratory chain in vertebrate cells. Miller notes the work in 1998 of Musser and Chan, who were able to produce in impressive



detail, "an evolutionary tree constructed using the notion that respiratory complexity and efficiency progressively increased throughout the evolutionary process."[7]

The paper of Musser and Chan is a very careful study of the different enzyme complexes utilized for proton translocation in bacteria as well as in cells of mammals, plants, and fungi. They note the differences in hydrogen donors in these different organisms as well as the difference in the terminal proton acceptor. They also note the similarities in the heme protein catalytic group used in all of these organisms. With an evolutionary tree based on ribosomal RNA sequences as a model, the authors propose a similar tree for the evolutionary development of the components of the proton pump. However, the authors note that they use only minimal amino acid sequence information of the heme proteins in their analysis. Therefore, it should be emphasized that their phylogenetic tree is based on ribosomal RNA sequences rather than sequences in the actual enzymes of the proton pump.

*Until protein and gene sequences are more carefully examined, it is premature to claim, as does Miller, that the question of the origin of the vertebrate pump has been resolved.*

Despite the differences in the bacterial proton pump and the proton pump found in mammals, the authors do note a number of developmental similarities that suggest an ancestral relationship. However, they assume that any such relationship could come about only by chance events (gene duplications, mutations, etc.). They do not eliminate the possibility of design because they do not consider it. In my view, all of the similarities they note may very readily be explained as due to a common creator (designer). Until protein and gene sequences are more carefully examined, it is premature to claim, as does Miller, that the question of the origin of the vertebrate pump has been resolved. Musser and Chan do discuss the importance of the spatial relationships of the various components in the mammalian mitochondrial pump. However, they do not suggest how this spatial organization might have developed from the structures of the different components as they are found in bacteria.

## Conclusion

In summary, Musser and Chan have suggested a possible ancestral relationship of a bacterial proton pump to the mammalian proton pump in the mitochondrial respiratory chain. However, they have not presented protein or DNA sequence studies that would be essential for placing their hypothesis of an ancestral relationship on a firmer basis. If the evolutionary model of formation is correct, the authors would need to demonstrate verifiable evolutionary pathways utilizing only chance events. It also should be emphasized that similarities do not prove that relationships have come about by chance. Similarities may also be a consequence of a common creator or designer.

**Comments regarding Intelligent Design.** After dealing with some of the criticisms of Intelligent Design, I believe a few additional positive comments are warranted. Many writers assume that a Creator would use only fiat creation, i.e., creating entire organisms. However, there is no reason to limit the creative activity of a Creator to fiat creation. In some cases, the jumps necessary to bridge gaps in phylogenetic relationships might be brought about by relatively small changes in chromosomal DNA, particularly with changes in developmental genes. Unless one can make probability estimates for the possibility of these changes, it may be nearly impossible to know which changes were a consequence of chance mutations and which were due to modifications by a designer. My view, which I now refer to as a Design Theory of Progressive Creation, never postulates that all changes must be due to specific acts of design,[8] whereas the traditional evolutionary view insists that all changes must be a consequence of chance (usually gene duplication, mutation, and natural selection).

The hypothesis that enzymes or other protein molecules might be built up from smaller modular units at the level of genes is worthy of serious consideration. I have considered possible movement of modular units in several of my papers.[9] However, if modular units are used, one still must postulate some source of information in nonmodular portions of protein molecules, and controls for regulating movement of modules around in cells of higher organisms are very stringent. The overall probability of putting a protein together by combining modular units, each of which had been formed separately, is no different than putting a protein together one amino acid at a time. All studies carried out so far indicate the extremely low probability of obtaining a single protein

by chance. For cytochrome c, a small protein with about one hundred amino acids, the probability of starting with only L-amino acids is $2 \times 10^{-65}$.[10] Present estimates for the human genome indicate that 30,000 to 40,000 genes are present. Since the cytochrome c gene is smaller than average in size, and all evidence indicates that production of other genes for proteins would have corresponding low probabilities for chance formation, how can one not postulate a designer? ✯

## Notes

[1]Kenneth Miller, *Finding Darwin's God* (New York: Harper-Collins Publishers, 1999).

[2]M. Ruse, *Can a Darwinian be a Christian?* (Cambridge: Cambridge University Press, 2001).

[3]Michael Behe, *Darwin's Black Box* (New York: Free Press, 1996).

[4]Clarification of my use of the word "chance" may be appropriate. In some cases, I use it in the sense of "pure chance" where process is entirely unrestrained. Its use in regard to mutations approaches this sense, although there are indications that in rare instances there may be "directed mutations." Natural selection, although dependent upon chance events, could be argued as having some direction. The probability calculations for the amino acid sequence of a protein molecule would probably approach "pure chance." For those postulating a designer, applying direction to chance events would become of major importance.

[5]E. Melendez-Hevia, T. G. Waddell, and M. Cascante, "The Puzzle of the Citric Acid Cycle," *Journal of Molecular Evolution* 43 (1996): 293–303.

[6]S. M. Messer and S. I. Chan, "Evolution of the *Cytochrome c Oxidase* Proton Pump," *Journal of Molecular Evolution* 46 (1998): 508–20.

[7]Ibid.

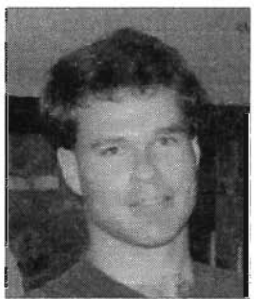
[8]G. C. Mills, "A Theory of Theistic Evolution as an Alternative to the Naturalistic Theory," *Perspectives on Science and Christian Faith (PSCF)* 47 (1995): 112–22; ——, "Theistic Evolution: A Design Theory at the Level of Genetic Information," *Christian Scholar's Review* XXIV (1995): 444–58.

[9]G. C. Mills, "Possible Role of Protein Modules in a Theory of Theistic Evolution," *PSCF* 50 (1998): 136–9; and ——, "The Origin of Antibody Diversity," *PSCF* 51 (1999): 254–6.

[10]H. P. Yockey, "A Calculation of the Probability of Spontaneous Generation by Information Theory," *Journal of Theoretical Biology* 67 (1977): 377–98.



# Natural Selection as an Algorithm: Why Darwinian Processes Lack the Information Necessary to Evolve Complex Life



*The invention of computers and the advent of computer science ... have begun to cast doubt upon Darwin's vision of a bottom-up world in which simplicity gives rise to complexity.*

Darwin's great insight was his explanation of the complex in terms of the simple. His elegant mechanism, natural selection, relies upon the facts of replication, variation, and competition to explain high-level complexity and even the very intelligence capable of understanding and contemplating evolution itself. The capabilities of the Darwinian mechanism appear to be literally limitless, as it creates and designs the well-wrought, complex life that inhabits the world.

The invention of computers and the advent of computer science, however, have begun to cast doubt upon Darwin's vision of a bottom-up world in which simplicity gives rise to complexity. The computer is an ideal modeling tool for the slow, drawn-out process of biological evolution, since many millions of operations can be carried out per second. One of the first to apply the budding field of computer science to evolutionary theory in the 1960s was John Holland of the University of Michigan, who coined the phrase "genetic algorithm" and, along with his students, began to experiment with creating a computer model of the evolutionary process. As the field of evolutionary programming has grown, it has begun to demonstrate that the complexity produced by genetic algorithms first must be encoded into the parameters and fitness functions—it does not arise from scratch.

To illustrate this, consider the public lecture that first sparked my interest in genetic algorithms. The seminar was presented on February 21, 2001, at New Mexico Tech in Socorro, NM, while I was an undergraduate student there. Dave Thomas, an alumnus of New Mexico Tech and current president of the local skeptics group, New Mexicans for Science and Reason, presented a computer program that purportedly generated specified complexity entirely without intelligent input or design. The program's task was to solve the Steiner problem, which entails finding the minimal network that connects five pre-given points. The program began by generating a series of random networks. Then through a series of random "mutations" and rounds of selection, the program was able to converge to the optimum Steiner solution with great regularity.

After his presentation, Thomas and I had a lengthy email exchange in which I pointed out that the Steiner solution is the network that connects all five points and has the shortest path-length. But the genetic algorithm selected for networks that connect all five points and have shortest path-lengths. Thus, the very properties that define the Steiner solution were programmed into the fitness function. Notice how specific the fitness function had to be: it captured the defining characteristics of the desired solution. The high degree of specificity embodied in the fitness function also prevented the program from ever converging on any other configuration that might be useful or interesting, or from providing a solution to a different problem; in that sense, the program was deterministic. The implication is that there are no general-purpose genetic algorithms. They must be carefully tuned to fit the problems they are supposed to solve, and they must contain large amounts of very detailed information.

Several prominent scientists in the field of genetic algorithm theory echo this conclu-

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sion. Geoffrey Miller of University College, London, notes that fitness functions must be carefully designed. He says:

> In effect, the fitness function must embody not only the engineer's conscious goals, but also her common sense. This common sense is largely intuitive and unconscious, so is hard to formalize into an explicit fitness function. Since genetic algorithm solutions are only as good as the fitness functions used to evolve them, careful development of appropriate fitness functions embodying all relevant design constraints, trade-offs and criteria is a key step in evolutionary engineering.[1]

Furthermore, Miller notes:

> All the expertise that human engineers would use in confronting a design problem—their knowledge base, engineering principles, analysis tools, invention heuristics and common sense—must be built into the genetic algorithm. Just as there is no general-purpose engineer, there is no general-purpose genetic algorithm.[2]

Melanie Mitchell, expert on genetic algorithms from the Santa Fe Institute and author of an introductory text on genetic algorithms, notes:

> Choosing a fixed encoding ahead of time presents a paradox to the potential GA [Genetic Algorithm] user: for any problem that is hard enough that one would want to use a GA, one doesn't know enough about the problem ahead of time to come up with the best encoding for the GA. In fact, coming up with the best encoding is almost tantamount to solving the problem itself![3]

In other words, the amount of design work and information a genetic algorithm needs to solve a problem is often enough to permit a direct solution, without the genetic algorithm as an intermediate step. The important point is that the particulars of the problem and the desired outcome both must be explicitly put into the system before it can solve the problem. The genetic algorithm, especially the fitness function, is highly specific and contains very detailed information about what it is to produce. The complexity and information is all there in the antecedent conditions before the program begins to operate, and the program acts as a conduit for that information to flow into the end result. The information content of the resulting simulated organisms does not originate step-by-step; rather, it is present, in its entirety, in the program at the beginning, and it is incorporated into the end result in a step-by-step fashion.

Another example will help illustrate this point. Thomas Schneider, research biologist in the Laboratory of Experimental and Computational Biology at the National Cancer Institute, has published an article in *Nucleic Acids Research* in which he describes a genetic algorithm he created.[4] His program generates a population of 64 "organisms" each having a genome of 256 "base pairs." These base pairs may take one of four values (to simulate the four bases available to real DNA). The goal of the simulation is to model the evolution of binding sites in the genome of hypothetical organisms. Schneider set up sixteen 6-base long binding sites and a weight matrix that is used to assign numerical values to each binding site. In addition, the genome contains an encoded threshold value, and if the numerical value of a binding site (as determined by the weight matrix) is above the threshold, a hypothetical protein is considered to have bound to the site.

*The complexity and information is all there in the antecedent conditions before the program begins to operate, and the program acts as a conduit for that information to flow into the end result.*

The fitness function simply counts the number of mistakes made by each organism and eliminates the half of the population that make the most mistakes. Those making the fewest mistakes then replicate (with one mutation per organism) and replace those organisms that have been eliminated. A mistake is defined as non-binding at a binding site, or binding at a non-binding site. In other words, if the numerical value of a binding site is below threshold, or the numerical value of a non-binding site is above threshold, a mistake has been made. What this implies is that the fitness function selects directly for organisms with binding site values above threshold (and no non-binding site areas above threshold).

Schneider comments: "Remarkably, the cyclic mutation and selection process leads to an organism that makes no mistakes in only 704 generations." Furthermore, he notes:

> The ev model quantitatively addresses the question of how life gains information, a valid issue recently raised by creationists ... The ev model shows explicitly how this information gain comes about from mutation and selection, without any other external influence, thereby completely answering the creationists.[5]

However, it is abundantly clear from the analysis given above that the information produced by the program was actually smuggled in by the programmer. The fitness function selects directly for organisms that have the most binding site values above threshold and have the fewest non-binding site values above threshold. Is it any wonder, then, that the program produces organisms that have all

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*Genetic algorithms always must start with the information they output. The fitness function must select directly for the defining qualities of the desired outcome. In other words, evolutionary processes precisely follow their fitness function.*

binding site values above threshold and have no non-binding site values above threshold? Again what we see is that the very characteristics of the desired outcome are put directly into the fitness function, and there is no magic or mystery about where this information comes from. It is not generated "from mutation and selection, without any other external influence." It is inputted by Schneider himself and is extracted and made explicit by the mutation and selection process.

The program Schneider produced has several characteristics which cannot be generated by selection and mutation and which are necessary before selection and mutation may begin to operate. These characteristics manifest as certain fixed parameters that Schneider prepares ahead of time. They constitute the *encoding* of the problem—the settings that configure the program to deal with things like simulated DNA sequences and binding sites.

The fact that mutation has to have something to work upon requires some sort of genome and system of translation or expression, which are given by the weight matrix and binding sites. Even though the binding sites may change position between runs, the precise position of binding sites is fixed within a run, and the computer program must know where the binding sites are in order to know how to evaluate the number of mistakes (recall that whether a site is a binding-site is essential to whether binding is desirable). Furthermore, the fitness function must have a logical structure that allows it to determine which sites to favor and which to reject. This entails the complex interrelationship among weight matrix, threshold, and interpretation of binding site value that Schneider set up ahead of time. These parameters, the encoding, are absolutely fixed but could conceivably take any number of possible configurations—the options are as limitless as the number of possible problems that could be encoded into a computer program.

The selection of one option from many in the encoding amounts to the introduction of huge quantities of information, and essentially gets the program "in the ballpark" for finding the answer Schneider wants. The fitness function is overlaid upon the encoding parameters, and functions to direct the program to the right solution within the pre-given encoding. The fitness function, then, is something like a "map" of the ballpark, showing the program precisely where to go to find the solution (or, more precisely, defining what a solution *is*). Therefore, to claim (as Schneider does) that his program generates information "from scratch" and requires no intervening intelligence is patently false. The information was carefully encoded by the choice of inserted and fitness function to allow something interesting, like the evolution of binding sites, to happen.

These examples show that genetic algorithms always must start with the information they output. The fitness function must select directly for the defining qualities of the desired outcome. In other words, evolutionary processes precisely follow their fitness function. If the fitness function does not go anywhere, neither does the evolutionary process. If the fitness function explicitly points toward some complex and interesting result, then that is what the evolutionary process will produce. The question we need to consider, then, is: Does biological selection point toward complex and interesting organisms like ourselves? Does it contain the sort of explicit, detailed information needed to drive an evolutionary process to produce complex, higher organisms? Even a cursory examination of natural selection is enough to show that it does not point toward anything complex and interesting, and indeed that it should penalize increases in complexity.

It is commonly observed that evolution has no goal, no purpose in mind. It is a process which relies on nothing more than the sifting of variants; a form of filtered randomness. Schneider's program starts with an end goal, a perfect picture of what it is to work toward. In fact, this is a general characteristic of genetic algorithms: they require a detailed picture of what they are to produce before they can produce it. They cannot simply generate random things and grab "whatever looks interesting." They require a specific, detailed idea of "what is interesting," a goal that they can work toward. The problem is that the Darwinian fitness function, natural selection, *has no analogous goal*. It does not have an internal "human-producing" module that contains complete specifications for a human being. Yet all of our experience in

genetic algorithms suggests that the only way evolution could produce complex entities like human beings is if that endpoint is specifically targeted by the fitness function—that is, if humans (and all the rest of biological complexity) are explicitly identified as targets before evolution begins to work. If this is true, then the sheer volume of information that must be contained within the Darwinian fitness function must be enormous, and we are justified in asking where all of this information is stored.

*By invoking the Darwinian mechanism as the cause of all biological complexity, [Darwinists] imply that somehow, without any goal-directedness, their mechanism was able to sift randomness and preserve "whatever is interesting"—all without knowing, ahead of time, what the definition of "interesting" is.*

Darwinists are quite right to insist that their mechanism actually does not contain pre-encoded endpoints, or goals; it does not contain the vast amount of information needed to precisely describe all of biological complexity. It is here, though, that a problem arises. For by invoking the Darwinian mechanism as the cause of all biological complexity, they imply that somehow, without any goal-directedness, their mechanism was able to sift randomness and preserve "whatever is interesting"—all without knowing, ahead of time, what the definition of "interesting" is. And as we have seen, computer simulations of the evolutionary process demonstrate that only a precisely defined fitness function, with a detailed goal in mind, can produce complex and interesting things. In short, the program has to know exactly what end goal to select for—and evolution simply does not have any knowledge of such goals. Thus, in a detailed, goal-oriented sense, evolution is *in principle* incapable of producing biological complexity.

This is where the plot thickens. The Darwinian argument is that evolution need not have an end goal in mind because it can substitute "fittest" for "interesting." Evolution can just generate random variations of each organism, and, by preserving (selecting) the fittest variant (defined as those organisms capable of most efficiently producing offspring) is able to boot-strap itself up to build all biological complexity (given enough iterations of the cycle). In that sense, the end goal of the Darwinian process is not any particular piece of biological complexity, but rather a good-enough substitute: the fittest organism.

There are now two problems facing the Darwinian mechanism, and I will focus here upon the second (the first has been dealt with elsewhere by myself and other authors).[6] The first problem is that generating new variants to test (new candidates to run through the filter of selection) is the job solely of random mutation, and those mutations must produce new adaptations which natural selection can then preserve. This works fine for certain types of adaptations (like antibiotic resistance or finch beak size evolution) but there are some adaptations which require too big a step for chance to take. The reason is that a novel adaptation sometimes requires multiple, coordinated changes in many genes (or the origin of many entirely new genes) before any selectable advantage is realized, putting such adaptations simply beyond the reach of a chance-based adaptation generator. Because of the interlocking requirements for function, there is no gradual route to such adaptations; they must be formed in a single step—a step that is beyond the reach of chance. And if chance cannot generate those adaptations, they will never exist for natural selection to act upon and these adaptations will never be generated via a Darwinian mechanism—yet many such adaptations actually do exist in the biological world.

The second problem concerns the Darwinist's proposed substitution of "fittest" for "interesting" as a goal for the evolutionary process. By "interesting" I mean biological complexity beyond simple bacteria and other microorganisms (we could call this "higher biological complexity," and it includes ourselves). "Fitness," in a biological sense, is a measure of one's ability to propagate oneself. I intend to challenge the link between "fittest" and "interesting." There is no reason they should be synonymous, and there are good reasons to suspect that in most or perhaps all cases they are actually antonymous.

Let's take another look at natural selection. Richard Dawkins, in *The Blind Watchmaker*, describes how natural selection operates to increase the fitness of organisms in a population. He says:

> And if any entity, anywhere in the universe, happens to have the property of being good at making more copies of itself, then automatically more and more copies of that entity *will* obviously come into existence. Not only that but, since they automatically form lineages and are occasionally miscopied, later versions tend to be "better" at making copies of themselves than earlier versions, because of the powerful processes of cumulative selection. It is all utterly simple and automatic. It is so predictable as to be almost inevitable.[7]

The problem here is that "fit" (efficiently replicating organisms) and "interesting" (higher biological complexity) are diametrically opposed to each other. As the complexity of a system increases, so does the cost (in time

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*Natural selection favors simple, single-celled replicators and penalizes higher complexity and organization as we see in multicellular life and in higher animals. The Darwinian world should consist entirely of bacteria and other single-cellular life forms competing to be the simplest and most efficient replicator.*

and material resources) of making more copies of it. Therefore, the best way to increase reproduction efficiency is to reduce complexity. In other words, the selection pressures of evolution point *away* from the advanced biological complexity that we consider "interesting." Richard Dawkins addresses this point when he describes Sol Spiegelman's experiments in the 1960s with RNA replication in test tubes.[8] The RNA used in the experiment originally came from a Q-beta virus (which normally infects E. coli), and it encodes an RNA replicase used by the virus to duplicate its RNA and take over a cell.

Spiegelman prepared a test tube with pre-made RNA replicase, and added the Q-beta RNA. After allowing the RNA to go through replication, he took a drop from that test tube and added it to a fresh test tube (again, with pre-made replicase present). The result was an unequivocal drive toward simplicity, with the most successful RNA replicators being those molecules which managed to jettison the unneeded RNA replicase sequence. Since Spiegelman was supplying replicase in high quantities, there was no need for the viral RNA to carry instructions for making more—and the RNA was able to replicate much faster by becoming as simple as possible, in this case, simplifying down to the bare minimum needed to carry out the act of copying. Even some original complexity in this relatively simple replicator was lost since it was not absolutely essential to the replication process.

The clear implication is that natural selection favors simple, single-celled replicators and penalizes higher complexity and organization as we see in multicellular life and in higher animals. The Darwinian world should consist entirely of bacteria and other single-cellular life forms competing to be the simplest and most efficient replicator. After all, bacteria, which can reproduce (under optimum conditions) every twenty minutes, far outstrip the twenty-year life cycle of humans in terms of replication efficiency. In general, as one moves up the complexity ladder, one finds a corresponding increase in life cycle time and a consequent decrease in replication efficiency. Furthermore, bacteria are far more adaptable than humans and are found in every environment that humans inhabit—and quite a few that we do not (just think of the deep thermal ocean vents).

The increased complexity of human beings (or any other higher life form) gives no benefit in terms of habitable environment or fitness in a Darwinian sense. In fact, it is often noted that if some global catastrophe occurs (such as a nuclear exchange), the only organisms that survive will be the bacteria and relatively simple organisms such as cockroaches. This only highlights the fitness cost (in terms of survival, not just reproduction) of increased complexity. It is difficult to see what possible benefit could accrue from increased complexity such as to overcome the corresponding decrease in replication efficiency and overall fitness. The fittest, in a Darwinian sense, are the bacteria and other micro-organisms of which we are hardly aware. Humans and other multi-cellular organisms are anomalies—lumbering, gigantic, and ponderously unfit in the Darwinian world.

The brute fact of the existence of beings like ourselves suggests one of two things; either (1) we were not "in the program" of Darwinian evolution (and hence came from a non-Darwinian process) or (2) we are "in the program" of evolution (and need to find out where). Let us consider the implications of the second possibility. Perhaps the Darwinian fitness function is, in reality, more complicated and nuanced than I am giving it credit. Perhaps scientists will one day find that it does contain the sort of information required for complex life like ourselves to arise; perhaps the evolutionary fitness function points directly and unequivocally toward complex organisms. Precisely what would this evolutionary fitness function look like?

Before we consider the information required to make a human being, let us consider the much simpler case of a "mere" bacterial flagellum. In this case, we have a good idea of the constraints and requirements that would be needed to create this miniature outboard motor, since extensive research has been done on the system.[9] We know that it normally rotates at 20,000 RPM, that it has various rotors and stators, a "propeller" and hook joint (a sort of universal joint on a molecular scale), and an elegant system for converting acid flow to rotary

motion. Recall that the study of genetic algorithms reveals that fitness functions must select for *the defining characteristics of the desired result*. Therefore, if natural selection were to produce a complex system like the bacterial flagellum, it would have to somehow select for a rotary motor, complete with drive shaft, propeller, and acid-powered engine. Granted, there may be more than one way to construct such a motor, but such possibilities are very limited considering the vast space of possible configurations of protein molecules. It is to this highly specialized target area that natural selection must guide the evolutionary process if it is to create a bacterial flagellum. Under these conditions, a flagellum should be expected to emerge, and always emerge. However, this fitness function would be unable to select for anything *but* a bacterial flagellum. We run into the determinacy problem of genetic algorithms; they always converge on their target, with a probability of one.

*The complex design produced by the algorithm must be programmed into the fitness function from the outset. In defiance of Darwin's vision of a bottom-up, step-by-step route to complex life forms, genetic algorithms are demonstrating that the complexity and order inherent in life is not reducible to simpler components.*

This flagellum-building fitness function certainly could not work to build other complex structures like the blood clotting cascade or eukaryotic cilium, let alone the brain/eye system or the intricacies of the circulatory/respiratory system required by large organisms like ourselves. The problem here is that the evolutionary algorithm is too specific and cannot function as a universal problem solver to produce all the different types of order in the biological world. Even given enough information to produce some sort of complex life, it would lack the ability to produce other sorts of complex life.

Perhaps even more importantly, there is absolutely no reason to suspect that the evolutionary fitness function does anything like selecting for bacterial flagellum proteins; in nature, we only observe selection for reproduction. Indeed, if the evolutionary process did select for proteins useful to making a bacterial flagellum it would be deeply teleological, working toward an overall goal—and the oft-cited benefit of Darwin's idea is that it separates teleology from (apparent) design. Thus, even if we eventually find that a teleological fitness function is responsible for some or all complex life in biology (an idea unsupported by current knowledge), it would be a profoundly non-Darwinian mechanism.

The bottom line is that an evolutionary fitness function sufficient to do the design work of complex life forms would itself have to be designed and very complex. Also, it would have to be re-designed for each new feature that emerged—there is no universal genetic algorithm which can create a bacterial flagellum one moment and then build a vertebrate eye the next. These multiple fitness functions would each embody the design and complexity they create, and thus they would simply beg explanation, making the design problem in biology even more acute. However, such elaborate fitness functions do not exist in nature, at least as far as we can tell, and the central claim of Darwinism is that we do not need them—that we can explain the complexity of life in terms of the simple fitness function of natural selection. But computer simulations of evolution have shown the inadequacies of such a simplistic model. There is no universal problem-solver, and each fitness function must be carefully tuned to select for the desired outcome. The complex design produced by the algorithm must be programmed into the fitness function from the outset. In defiance of Darwin's vision of a bottom-up, step-by-step route to complex life forms, genetic algorithms are demonstrating that the complexity and order inherent in life is not reducible to simpler components. The complexity and design of life is holistic; it is top-down, not bottom-up. And that concept is profoundly non-Darwinian. ✯

## Notes

[1]Geoffrey Miller, "Technological Evolution as Self-Fulfilling Prophecy," in *Technological Evolution as an Evolutionary Process*, ed. John Ziman (Cambridge: Cambridge University Press, 2000), 207.
[2]Ibid., 209.
[3]Melanie Mitchell, *An Introduction to Genetic Algorithms* (Cambridge: MIT press, 1998), 158.
[4]Thomas Schneider, *Nucleic Acids Research* 28, no. 14 (2000): 2794–9.
[5]Ibid.
[6]See chap. 5 of *No Free Lunch* by William Dembski (Lanham: Rowan & Littlefield, 2002). My own writings on the problems for a Darwinian mechanism posed by the bacterial flagellum can be found on Metanexus (http://www.metanexus.net/index.html). See my response to Matt Young (found at www.metanexus.net/archives/message_fs.asp?list=views&listtype=Magazine&action=sp_simple_archive_&page=1&ARCHIVEID=6385&searchstring=Bracht) and forthcoming response to Ursula Goodenough dealing extensively with the bacterial flagellum.
[7]Richard Dawkins, *The Blind Watchmaker* (New York: Norton, 1987), 134.
[8]Ibid., 300–4.
[9]See, for instance, Michael Behe, *Darwin's Black Box* (New York: Simon & Schuster, 1996), 70–2.

# Book Reviews

## ANTHROPOLOGY & ARCHEOLOGY

**MAMMOTH: The Resurrection of an Ice Age Giant** by Richard Stone. Cambridge, MA: Perseus Publishing. Hardcover; $26.00. ISBN: 0738202819.

The woolly mammoth, the fabled creature of the Pleistocene Era, exerts a powerful hold on the imagination of explorers. Once an improbable notion, today the plausibility of resurrecting a prehistoric creature is theoretically feasible thanks to advances in genetic science. This book offers such a scenario. With the intention of establishing a "Pleistocene Park," in which long-extinct creatures like the mammoth, saber-toothed tiger, and woolly rhino could be resurrected and given sanctuary, Richard Stone, European news editor for *Science* magazine, ventures out to Siberia in an effort to find a potential carcass to excavate.

This book is about the daring individuals who are penetrating the farthest reaches of Siberia in search of the mammoth. Stone appreciates that to discover the frozen remains of a woolly mammoth holds out the tantalizing prospect of finding tissue with DNA that could be used for cloning. The very idea of establishing a Pleistocene Park may seem radical to some, but Stone's premise is that it may not be radical enough for it to thrive. A woolly mammoth is needed to meet the requirements of developing a "mammoth steppe."

In late October 2000, Stone follows Arctic explorer Bernard Buigues and his multinational team to a remote village in an attempt to excavate and airlift the mammoth carcass known as "the Jarkov"; appropriately named after its discoverers. Studying the potentiality of restoring a stretch of northern Siberia to its prehistoric condition, creating what they call a "mammoth steppe," Stone envisions the area populated by bison, Yakutian horses, and elephants—and one day, creatures such as the woolly mammoth, genetically "summoned from the world of the dead." The excavation of the woolly mammoth is the first step in making this "park" a reality.

This lively adventurous chronicle is divided into three well-balanced chapters that explore the primary, and often conflicting, theories on mammoth extinction: shifting weather patterns caused by climate change, overhunting by humans, and a "hyper disease" passed from humans to mammoths. In the end, *Mammoth* is an extremely intriguing, entertaining, and detailed account of our quest to resurrect the past. It is a provocative look at an intellectual voyage "through uncharted moral terrain, as we confront the promise and peril of resurrecting creatures from the deep past."

*Reviewed by Dominic J. Caraccilo, Lieutenant Colonel, U.S. Army, Vicenza, Italy, CMR 427, Box 1628, APO AE 09630.*

## ENVIRONMENT

**THE REENCHANTMENT OF NATURE: The Denial of Religion and the Ecological Crisis** by Alister McGrath. New York: Doubleday, 2002. xvii + 204 pages. Hardcover; $23.95. ISBN: 03855005909.

The review copy was a bound galley, and this means that I cannot be sure what the final version of this book will be like. There were some English errors that I am hoping will be corrected. The index had eight pages designated, but they were all blank, so I have no way of knowing how useful the index may be. However, based on the galley, I judge the final version will be worth the price.

McGrath is a professor of theology at Oxford, and a consulting editor of *Christianity Today*. He has written or edited a number of books, some of which have been about science and Christianity.

This volume attempts to do a number of things. Let me summarize three major thrusts: (1) It attacks the thesis of Lynn White, author of "The Historical Roots of our Ecologic Crisis," (*Science* 155 [1967]: 1203–7), which mostly blamed Christianity for that crisis, and has been widely followed; (2) It attacks the Enlightenment view of Nature, quoting Steven Vogel, who, according to McGrath, says that "Enlightenment is marked by the 'disenchantment' of nature, its transformation from something sacred into mere matter available for human manipulation" (in A. McGrath, *Against Nature: The Concept of Nature in Critical Theory*, p. 54); and (3) It attacks Richard Dawkins, devoting an entire chapter, "Disenchanting Nature: The Case of Richard Dawkins," and other parts of the book to him.

McGrath argues that the view of Dawkins and others, which leaves out the enchantment of nature, is a fairly recent matter, and that, historically, the West has mostly seen nature as enchanted (more than quarks and chromosomes), and should return to such a view, which he believes is compatible with the practice of modern science.

There is more here, for example, McGrath's take on postmodernism, and quite a few references to C. S. Lewis, and even some to *Star Trek*. McGrath is widely read, and writes well. Reasonably intelligent readers should have no trouble understanding and profiting from reading this book.

Its main shortcoming is the absence of notes indicating sources. Perhaps they will be added. A list of works consulted is given, albeit without specific page numbers. If an author has written more than one work on a relevant subject, McGrath usually does not point out which of these sources he is discussing. If an author is of historical significance, like Aquinas, Lenin, or Pascal, there is usually no mention of the work to which McGrath is referring. He just says that Lenin said something, and it is up to the reader to find out when and where.

McGrath believes that the Enlightenment of the eighteenth century still affects the way many of us view the created world and ourselves. He claims that Christians ought to see nature as enchanted, having more meaning

than reductionism would give it. He is on to something, and deserves to be read.

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

## ETHICS

**YOUR GENETIC DESTINY: Know Your Genes, Secure Your Health, Save Your Life** by Aubrey Milunsky. Cambridge, MA: Perseus Publishing, 2001. 410 pages. Hardcover; $27.50. ISBN: 0738203777.

**GENETIC TURNING POINTS: The Ethics of Human Genetic Intervention** by James C. Peterson. Grand Rapids: Eerdmans Publishing Company, 2001. 364 pages. Paperback; $22.00. ISBN: 0802849202.

Genetic testing and gene therapy have taken a back seat to stem cell research in the recent popular press. In reality, these techniques are inextricably linked to stem cell research and as the technology expands will only become more prevalent in clinical settings to provide information about more disease-related genes. These books offer important, complementary treatments of this pressing issue.

In *Your Genetic Destiny*, physician and geneticist Milunsky writes one of the best scientific introductions to genetic technology that I have read. Persons with little background but some interest in the topic will benefit from and enjoy reading the first three sections of the book. Milunsky begins the book with "Knowledge is Lifesaving," a section devoted to helping the reader understand why knowing genetic information is beneficial, and how to go about obtaining it. He writes: "If you choose not to know [about your genetic information] you might not be altering your chances, but you most certainly will be limiting your choices." It is particularly noteworthy that Milunsky discusses collecting family history information at length. This part of genetic information is often overlooked, and forms a critical basis for continuing on to more specific DNA-based tests. The second and third sections are excellently written treatments of chromosomal and single-gene inheritance and associated diseases.

The most informative section of the book is the fourth, where genetic contributions to such disorders as heart disease, diabetes, and cancer are discussed. The science in these sections is accurate and the writing is clear and interesting. This section alone could serve as an important reference guide for anyone interested in genetic diseases. The book closes with sections describing prenatal testing, ethics and legal issues, and treatment of genetic disorders. Milunsky is clearly a proponent of using genetic information extensively in medical decision-making, but to his credit he presents drawbacks and risks associated with testing as well as the positive aspects of obtaining genetic knowledge.

The ethical aspects of genetic testing and intervention are the focus of Peterson's book, *Genetic Turning Points: The Ethics of Human Genetic Intervention*. This book is the extension of Peterson's doctoral work in ethics at the University of Virginia. A unique facet of the author's background is the time Peterson spent as a research fellow in molecular and clinical genetics at the University of Iowa. Although the book is written by an accomplished ethicist, he is a Christian ethicist who thoroughly understands the science and technology of which he speaks.

*Genetic Turning Points* is organized in the best possible way. First, a section on the context of science and technology and a Christian perspective on both are provided. Then the book moves gradually from impersonal genetic research, on to genetic testing, followed by genetic drugs, or gene therapy as we know it today, and finally the potential genetic surgery of the future. In each section, the author discusses the ethical implications to the individual, families, and communities. The chapters on community ethics are particularly well thought out, and raise important questions that are often overlooked in discussions of genetic testing and therapy.

My one major criticism of the book is that it deviates from the task at hand into an extended treatment of developmental biology and abortion in chapter five, and it returns to the abortion theme too often. The abortion sections distract from the excellent ethical discussion of genetic technology that are present in the same chapters. While abortion is clearly a related issue, genetic technology in and of itself presents Christians and the greater society with specific, important issues that Peterson ably addresses.

I highly recommend both of these books to readers interested in the nuts, bolts, and more of genetic technology, and to those interested in expanding their knowledge of ethical issues associated with modern genetics. As the use of genetic medicine spreads, books like these will become necessary reading for educated patients.

*Reviewed by Robin Pals-Rylaarsdam, Trinity Christian College, Palos Heights, IL 60463.*

## FAITH & SCIENCE

**GLIMPSING THE FACE OF GOD: The Search for Meaning in the Universe** by Alister McGrath. Grand Rapids, MI: Eerdmans Publishing Co., 2002. 124 pages. Hardcover; $18.00. ISBN: 0802839800.

McGrath, professor of historical theology and principal of Wycliffe Hall, Oxford University, is the author of over forty books. This book's print is rather small. However, its thoughts are not dense, and they are well illuminated by trenchant quotes and insightful illustrations. Modern publishing is complex: McGrath wrote this book at Oxford, it was printed and bound in Singapore, first published in the UK, and now released by Eerdmans in Grand Rapids. The twelve chapters of this book are produced on quality, slick paper, interspersed with beautiful color photographs and paintings.

Especially appealing is its nondogmatic tone. McGrath approaches the topic—the meaning of life—in a gentle, compassionate, kind way. He disarms the critic by admitting the evidence for both theism and atheism is ambiguous. To McGrath, it is a matter of choosing the view which is the best fit. The scientific minded will appreciate illus-

trations from the history of science, mystery aficionados will enjoy references to the great detectives of fiction, and those who appreciate the world of aesthetics will have a peak experience admiring the selection of color pictures.

This book might be considered an apologetic for the Christian faith. And yet, it is not argumentative nor combative. It might also be considered a devotional book, intended to inspire, motivate, and confirm believers. Appropriately, too, it has an evangelistic tone to it and might point the undecided to faith. I think it serves all three of these functions well and therefore will appeal to doubters, believers, and seekers. I highly recommend it.

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

**IN SIX DAYS: Why Fifty Scientists Choose to Believe in Creation** by John Ashton, ed. Green Forest, AR: Master Books, Inc. 2000. 384 pages, notes. Paperback; $13.99. ISBN: 0890513414.

The fifty scientists contributed short essays varying in length from two to twenty pages. They had responded favorably to a question from the editor Ashton: "Why do you believe in a literal six-day biblical creation as the origin of life on earth?" No other stipulations were placed on the essayists other than that statement. Ashton arranged the "final" papers into two divisions. In the first, the heading was "Science and Origins," and the second, "Religion and Origins." The first division deals with a scientific critique of evolution and presents a scientific case for creation. The second division presents "a more philosophical approach" to the debate on evolution and creation.

The scientific credentials of the fifty authors are listed at the beginning of each paper. All have earned Ph.D. degrees in their field of science. As far as this reviewer can estimate, all Ph.Ds. were granted by reputable institutions of higher education.

After reading and analyzing the papers, I made the following observations. Twenty-two essayists affirm their belief in a literal six-day creation. Eight essayists affirm their belief in six-day creation but do not use the adjective "literal." Twelve essayists affirm creation rather than evolution, but the words "young earth" or "six-days" do not appear in the text. Eight essayists do not mention "six-days" in their texts. Ben Clausen (essayist number 30) makes the interesting statement (pp. 272–3): "I do not find the evidence for a recent creation compelling."

Most of the papers do a very respectable job of pointing out the scientific weaknesses of the evolutionary hypothesis. Jerry Bergman (essay number 2) made a good impression on this reviewer with his analysis of naturalism. He quotes Michael Behe's illustration of "irreducible complexity" as found in the simplest of living cells. "Naturalism," he says, "must account for both the parts necessary for life and their proper assembly." The Darwinian hypothesis fails here. "Living cells must be created at once with all parts functioning."

Some of the essayists were "hard core" atheists and evolutionists before they abandoned that belief system for a creationist viewpoint (Allen, Cimbala, White). To me, one of the more interesting articles was by Andrew McIntosh as a result of his study of the principles of flight. He points out how beautifully flying insects and birds show evidence of design which enables them to fly. There is "no fossil evidence for 'pro-avis' creatures." He says birds are classic cases of "irreducible complexity, and design by a 'designer.'"

I strongly recommend this book of essays to ASA members and any open-minded scientist. The case for "literal Six-day" creation is not proven, and the authors admit that neither creation nor evolution can be "proven."

*Reviewed by O. C. Karkalits, Dean College of Engineering and Technology, McNeese State University, Lake Charles, LA 70609-0695.*

**THE FRONTIERS OF SCIENCE & FAITH** by John Jefferson Davis. Downers Grove, IL: InterVarsity Press, 2002. 177 pages, index, bibliography. Paperback; $14.99. ISBN: 0830826645.

Davis is professor of systematic theology and Christian ethics at Gordon-Conwell Theological Seminary. This is his ninth book but the first in this area, although he has won awards for excellence in the teaching of science and religion. The book has ten chapters discussing the implications to theology of the Big Bang, quantum indeterminacy, delayed choice experiments, mathematical chaos, Goedel's Theorem, artificial intelligence, progressive creation, the anthropic principle, the search for extraterrestrial life, and the ultimate fate of the universe. The book is a wide-ranging discussion of important issues the Christian faces in the world of science. And Davis faces them fairly and squarely without distortion of the information he has available.

Davis deals with the Big Bang, following the history of the idea that the universe had a beginning from ancient to modern times. He displays a quite up-to-date knowledge of the cosmological thinking. However, he seems to be behind in the very recent indications of a cosmological constant and the implications of charge conjugation-parity symmetry violations to the creation of the excess of matter over antimatter. He is correct when he points out that the Big Bang is no threat to Christian doctrine.

One of the most amazing features of the book is his acceptance of chance in the universe. So many apologists writing today flee from chance as if it would be the death of God. Davis accepts true indeteminacy but adopts a position which allows God and the creature to have control of contingent events. If one has to put his position in one phrase, it is that God ratifies what the creature proposes. But God also has knowledge of how a radioactive atom will behave when placed in a particular circumstance, which is a variation of the hidden variables approach to quantum mechanics.

This surprising book also bursts several canards which are widespread in the apologetical literature. In discussing chaos theory (nonlinear dynamics), Davis acknowledges that effects may be larger than the cause. This is the butterfly effect in which tiny differences in initial conditions of nonlinear systems lead to huge differences in results. Davis clearly accepts the data for transitional forms and the gradual development of the human body.

Davis acknowledges the force of Hume's objections to the design argument while not rejecting their use entirely. Davis notes that the anthropic principle has re-introduced teleology and design into modern philosophy. Refreshingly, he does not simply cite evidence in his favor, ignoring contradictory data. He openly and intelligently discusses the implications of Guth's inflationary universe and Everett's Many Worlds Hypothesis as counters to the anthropic principle. Davis makes one rather weak criticism of those two views by appealing to Occam's razor that they are complex options or untestable. This criticism rests on the *assumption* that nature is simple which simply may not be true. What if God decided to create complexity? Does Occam overrule God? And as to untestability, Goedel's theorem, which is discussed in the book, shows that certain mathematical statements are true but quite indemonstrable, i.e. without evidence. Is it totally out of the realm of possibility that the same can be said for the universe as a whole? What legislative body has told God that he must make every object in the universe display evidence for its existence? God himself is often accused of hiding from the scientist's gaze.

The main weakness of the book lies in the area of paleontology broadly defined. The references were rather old. Davis cites the Cambrian explosion as evidence of creation, but because the references are old, he apparently is unaware of data showing connection of Cambrian with Precambrian animals. He also erroneously claims that no new phyla have appeared since the Cambrian. Treatment of anthropology is cursory and generally cites old texts.

I would heartily recommend this book. It is truly a rarity when a conservative theologian actually deals with the world as it is rather than as he wishes it to be. Davis does not deny evidence or try to twist facts into a mold of his making. His approach is refreshing and raises the question of why it is such a rarity.

*Reviewed by Glenn R. Morton, Ramsden Lodge, 103 Malcolm Road, Peterculter, AB14 0XB Scotland.*

**NEW MAPS FOR OLD: Explorations in Science and Religion** by Mary Gerhart and Allan Melvin Russell. New York: Continuum, 2001. 232 pages; notes, bibliography, indexes. Paperback; $24.95. ISBN: 0826413382.

Gerhart, professor of religious studies at Hobart and William Smith College, and her colleague Russell, professor of physics emeritus, explore in these previously delivered or published papers and articles the implications of the epistemological model described in their 1984 book, *Metaphoric Process*. MP is their term for the process that leads to new insight and knowledge, often revolutionary, in both religion and science. It differs from analogy, in that in analogy, an unknown is compared to a known in a way that leads to a greater understanding of the unknown, as when the motion of a gas in an enclosed space related to the motion of balls on a billiard table leads to new insights about the characteristics of the gas in this circumstance. In MP, however, similar things are related, but in a way that leads through "cognitive disruption" to a "higher viewpoint." For example, the Copernican and Ptolemaic models of the cosmos (the metaphors) are alike, but the change in the positions of the sun and the earth (the disruption) led to new discoveries (the process) by Galileo and Kepler about motion on earth and in the heavens, and the later recognition by Newton that the same laws of motion govern both (the higher viewpoint).

This concept of MP lies behind most of the eleven chapters in the collection. The topics are too varied and complex to summarize here, so let me highlight a few points. In the chapter "MP as the Tectonic Reformation of Worlds of Meaning in Theology and Natural Science," the authors cite examples of the cognitive disruptions brought on by MP in theology. God viewed from the standpoint of "relationality" rather than "being" (the "omni-" God), the notion of God as both human and divine, and the understanding of Christ as both *sophia* and *logos* are but a few examples of changes that have led to higher understandings of God.

In "The Genre Bidisciplinary Dialogue," the authors argue that collaborative dialogical work between persons from two separate disciplines (here physics and theology) can lead to greater understanding for both. They recommend this genre for its fruitfulness in bridging disciplinary boundaries and leading ideally to a higher viewpoint achieved not by compromise but by a synthesis of the two views. While their views remain unchanged, the participants may find a new level of understanding in the "amalgam," which in turn invites further dialogue. The authors illustrate this technique in the chapter following through one of their own dialogues.

In "A Generalized Conception of Text Applied to Both Scientific and Religious Objects," the authors argue that scientific research, discovery, and formulation of theory can be understood much as a scriptural text in religion. Four characteristics of "textness"—readability, formality, material transcendence, and retrievability—can be applied to scientific work in a way that illustrates commonalities in the processes of interpretation and shared understanding found in both the sciences and theology. Scientific data must be "read" (i.e., interpreted) within the framework of formal processes and techniques. The resulting interpretations and fields of meaning transcend their media; and they are retrievable, in that experiments carried on in any time or place may duplicate the results. The notion that those in the sciences interpret nature within their own hermeneutical sets in a way analogous to those in the humanities, including theology, has been gaining attention recently.

In another paper, "Mathematics, Empirical Science and Theology," the authors assert that "the natural sciences influence theology not so much by causing necessary changes in doctrine but by reforming the world of meanings within which human beings explore the limits of human understanding. This process is analogous to the enlarging of the realm of the analytical that occurs in the interaction between pure mathematics and the natural sciences." Developing this analogy with examples from physics and theology, they conclude:

> Just as the physicist prospects among the accomplishments of pure mathematics for the means to the achievements of the ends of science, so only the theologian is able to determine what changes in our world of meanings brought about by the many investigations and discoveries of the natural sciences, can be of use in furthering the ends of theology.

These are not easy pieces. The concepts are often rather abstract and difficult to grasp, even with concrete examples, and are sometimes vaguely expressed in cumbersome sentences. And the book shares the characteristics of any collection—some disconnection, even with editing, but much to ponder. Graduate students, faculty, and scholars interested in exploring the interface between science and theology might find the book useful.

*Reviewed by Robert J. Schneider, Episcopal Church Committee on Science, Technology and Faith, 187 Sierra Vista Drive, Boone, NC 28607.*

**THE GOD MAN WORLD TRIANGLE: A Dialogue Between Science and Religion** by Robert Crawford. New York: St. Martin's Press, 2001. 234 pages, notes, index. Paperback; $22.95. ISBN: 0312232381.

Beginning with the rise of science and the materialistic world view that accompanied it, Crawford asks where is God? He first looks for him in the world and in humankind, and then in the world religions, setting quotations from members of the scientific community against quotations from the theologians or from the scriptures of the major world religions to find answers.

Crawford concludes that God is present in the world and in humankind and that his presence is demonstrated by such evidence as the facts of values and purpose—human characteristics that are not compatible with an atheistic evolutionary model based on the selfish gene—and recent discoveries in physics. Hence Crawford concludes that science has not been able to exclude God from the world. However, the world described by modern science is not the same as the world of the Bible. Thus the second question: if modern people are to believe in God, what kind of God are they to believe in?

To answer this question Crawford looks at religious ideas throughout all cultures and ages, i.e., the world religions. He notes that world religions all proclaim a God who is both transcendent and immanent, impersonal and personal. With the exception of Buddhism, all believe that God creates and sustains the universe. Semitic religions differ from the Oriental religions, however, in their belief that history is linear, not cyclic, and God is directing history toward the consummation of all things. The religions also differ in their views of the nature of the imperfection of humanity, but all agree that each human being is responsible for his or her own actions. Judaism and Christianity specifically recognize the image of God in mankind. In Christianity this image reaches its perfection in Jesus Christ.

Crawford writes for the seeker, the person who is looking for evidence for faith. His argument in summary is that the only model of God that will stand up in a scientific age is one of a God who is in loving interaction with the world, who is omnipotent but has modified his attributes to grant true freedom to his creatures, who has made this world a testing ground for faith. The challenge for seeker and believer alike is to respond to God's love, to try to understand God's world, and to cooperate with God in changing it.

*Reviewed by Elizabeth M. Hairfield, Professor of Chemistry, Mary Baldwin College, Staunton, VA 24401.*

**CREATION AND LAST THINGS: At the Intersection of Theology and Science** by Gregory S. Cootsona. Louisville, KY: Geneva Press, 2002. 102 pages, notes. Paperback; $11.95. ISBN: 0664501605.

This erudite but accessible book is one of twelve planned titles in the series "Foundations of Christian Faith," sponsored by the Presbyterian Church, USA (PCUSA). The author, an associate pastor at Fifth Avenue Presbyterian Church in New York, seems solidly Christ-centered but not as doctrinally conservative as some in the PCUSA (my own denomination). He emphasizes theology more than science, which I applaud since I believe most of our problems in this area spring from poor theology. Despite some small errors, like an endnote attributing *Finding Darwin's God* to "Keith" Miller, Cootsona does well (for a non-scientist) at presenting the relevant science.

After a brief introduction, the book discusses what it means for God (as Trinity) to be the Creator, giving meaning to a universe that is wholly dependent on him. The nature and limitations of general revelation are stated; it can be a witness to God, but is "fleeting and vain" (quoting Calvin) without special revelation. After rejecting the warfare model of science and theology, Cootsona advocates Ian Barbour's "integration" approach.

The next chapter concerns what it means to be created in God's image. I especially liked the material connecting image-bearing to our relationships with others and to our stewardship responsibility for God's creation. When Darwin comes up, the author wisely makes the vital distinction between evolution as a scientific explanation and the philosophical baggage some attach to it. While rejecting the God-excluding metaphysics often associated with Darwinism, he sees no reason to reject the science itself and to deny God the option of creating by evolutionary means.

The next chapter discusses how all is not right with creation. The problem of evil cannot be covered in a few pages, but helpful things are said about the incarnate God suffering with us, and about God providing himself as our answer when we want explanations. Evolution comes up again in the context of the Fall, and Cootsona suggests a "typological" Adam.

In the final chapter on "last things," the connection to science is weaker. Science has much less to say about how God will make all things new than about how he made things in the past. The author closes with the important reminder that our future hope in Christ should affect the way we live today.

I liked the book, but at times I felt like a teacher reading a B+ paper from a student who had the talent to earn an A. It sometimes seemed to lack focus, but I was most disappointed by some missed opportunities to clarify key issues.

Readers will bring questions like "Is evolution compatible with Christianity?" "How should I read Genesis 1?" and "Is 'Intelligent Design' (ID) good apologetics?" Cootsona does answer the first question (in the affirmative). Concerning Genesis, the idea of God accommodating revelation to human limitations is introduced, and it is implied that we should not treat the Bible as a science text. The stage is set to advise readers that concordism is an unwise approach to these passages, but that statement is

never made. As for the ID movement, several of its flaws are mentioned in other contexts, such as the need to distinguish between science and materialist philosophy, the mistake of looking for God primarily in the gaps of our knowledge, and the danger of "natural theology" divorced from special revelation. I was hoping for a clear statement that the ID movement is theologically deficient when it does not allow God to create *via* his sovereignty over nature and when it elevates a gap-based, Jesus-free apologetic. The author may have been unwilling to rebuke a movement that he felt had some worthwhile things to say, but he missed a prime opportunity to caution readers about its less healthy aspects.

As an introduction to science/faith issues, my first recommendation would still be Charles Hummel's *The Galileo Connection* or George Murphy's *Toward a Christian View of a Scientific World*. But *Creation and Last Things* is well worth reading. Perhaps it will find its way into the hands of a certain prominent anti-evolution crusader who attends a PCUSA church in Berkeley; it might help him see why many of us think his movement needs to think about its theology.

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

## GENERAL SCIENCE

**THE TRUTH NEVER STANDS IN THE WAY OF A GOOD STORY!** by Jan Harold Brunvand. Urbana and Chicago: University of Illinois Press, 2000. 217 pages, index. Hardcover; $22.95. ISBN: 0252024249.

Brunvand is professor emeritus of English at the University of Utah, specializing in folklore. His previous books include *Too Good to Be True* and *The Baby Train and Other Lusty Urban Legends*.

Among the thirteen stories in this book, the one most likely to interest ASA members is chapter 10, "The Missing Day in Time." Since at least 1970, this urban legend has surfaced sporadically in sermons, church bulletins, and even at least one usually reputable Christian journal (which later retracted it when informed of its bogus nature).

The claim is that a NASA computer had verified a discrepancy in planetary movement, thus verifying two Old Testament accounts. Harold Hill, an electrical engineer who claimed to have been a consultant for NASA, circulated a story that NASA computers in Greenbelt, MD, had computed the positions of the various celestial objects over several millennia, and had discovered that there was a day missing. Hill interpreted this "missing day" to be a composite of 23 hours and 20 minutes when Joshua commanded the sun to "stand still" for "about a day" (Joshua 10:12–14), and 40 minutes when "the shadow return[ed] backward ten degrees" during a confrontation between Isaiah and Hezekiah (2 Kings 20:9–11). He concluded one article by saying that this NASA evidence confounded skeptics by "Our God ... rubbing their noses in His Truth!"

The obvious difficulty with such a story is the lack of computer data from the Old Testament era, which allegedly conflicted with the smooth flow of the celestial bodies through time and raised the computer's "red flag." Brunvand notes that the story bears a striking resemblance to pre-computer versions, including a 1927 book by Harry Rimmer and an 1890 book by a military science professor.

Hill died in 1987 without either retracting the story or finding the original notes on which he allegedly based his claim. But the story still circulates, with variations and permutations, "continually re-created in oral and printed tradition just as any urban legend is modified."

Aside from "The Missing Day in Time" chapter, this book may have some entertainment value when we need to unwind from weightier matters, but not much practical instructional value.

*Reviewed by Dave Fisher, editor of "Truth in the Test Tube" broadcast, Aurora, IL 60504.*

## HISTORY OF SCIENCE

**BODIES POLITIC: Disease, Death and Doctors in Britain 1650–1900** by Roy Porter. New York: Cornell University Press, 2001. 328 pages, index, bibliography. Hardcover; $35.00. ISBN: 0801439531.

Porter, professor of the social history of medicine at the Wellcome Institute for the History of Medicine, Oxford University, has the credentials to write this gripping account of emerging medicine. His expertise in this field is unchallenged. He writes with erudition, shown in the frequent comparisons of classical and Christian traditions. This requires the reader to keep an unabridged dictionary handy. Pithy axioms permeate the text. The author's aim is to show that historically the body was presented as an expressive medium because the control of the flesh had a high priority in Western philosophy and religion, art and ethics, and law and order.

The text concerns healers and those who sought healing, the art of dying and the deathbed, and the doctor as Death's deputy. Although the patient is sometimes the hero, the doctor was often viewed negatively by contemporary society because of his deceit, love of money, and in these earlier times, his undeserved social standing. Prevention of diseases came to be seen as better than available cures.

The author describes how the flesh was constantly pummeled, punished, exploited, and subjected to the prying gaze of science, medicine, and the people. That reality is often hilarious. From Tudor times, the medical profession showed dexterity in its promoting of a high-minded image of itself although the doctors continued to fight each other. The health of the body eclipsed the previous concern for the salvation of the soul. It was rumored that the doctors fleeced the patients first, then killed them with their untried potions.

The author explains how sexuality gained the stamp of approval in the eighteenth century. Among the pre-1800 doctors, the elite physicians occupied the highest social position, but surgeons, because they practiced manual crafts, and apothecaries were on lower strata. This seemingly demonstrated the superiority of head over hand,

mind over matter, even a model of sagacious self-control. Porter shows that eventually a union of hand and head was achieved by these medical people. All of these doctors were regulated by their own governing bodies. A Georgian doctor who lacked civility risked censure. Genuine skills developed at this time such as bone setting. Clinical relationships were often power plays, patients negotiating with their doctors for the high ground.

With the arrival of the twentieth century, science and technology moved the balance in the doctors' favor. The symbol of the physician who achieved worldly success was a gold-headed cane. He was now emerging as a person manifesting a liberal education and a cultivated mind. The physician's wig, the surgeon's saw, and the apothecary's mortar and pestle became a part of this changing society. Books on domestic medicine that began to appear in the seventeenth century now became widely available. Elizabeth Garrett Anderson, in the mid-Victorian era, stormed this male citadel. By now specialization had emerged and the highly influential Scottish universities were instrumental in and encouraged the rise of the family doctor.

Porter thinks that the culture of the day contributed to an understanding of the body and he demonstrates this in 137 quality illustrations. These are mainly archival cartoons in color, visual images that complement the text. By skillful melding of the visual with the written word, the author has produced an excellent book. He achieves his aim of presenting a visual medical history of those times. The typeface and paper are of the highest quality. No footnotes distract the reader. The book is extensively and helpfully referenced. This book, with its refreshing insights and details, will be of interest to many readers. It would be a welcome gift for a doctor, physician or surgeon, or any reader of this journal. It is highly recommended.

*Reviewed by Kenneth NP Mickleson, Mt Eden, Auckland 3, New Zealand.*

**DRIVING MR. ALBERT: A Trip Across America with Einstein's Brain** by Michael Paterniti. New York: The Dial Press, 2000. 211 pages. Hardcover; $18.95. ISBN: 0385333005.

A tale of a man who kept Einstein's brain stored in a Tupperware container for decades sounds like an urban legend, but it turns out to be true. In *Subtle is the Lord ...*, Abraham Pais mentions in a footnote that Einstein's autopsy was performed "by Dr. Thomas F. Harvey, who removed the brain, part of which now rests in a bottle somewhere in Weston, Mssouri." This book picks up where most Einstein biographies leave off.

The story begins with how the author learns about Dr. Harvey from his landlord and becomes obsessed with contacting him. After tracking down the doctor, Paterniti offers to drive him and Einstein's brain from New Jersey to California to visit Einstein's granddaughter. The author portrays the decision to go on a road trip across the country with Dr. Harvey as spontaneous. However, one gets the impression that he went into it with the intention of writing about the experience. He did a good deal of background research before leaving on the trip. For example, he even visited a collector of Einstein memorabilia in Japan to learn more about Dr. Harvey.

The dust cover accurately describes the book as "part travelogue, part memoir, part history, part biography, and part meditation." The doctor was not very communicative during the trip so the dialogue between him and the author is not very exciting. Paterniti fills in the gaps with biographical information about Einstein and the doctor. The duo sees some interesting pieces of Americana along the way, such as a place in Kansas called the Garden of Eden. They also meet some interesting people along the way including William Burrows, the Beat poet, and Roger Richman, president of a celebrity-licensing agency or "Upholder of Dead Celebrities."

The science in this book should be taken with a grain of salt. For example, the predictions of general relativity about the gravitational deflection of light by the sun and the precession of the orbit of Mercury are conflated. The description of the "Z machine" at Sandia Labs is also inaccurate.

The book only touches briefly on Einstein's religious beliefs. Paterniti describes his "attempt to devise a kind of personal religion." He claims that "Einstein's brain is one of those rare objects in which science and religion actually meet." There is also a brief discussion of how Einstein tried to reconcile his pacifism and his actions related to World War II.

The book has enough suspense to keep the reader interested: Why does Dr. Harvey want to visit Evelyn Einstein? What will happen to the brain? It will appeal to those who like hearing about the lives of quirky people. If you enjoy the NPR program "This American Life," you will probably like this book, too.

*Reviewed by Alan J. DeWeerd, Assistant Professor of Physics, University of Redlands, Redlands, CA 92373.*

**THE AZTEC TREASURE HOUSE: Selected Essays** by Evan S. Connell. Washington, DC: Counterpoint, 2001. 470 pages. Hardcover; $28.00. ISBN: 1582431620.

The essays in this book for the most part appeared in two collections of essays published by Connell in 1979 and 1980, both now out of print. The essays show their age in that many of the entries in the bibliography date from the 1960s and 1970s, with a good few in the 1950s and only a relative handful in the 1980s and 1990s. Presumably not much modernizing has been done. For many of the essays, this is not a problem but there are certainly new perspectives available on some matters (such as deciphering the inscriptions of the Maya).

Connell is a historian, but not a cataloguer of facts and dates. He tells stories well, making the events he describes seem like the activities of real people in real situations. He interweaves some of his own experiences with the historical material (and describes some places in a way that makes one think he must have visited them himself); he turns aside to draw in other facts that cast light on his main topics; he reads widely (the bibliography is ten pages long) and synthesizes these various aspects of his interests very well.

The essays here cover a wide range of topics. Some deal with scientific history (the development of the heliocentric

model of our neighborhood in space), others with visits to the new world by European explorers from the northern Europeans to the Spanish, others with exploration of polar regions and searches for the South Pole and the Northwest Passage. Some investigate bizarre topics such as the Children's Crusade or the search by alchemists for a way of producing gold.

This is an entertaining collection of essays. In several places, the author pokes fun at the role played by the church and individual believers, but it is generally justified.

*Reviewed by David T. Barnard, University of Regina, Regina, SK S4S 3X4 Canada.*

## ORIGINS & COSMOLOGY

**MEASURING ETERNITY: The Search for the Beginning of Time** by Martin Gorst. New York: Broadway Books, 2001. 338 pages, index. Hardcover; $23.95. ISBN: 0767908279.

Gorst is a writer and director of science documentaries which have aired in Britain and on the Discovery channel. This book is organized into fifteen chapters. The topics include an introduction to the philosophical implications of a finite or infinite universe, the histories and science of the people who have been involved in the dating of the earth and the universe, and a discussion of how knowledge of the age of the universe may alter our thinking about ourselves.

Gorst discusses the efforts of Bishop Ussher to arrive at the often cited creation date of 4004 B.C. Ussher arrived at his date by comparing various Bible translations, verifying the biblical dates with other historical records, and studying the "gap" problem which addressed the length of time between the end of the Old and the beginning of the New Testaments. Not only are Ussher's research efforts documented, but Ussher's life experiences are also noted.

In subsequent chapters, Gorst describes how European expansion and the resulting interactions of Europeans with other cultures, such as the Chinese who also had well-documented histories, gave rise to questions about the accuracy of Ussher's date. Isaac La Peyriere proposed that there may have been other human histories that predated Adam. Views of Father Martino Martini and Father Perrenin, Roman Catholic missionaries to the Chinese, are also discussed.

Gorst describes the shift from a historical chronology for dating the earth to a natural science-based methodology. This discussion begins with Descartes and Copernicus and their philosophy of using naturalistic means to describe the behavior and formation of the earth and the universe. The interaction between these thinkers and the Roman Catholic church is also recorded.

Other chapters discuss the historical accounts of some of the other persons involved in the dating of the earth. These stories range from Thomas Burnett's explanation of a global flood to Hubble and the standard model to a discussion of evidence for an expanding universe. All of the scientific discussions are qualitative and placed within the context of the contemporary thinking of the time.

Gorst concludes the book with a brief discussion of how knowledge of the age of the earth and humankind may impact our thinking. He implies that the vast amounts of time involved in the making of the universe and the relatively small amount of time that human beings have lived on the earth suggest that the universe was not made for humans, but rather that humans are a small inconsequential part of this process. In this respect, I disagree with Gorst. The vastness of space and time may change our perspective on the influence we exert on the universe, but it can only magnify our awe for the concern that God extends to us.

Gorst's atheistic conclusion with respect to the dating of the earth does not diminish the value of this excellent resource. The book provides a useful overview of the history and science related to the dating of the earth and includes an extensive section of notes and sources for those inclined to pursue the subject further.

*Reviewed by Gary De Boer, Assistant Professor of Chemistry, LeTourneau University, Longview, TX 75607-7001.*

**THE BATTLE FOR THE BEGINNING: Creation, Evolution and the Bible** by John MacArthur. Nashville, TN: Thomas Nelson, 2001. 237 pages, index. Hardcover; $21.99. ISBN: 0849916259.

MacArthur is pastor of Grace Community Church in Sun Valley, CA, and president of The Master's College and Seminary. He has written numerous books and has a popular radio program, *Grace to You*. His MacArthur Study Bible has sold more than 300,000 copies and won the Gold Medallion Award.

This book has ten chapters between a twenty-page Introduction and a nine-page Epilogue. In my opinion, MacArthur says everything important that he has to say in his introduction. He states his "chief aim is to examine what the Bible teaches about the origin of the universe and then to look at the moral, spiritual, and eternal ramifications of biblical creationism ... " I agree with MacArthur that Scripture is the ultimate test of truth, but we obviously do not agree on how truth is obtained. He claims that more and more educational institutions, apologists, and theologians are abandoning the truth by abandoning faith in the literal truth of Genesis 1-3. I think it is unfortunate that MacArthur has based his understanding of science on the works of Ken Ham and Henry Morris and their organizations.

MacArthur criticizes old-earth creationists for blending "some of the principles of biblical creationism with naturalism and evolutionary theories, seeking to reconcile two opposing world-views," while "lacking any skill whatsoever in biblical interpretation," leading to "all sorts of theological mischief" by rejecting or compromising the literal truth of the biblical account of creation. He is emphatic that "all the geological, astronomical, and scientific data" can be easily reconciled with creation in six literal, 24-hour days. One might suggest that the author has given commentary on science while lacking any skill whatsoever in understanding modern science. I can agree with

MacArthur when he states: "the only reliable source of truth about our origin is what has been revealed by the creator." I would add, however, that our interpretation of God's revelation, whether in his Word or in his creation (see Rom. 1:19-20) is fallible.

MacArthur is convinced that "the universe is relatively young, albeit with an appearance of age and maturity." He finds "absolutely no reason for an intelligent mind to balk at accepting" Genesis 1-3 as a literal account of the origin of our universe. He says: "As we see consistently throughout the Genesis account, from the moment God creates something, it appears as if it has been there for some time."

I searched for strengths in this book which could be recommended. Unfortunately, I have not been very successful. I found little in this book which contributes to a resolution of *The Battle for the Beginning*. However, MacArthur does clearly demonstrate our continuing failure to educate evangelicals about beginnings.

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

**NATURE, DESIGN, AND SCIENCE: The Status of Design in Natural Science** by Del Ratzsch. Albany, NY: SUNY Press, 2001. x + 220 pages. Paperback; $18.95. ISBN: 0791448940.

Ratzsch is professor of philosophy at Calvin College and author of other books related to theism and science. His excellent book gives both a detailed philosophical explanation and defense of intelligent design and a careful qualification as to its parameters. Ratzsch notes that despite a spate of material written on intelligent design, "almost none of the foundational philosophical work essential for such debate [regarding intelligent design] to make real progress had been or was being done" (vii).

The book is divided into four parts. In Section I "Design Basics," Ratzsch explores what *design* is and looks at the concept of design as it pertains to the activities and productions of *non*supernatural beings. He describes features related to design such as counterflow and mind-correlativity. Giving an interesting design parallel, Ratzsch explores finite design by aliens and paves the way for comparing and contrasting natural (e.g., human, extraterrestrial) and supernatural design.

In Section II, "Supernatural Design" is explored. While similarities exist between finite design and supernatural design, there are important differences. In this section, Ratzsch refers to categories of *nomic* and *contranomic* activity. He notes how a supernatural being may use natural means to produce something—or may use special means but produce something that finite beings could produce. He points out, for example, that nature's producing something does not conclusively establish that nature could have produced it on its own. Moreover, it could be that God could have acted proto-historically in creating certain conditions and the structure of laws, eliminating alleged gaps in nature.

Section III "Boundaries of Scientific Legitimacy" claims that to place the concept of design properly, one must look at what the boundaries of scientific legitimacy are. In this section, Ratzsch claims that empirical data and logic alone cannot establish science in any rigid sense. While science is committed to limiting and neutralizing subjective factors and its social embeddedness is not fatal to objectivity, the scientific method is not a human-free zone and there are no airtight distinctions between science and nonscience.

Section IV looks at "The Permissibility Question—Conceptual and Pragmatic Issues." Ratzsch examines a host of "legitimacy" criteria alleged to offer lines of demarcation between science and nonscience (empiricality, falsifiablity, controllability, etc.), but these all fail to carry the day. Perhaps the relevant question boils down to the scientific fruitfulness or the payoff supernatural design affords. Ratzsch suggests that some kinds of supernatural design can meet the relevant criteria (under certain conditions). Of course, design can readily fit into a nonrealistic approach to science—we can approach nature *as if* it is designed and work from there (instrumentalism) or according to the fruitfulness of a design hypothesis (e.g., Maxwell's field equations shaped by his thinking about inter-trinitarian relations).

Historically, modern science emerged from and was shaped by a theistic world view. Ironically, many "scientists" will discount God's existence on the basis of simplicity/economy (Ockham's razor), but they will posit an infinite number of universes to account for the universe's fine-tuning. Physicist Edward Harrison has remarked: "Take your choice: blind chance that requires multitudes of universes, or design that requires only one." Openness to theistic explanation may actually open up doors of discovery whereas naturalism may actually close certain doors of scientific exploration. Prohibitions to design have their risks as well. Also, any alleged "gaps" that exist need not destroy science, but may simply help *focus* scientific endeavor.

In an appendix, Ratzsch examines William Dembski's explication of design (which uses the "Explanatory Filter" of *regularity*, *chance*, and *design* as disjuncts), noting that it is primarily a negative concept with "almost no positive content" (p. 154). Dembski tells us what design is not rather than what it is. He also gives examples revealing Dembski's criteria which are unable to deal with the full range of possibilities.

Despite distracting typographical errors in the text, Ratzsch has made a significant contribution to the field of intelligent design theory, laying an important foundation for furthering the discussion. The book is a superb piece of groundbreaking work in the field of design theory.

*Reviewed by Paul Copan, Trinity International University, 2065 Half Day Rd., Deerfield, IL 60015.*

**DARWINISM AND THE "CREATION SCIENCE" MOVEMENT** by Joe T. Ator. Fort Worth, TX: Star Bible Publications, 2000. ix + 88 pages. Paperback. ISBN: 1567942210.

To get right to the point, Ator does not believe that everything that science says about origins is true, but he does believe that the earth is at least millions of years old. A physical scientist by training, and a teacher, Ator has apparently created this book without a lot of help, as a

labor of love. He could have used some help. The English usage is fine, but the organization is strained in places. The scholarship could have used some assistance, as well. For one thing, there is not enough from primary sources. For example, on page 20, he says: "Ross reported on the summary announcements presented at the 1996 conference when this myth was exploded ..." and goes on to quote someone, presumably Ross, for 22 lines. Although he also cites Shapiro among these 22 lines, it is not clear whether Ator personally has ever looked at Shapiro.

Another problem with the scholarship is that some of it is out of date, which is hardly surprising, since he uses material from biology, biochemistry, astronomy, and other areas, and it is impossible for anyone to keep up with all these fields. As probably the worst example, on pages 30 and 31, Ator quotes a reference which says, in part, that "Man is able to use symbols; no other creature possesses this ability." Unfortunately, his source is, he says, a Leslie A. White, in the 1968 book *Readings in Anthropology*, 2d edition (New York: Thomas Y. Crowell Co.) There has been a lot of work, most of it since 1968 (although not all) that establishes that at least some non-human creatures do possess some ability to use symbols. There is some mention of Intelligent Design and the Creation Research Society. I found no mention of this journal, nor of the affiliation that publishes it.

Ator is to be commended for his belief that young- and old-earth creationists should both be called creationists, and that they should stand together, without either doubting the orthodoxy of the other. He is also to be commended for his sincerity, and his effort in getting this book published. However, neither Amazon, Barnes & Noble, nor the publisher list it as being in print at this time.

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

**MANY WORLDS: The New Universe, Extraterrestrial Life and the Theological Implications** by Steven Dick, ed. Philadelphia, PA: Templeton Foundation Press, 2000. 217 pages, index. Hardcover; $22.95. Paperback; $14.95. ISBN: 1890151424.

Editor Dick is historian of science at the U.S. Naval Observatory and president of the International Astronomical Union's Commission on History of Astronomy. The book is a compilation of papers presented by authorities in diverse disciplines at a conference convened by the John Templeton Foundation on "Cosmotheology."

Recent discoveries of new planets make this book timely for a wide audience. Newcomers to cosmology and SETI will find Parts I and II an excellent introduction. Those knowledgeable in the technical aspects may skip ahead to Part III, dealing with philosophical and theological interpretations.

Part I is "Origin and Evolution of Life." Nobel laureate biochemist Christian de Duve opens with "Lessons of Life." Axiomatic to most of the book are his summary statements:

- "[L]ife is explainable in terms of the laws of physics and chemistry."
- "[O]ur species ... now appears as a transient link ... in a long evolutionary process very likely to give rise ... to beings much more advanced than we are."
- "Even though we may not be the final product of evolution, ... the human species is not the meaningless outcome of chance events in a pointless universe."

Paul C. W. Davies writes "Biological Determinism, Information Theory, and the Origin of Life," Bernd-Olaf Kuppers adds "The World of Biological Complexity: The Origin and Evolution of Life" and Christopher P. McKay covers "Astrobiology: The Search for Life Beyond the Earth."

Part II, "Humanity's Place in Cosmic Evolution," begins with England's Astronomer Royal, Martin J. Rees, on "Life in Our Universe and Others: A Cosmological Perspective." Theoretical physicist Lee Smolin contributes "Our Relation to the Universe." Physical chemist/theologian Arthur Peacocke's paper, "The Challenge and Stimulus of the Epic of Evolution to Theology" and philosopher John Leslie's "Intelligent Life in Our Universe" conclude the section.

Part III, "Extraterrestrial Life and Our World View," is the most novel part of the book. SETI astronomer Jill Cornell Tarter depicts believers as rigid and doctrinaire. In "SETI and the Religions of the Universe," she says people who think "there is a special relationship between humans and their God, have been uncomfortable since Copernicus first moved the Earth from center stage." Those who think the presence of intelligent aliens could mean sinful souls, who "require ... Sons of God" to die on each fallen planet "and a like number of resurrections," would "be quite discomforted by the information revealed by the fact of extraterrestrial technologies."

In his chapter, "The Many Worlds of Neurology," physicist Freeman J. Dyson says discovering intelligent extraterrestrials would not be a setback for theology; Bruno and Newton accommodated multiple worlds and possible inhabitants in their speculations. In "Life and Intelligence Far from Earth: Formulating Theological Issues," Notre Dame emeritus philosopher Ernan McMullin adds:

> ... the notion that we should expect to find such intelligence came, in significant part, from Christian theology in the first place ... Were traces of life to be discovered elsewhere ..., it would favor the Augustinian idea that the "seeds" of life were implanted in matter from its first appearance. Such seeds could presumably come to fruition anywhere ... "water and earth" provided the right environment.

Vatican Observatory director George V. Coyne writes "The Evolution of Intelligent Life on the Earth and Possibly Elsewhere: Reflections from a Religious Tradition." Of approximately $10^{22}$ stars in the universe, Coyne estimates that perhaps $10^{17}$ may be Earthlike. He states: "Unless our scientific thinking is drastically wrong, this conclusion ... implies: at a minimum the macroscopic physical conditions for life (an Earthlike planet in a 'habitable zone' about a solarlike star) exist elsewhere in the universe."

As in any compilation, the authors of this book publish conflicting opinions. Some of their viewpoints elevate human reason above scriptural revelation. Among several examples, Steven J. Dick states in his concluding chapter, "... the true meaning of God is not grounded in any single human culture, but in the best elements of otherworldly

thinking of all of them." Later he adds, "... the natural God of cosmic evolution and the biological universe, not the supernatural God of the ancient Near East, may be the God of the next millennium." With this one caveat, this book can be a very good source of information and a "springboard for discussion."

*Reviewed by Dave Fisher, editor of the "Truth in the Test Tube" broadcast of Trans World Radio, Aurora, IL 60504.*

**THE THEORY OF CREATION: A Scientific and Translational Analysis of the Biblical Creation Story** by Jim Schicatano. San Jose, CA: Writers Club Press, 2001. 278 pages. Paperback; $20.95. ISBN: 0595199283.

This book is based on the premise that the Bible is objectively true, the findings of modern science are reliable, and the creation account found in the early chapters of Genesis can therefore be harmonized with modern science. The book examines each verse in the creation story in Genesis and relates the biblical creation account to current scientific theories of the origin of the universe, earth, life, and humans.

The book is easy to read. It is broken up into 32 chapters that average less than ten pages each. Although the author is not a Hebrew scholar, he does look back at the Hebrew manuscripts to clarify the meaning of the Genesis creation account. He recognizes that many Hebrew manuscripts exist, and so he does not take an overly simplistic view of the reliability of the early manuscripts.

The author accepts most of the findings of modern science (such as the age of the earth, the age of the universe, and the fossil record). However, his strict alignment of the Genesis creation account with modern science will be bothersome to many *PSCF* readers. He does not interpret Genesis as an allegory or a theological statement, but rather as a historical document that should be interpreted literally. He believes that the chronology of Genesis 1 is exact. However, he does not interpret Genesis 1 literalistically, and he has no patience for young earth creationists. His approach to this topic is reminiscent of Hugh Ross, whom he cites often in his book.

The book recognizes the existence of early hominids and discusses in some detail the fossil record on this subject. But the book states that there is not enough scientific evidence to genetically link ancient hominids with modern man. This is consistent with a literal interpretation of the Bible, which states that modern man was created just a few thousand years ago independently of any other living creatures. Surprisingly, the book states that if it is proven conclusively that ancient hominids are the ancestors of modern man, it would prove that the biblical account of man's origin is incorrect (p. 106). Statements like these are admirable for their intellectual honesty, but this is one of the aspects of intelligent design that Christian opponents worry about. Linking the Bible and science so closely together sets the Bible up for a possible fall when science makes new theories and discoveries.

As a general believer in intelligent design, I appreciate many of the discussions in this book. Methodological naturalists, along with young earth creationists, will not have much patience for this book. But the majority of Christians, who read the Bible literally and take the findings of science seriously, will find much intellectually and spiritually appetizing food for thought in this book.

The author has a bachelor's degree in science and is employed as a computer systems analyst. He has had several articles and short stories published.

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

**DESIGNER UNIVERSE: Intelligent Design and the Existence of God** by Jimmy H. Davis and Harry L. Poe. Nashville, TN: Broadman & Holman Publishers, 2002. 252 pages. Paperback; $12.95. ISBN: 0805424474.

Davis is associate provost and professor of chemistry at Union University in Jackson, Tennessee. Poe is also from Union University and serves in the position of Charles Colson professor of faith and culture. This book is an extension to their previous book, *Science and Faith.*

The book has a preface, seven chapters, an epilogue, endnotes, and an index. The topics include a history of general design philosophies from Plato to Behe, descriptive chemistry and biology, and a discussion of more recent ideas on the specifics of intelligent design. The book contains black and white drawings, graphs, and tables to illustrate both the philosophical and the scientific discussions. The preface and the epilogue are important parts of the discussion and should not be skipped by the reader. The endnotes are a valuable resource for further reading.

The first section begins with a discussion of the meaning of design under various religious perspectives before focusing on western monotheistic religions. The views of such western philosophers and theologians such as Plato, Aristotle, Augustine, Aquinas, Calvin, Descartes, and Pascal are compared and contrasted. The question of whether design can act as a proof of, or a path toward, God is examined with particular emphasis on the theologies of Aquinas and Calvin. A review of the thoughts of scientists such as Newton, Leibniz, Hobbes, Locke, Butler, Boyle, and Tindal follows. The atheist David Hume offers a critique of the above-mentioned design proponents. This section ends with the ideas of William Paley and his well-known watch in the forest. Paley's view is contrasted with the ideas of Hume, Darwin, and Dembski who state that evolution has only produced the appearance of design.

The second section presents a brief overview of some of the major topics in physics, chemistry, and biology in an attempt to speak to the question of whether design is indicative of a creator, or if its appearance is a logical consequence of natural processes. This section begins with cosmogony and the anthropic principle. A discussion follows that describes how the general revelation seen in the created world may be indicative of the nature of God and his possible multidimensionality. The book then continues with examples of design, or the appearance of design, in the areas of chemistry and biology. The opposing ideas of intelligent design proponent Behe and evolutionist Crick are explored.

The third section further explores the question of whether the presence of design can be determined. This

section is focused on the recent discussion of intelligent design with a continuation of the biological discussions in the second section. The question of irreducibility is specifically explored. The discussion includes a number of quotes from Behe's book, *Darwin's Black Box*, with quotes from evolutionists Dembski and Gould to counter. The epilogue also offers a good deal to this discussion.

This book is strong in three ways. It continues the dialogue style, begun in *Science and Faith*. It presents the issue of design in its historical perspective from Plato to Behe with contributions on both sides of the issue. It discusses findings in mainstream science in a thorough manner that is understandable to the general reader. The book falls short in its third section where it addresses the ability to distinguish between the appearance of design and intelligent design. But this weakness may provide an answer to the question presented in the first section: can design in creation be a proof of God's existence?

This is an excellent book for those interested in the philosophical and theological issue of design. It traces the history of design and allows both sides to speak, thus nurturing dialogue. It would be suitable for anyone teaching science or for anyone who is just beginning to explore the consequences of design on his view of science.

*Reviewed by Gary De Boer, Assistant Professor of Chemistry, LeTourneau University, Longview, TX 75607-7001.*

## PHILOSOPHY & THEOLOGY

**RACE AND THE COSMOS: An Invitation to View the World Differently** by Barbara A. Holmes. Harrisburg, PA: Trinity Press International, 2002. 208 pages. Paperback; $20.00. ISBN: 1563383772.

Holmes, associate professor of ethics and African American religious studies at Memphis Theological Seminary, posits an important potential solution to today's discussion of race by proposing that metaphors from quantum physics can provide new outlooks on race issues. In her introduction, she writes:

> The fact that race does not exist as a category of "human biological diversity" does not discount its effects. The resilience of the idea is rooted in deeply sedimented cultural beliefs ... While race may not have scientific origins, it cannot be relegated to the refuse pile until its very real offspring "racism" is no longer a hindrance to intercultural moral flourishing (p. xvi).

Holmes recognizes that today's theological, political, and social descriptions of liberation from racism are limited. She has written this book in an attempt to incorporate languages of science into the discussion of liberation, not as descriptions for why racism is not real, but as windows into alternate ways of viewing other humans in our world.

After introducing this topic in the first few chapters, the meat of the book is found in chapters five through eight. In these chapters, Holmes discusses race and cosmology, dominance and quantum theory, a community of hope and moral fulfillment shaped by both science and theology, and how scientific narratives of holism may lead to reconnecting marginalized people. As an example of her lines of reasoning, in chapter five she uses the cosmological ideas of dark matter's importance in our universe to encourage readers to rethink the cultural/theological valuation of "white" as good and "dark" as bad. She rightly suggests that justice is not a matter of transforming people of color into white people with dark skin but rather by recognizing the beauty and value of all people. We can celebrate the universe's content of and requirement for dark matter and light, just as we celebrate all shades of humans. "Diversity reflects the complexity of the life space and in quantum and cosmological terms is normative" (p. 102). Chapters six through eight contain similar types of analogies from the universe that may teach us to think about race in different ways.

The most challenging chapter was chapter four. Here Holmes discusses indigenous wisdom and science. She proposes assimilating other cultural and religious realities with western "objective" science. In some ways, this chapter reminded me of the challenges posed by philosopher Al Plantinga in some of his writings on the relationship between science and theology, although Holmes extends the theology beyond western Protestant Christianity to include "wisdom" and religion from indigenous peoples and the two-thirds world. This chapter challenged me as a scientist who "preaches" to her students that science is not the entirety of Truth, to once again evaluate whether I fully believe that claim. It is difficult for western scientists to think about incorporating other cultural norms into our quest for knowledge. Is this difficulty related to our inherent western cultural predisposition to dominate other cultures? Holmes does an admirable job of raising the question and suggesting that in part the answer is, yes.

After reading a well-written book such as this, I ask myself whether these great ideas are likely to make a difference. I hope so, but the one drawback I see to this approach is that it is necessarily limited to the well-educated in our society, as we live in a science-illiterate nation. Even if this book is only effective in opening the eyes of a portion of the cultural elite, it will be an important step toward improving justice for all in our world.

*Reviewed by Robin Pals-Rylaarsdam, Assistant Professor of Biology, Trinity Christian College, Palos Heights, IL 60463.*

**ANSWERS TO SATISFY THE SOUL** by Jim Denney. Clovis, CA: Quill Driver Books/Word Dancer Press, Inc., 2002. 273 pages. Paperback; $12.95. ISBN: 1884956203.

Jim Denney is a freelance writer. Some of his other works include biographies of football player Reggie White, *In The Trenches*, supermodel Kim Alexis, *A model for a Better Future*, and Star Trek Yeomen, *The Longest Trek*. These celebrity biographies also make an important contribution to this book.

The book is arranged into four sections, each containing five chapters. The sections discuss questions regarding ourselves, relationships, life, and the infinite (the existence and nature of God). The first three sections could be placed in the self-help genre, while the last section is a philosophical discussion of modern popular science and theology.

All four sections draw stories from the celebrity biographies and are written in an easy to read popular style. The book also includes an index.

The first section discusses character, success, luck, time and worry. Denney gives practical and sound advice about these issues. For example, he says: "Wealth is not the same as income. If you make a good income each year and spend it all, you are not getting wealthier ... Wealth is what you accumulate, not what you spend" (p. 22). He gives similar advice in regards to luck, which he says we make for ourselves. In his discussion of worry he describes the chronic worrier and gives practical steps to deal with worry.

The second section follows a similar style in that it also gives straightforward common sense advice in regards to relationships. Denney deals with topics such as types of love, how to deal with anger, and forgiveness. The book reads like a late night AM radio show with vivid real life examples taken from the celebrity biographies.

The third section begins to move to a more intellectual style as Denney begins to discuss the bigger questions of happiness, the meaning of life, the existence of evil and why it should exist. Denney again makes use of popular culture by referring to events such as the murders that took place at Columbine High School and the race motivated murder of James Byrd in Jasper, Texas. In addition to these powerful contemporary images Denney draws on the works of Christian apologist C. S. Lewis, atheist Martin L. Bard, and Christian psychologist Scott Peck. The discussion begins to move away from popular psychology to a more systematic study of the existence and why of evil and free will.

The latter part of the third section helps lead into the fourth section. This last section discusses evolution, cosmogony, and intelligent design. Denney makes clear distinctions among science, philosophy, and theology. It is evident that he is a supporter of intelligent design as a proof of a supreme being, and he develops this theme through a discussion of biology, quantum mechanics, cosmology, and cosmogony. Denney distinguishes between an irrational "supernatural" being and the rational "supreme being" that he says is indicated by intelligent design. To his credit, Denney also explains why an atheist would not accept the argument of intelligent design. Later chapters in the fourth section discuss ideas of a soul based on near-death experiences, on scientific studies of the therapeutic effects of prayer in hospitalized patients, on miracles, and on religion.

The book could easily be two shorter books; one of popular Christian psychology and the second a discussion of the existence of God based on theories in modern science. The writing style and the use of celebrity biographies may make this book very suitable to a younger audience. Though the book is not written with the rigor of a theological treatise, it does make a strong argument in a very conversant style and the index will allow readers to pursue the subjects further.

This is a book of hope for the seeker and information for those interested in what modern science may or may not indicate about the existence of God. The early sections are especially suitable for a younger audience while the latter sections would be beneficial to a much broader audience especially those who are interested in the interface of science and theology.

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## RELIGION & CHRISTIAN FAITH

**THE MOST RELUCTANT CONVERT: C. S. Lewis's Journey to Faith** by David C. Downing. Downer's Grove, IL: InterVarsity Press, 2002. 191 pages, index, bibliography, notes. Hardcover; $16.00. ISBN: 0830823115.

*"I believe in no religion"* —Clive Staples Lewis, 1916, age 17.

*"Christianity is God expressing himself ..."* —Clive Staples Lewis, 1931, age 32.

Born in 1931, I could have said both statements at similar ages. I suspect I have read every published word Lewis ever wrote; I have read many of them several times. In his 1955 book, *Surprised by Joy*, Lewis speaks of his conversion. It was that book that played an important part in my own understanding and embracing of the Christian message. So it was with great expectations and anticipation that I began this volume.

The author, a professor of English at Elizabethtown College, has written many articles on Lewis, as well as a book, *Planets in Peril*, which studies Lewis's famous Ransom trilogy. Downing dwells closely on Lewis's inner life, on the factors that influenced his spiritual journey, and on the issues that commanded the attention of his keen intellect along the way. Lewis did not have a "Damascus Road" experience; those who have had one are fortunate. The rest of us come to Christ gradually, in an unfolding (dare I say "evolutionary?") process. For (Jack) Lewis it was to take a fifteen-year quest, one that led him through strange pathways. Atheism in his youth turned to materialism, mind-matter dualism and the occult, then idealism and pantheism in the 1920s.

In the summer of 1929, at age 30, Lewis had a "mystical experience" while riding on a bus (surely as prosaic a setting as one can conceive). In *Surprised by Joy*, he describes his subsequent decision in these words: "In the Trinity term of 1929 I gave in, and admitted that God was God, and knelt and prayed: perhaps, that night, the most dejected and reluctant convert in all England."

Lewis's 1929 conversion experience was, of course, to theism, not to Christianity. He began attending church worship services, but only because he thought he ought to make some overt gesture toward his new philosophical position. In 1929, his mind was taking him where his heart was reluctant to follow. Two years of his quest were to follow. Downing describes these two years in chapter eight, and does so powerfully. Even knowing the result, I found myself caught up in the narrative, urging Lewis on, almost like watching a baseball game television replay.

Two steps forward, one step back, and then, on September 28, 1931, while riding in his brother's motorcycle sidecar to Whipsnade zoo, it happened. In Lewis's own words, "I know very well when, but hardly how, the final step

was taken. I was driven to Whipsnade one sunny morning. When we set out I did not believe that Jesus Christ is the Son of God, and when we reached the zoo I did. " David Downing describes his vision of this day in three pages of inspired prose, and there, except for an epilogue, the book ends. But the epilogue, it turns out, has perhaps the strongest message of all.

In the epilogue, one more event in Lewis's life, as recorded by Downing, must be mentioned, for it places a capstone on this remarkable giant of a human being. Lewis was famous for his imagination. His writings abound with ideas, figures of speech, and stories seldom dreamed of by others. In July 1963, sick with what would be his last illness, he was in a coma. Awakening, he asked for water. As his friend, Hooper, began to draw it, Lewis suddenly sat up in bed, staring intently at something across the room. He kept on looking, and then exclaimed, several times, "Oh, I never imagined. I never imagined." He then fell asleep with a rapturous expression on his face. I hope that, at the last breath, we will all have this to say. This book is a "keeper." I recommend it highly to my ASA colleagues.

*Reviewed by John W. Burgeson, 2295 East Iliff #101, Denver, CO 80210.*

**HOW CHRISTIAN FAITH CAN SUSTAIN THE LIFE OF THE MIND** by Richard Hughes. Grand Rapids, MI: Eerdmans Publishing Co., 2001. 172 pages. Hardcover; $18.00. ISBN: 0802849350.

This book joins a growing list of publications whose collective aim is in developing Christian intellectuals. Hughes' intention is to provide a book "for Christian scholars who want to connect Christian faith with scholarship and teaching in meaningful and effective ways" (p. xvii). Hughes previously surveyed Christian institutions in a book entitled *Models for Christian Higher Education* that serves as a prelude to what is intended as an individualistic focus on intellectual engagement.

Hughes begins with a historical analysis in which tensions between deism and early American politics are compared with apparent tensions between Christian presuppositions and diversity, openness, and academic freedom. Hughes extensively uses Sidney Mead's idea of the theology of the Republic to highlight "the finitude of humankind and the primacy of God over all human institutions" (p. 21). Human finitude, Hughes believes, creates a Christian imperative to search for truth through scholarship, scholarship that is influenced and informed by theological nuances arising from different denominations. Consequently, Hughes spends considerable time focusing on the question: "What might it mean for Christians to 'break through the particularities' of their own religious traditions?" (p. 31).

Chapter 4 presents the most interesting ideas in "The Power of Christian Traditions." Four case studies contrast the influence of Roman Catholic, Reformed, Mennonite, and Lutheran theologies on the life of the mind resulting in a complementary series of intellectual endeavors. As the key chapter, the ideas are unfortunately poorly interwoven with other chapters, creating the impression of a book derived by loosely connecting related papers together. The result is, in the words of one of Hughes' Jewish colleagues, rather choppy prose: "You envision teaching and scholarship precisely as I envisage teaching and scholarship. You value openness, diversity, and an unrelenting search for truth, just as I do. But why must you go through such theological gymnastics to get where you're going when you and I arrive at the very same place in the end?" (p. 135).

The main difference between Hughes' book and other books on the life of the mind lies in the specific characteristics emphasized by different denominations. Readers wanting to develop a Christian mind will find more ideas in books by David Gill, James Moreland, and James Sire, although Hughes does sow a few insightful embryonic thoughts. Ironically, the book, therefore, is of more use for understanding institutions than in achieving the stated aim of fostering the life of the mind for individual faculty.

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

**RESCUING JESUS FROM THE CHRISTIANS** by Clayton Sullivan. Harrisburg, PA: Trinity Press International, 2002. 182 pages. Paperback; $16.00. ISBN: 1563383802.

Sullivan is out-of-step theologically with his own denomination (Southern Baptist) and the historic Christian Church. He would like to bring some congruence between the two, but he says he is not the one out-of-step. In the first six chapters of his twelve chapter book, he questions (denies) Jesus' love for Gentiles, virgin birth, ethical teachings, vicarious death, deity, and soteriological message. He does this dogmatically without engaging divergent views. For instance, in discussing Mark 10:17–18, Sullivan thinks Jesus denied his deity when he said, "Why do you call me good? No one is good but God alone." The traditional view interprets this passage as confirming Jesus' deity. Another example: "In Matthew's version Mary and Joseph lived in Bethlehem; in Luke's version they lived in Nazareth." Sullivan sees this as contradictory. In sum, Sullivan does not adhere to biblical inerrancy.

Sullivan thinks a difference exists between the historical Jesus of post-Enlightenment scholarship and the embellished Jesus found in church creeds. He writes: "A majority of Christians rejoice in the orthodox 'old time religion,' which they view as their ticket to heaven." Sullivan quotes with approbation a comment made to him: "Take orthodoxy away from common folk and you transform them into atheists." Therefore, he proposes four strategies inquisitive believers can use to rescue Jesus from the prison of orthodoxy: (1) distinguish between the pre-resurrection and the post-resurrection Jesus; (2) do not accept all beliefs held by the early church; (3) do not sentimentalize or aggrandize Jesus; and (4) rejoice in religious pluralism.

Sullivan is disarming when he confesses that an inquisitive Christianity that strives for intellectual honesty is not superior to orthodox Christianity. However, he believes it is an alternative, valid version of Christianity. When he writes that thinking Christians can help churches become what they should be, it appears that inquisitive Christians may be more needed than orthodox ones. In that sense, it would seem they are at least more valuable if not superior.

Although Sullivan thinks that some of the beliefs of the orthodox church "have experienced a depletion of plausibility and have become obsolete," he does not write in a combative way. He writes with conviction, but not in a condemnatory fashion. In some cases, he is commendatory; he praises the historic church for its good deeds and aligns himself with it. He thinks it unfortunate that some thinking Christians abandon the church. Sullivan also identifies with the human predicament of having no answers to a "whirlwind of unanswerable questions" such as why life, why evil, why suffering, why God, why anything?

Sullivan defends an important aspect of the Christian faith. He writes that "Jesus was raised from the dead and continues to live in the spirit world ... His resurrection from the dead can be the basis for our hope in a blessed future life." If a label had to be attached to Sullivan, it would be liberal, albeit one who can be identified as a compassionate, inquisitive, thinking and questioning one. It might appear to some readers of his book that Sullivan experiences cognitive dissonance denying many Christian doctrines while accepting others.

Who will profit from this book? Anyone interested in a succinct, up-to-date presentation of post-Enlightenment research on who Jesus was (is) and its implication for the church. While Sullivan questions many orthodox doctrines, he does so as one within, rather than outside, the church. He writes: "I was raised within the Southern Baptist denomination. My fate has been to see this largest of Protestant denominations torn asunder by the fundamentalist controversy ... I have witnessed this controversy with great sorrow and dismay."

Sullivan teaches at the University of Southern Mississippi in Hattiesburg. He has written other books including *Toward a Mature Faith* and *Rethinking Realized Eschatology.* He has also authored a biography, *Called to Preach, Condemned to Survive,* and a novel, *Jesus and the Sweet Pilgrim Baptist Church: A Fable.*

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

**THE LIFE OF THE MIND: A Christian Perspective** by Clifford Williams. Grand Rapids, MI: Baker Academic, 2002. 95 pages. Paperback; $10.99. ISBN: 080102336X.

This book is the first contribution "to guide readers in reflecting critically on contemporary issues of faith and learning (inside cover)" in a partnership between Baker Academic and the Council for Christian Colleges and Universities. The author, a professor of philosophy at Trinity College, writes to convince Christians that the life of the mind is an integral, and important, component of being Christian. Williams' aim is particularly apt given Charles Malik's admonition that he who wins the world but loses the battle for the mind will find that he has lost the world.

*The Life of the Mind* is aimed primarily at college students and people wanting "to reflect on a special feature of the Christian life" (p. 13). The greater part of the book establishes a foundation admonishing Christians to intellectual pursuits to experience life fully. Williams gently repackages some of Sire's worldview questions, having the reader reflect on the meaning of life and death, as a prelude to developing a Christian world view encompassing all areas of thought. With the vision established, several characteristics for acquiring a Christian mind are offered along with some words of wisdom for those who intend to "make all thoughts captive to Christ." The closing chapters appropriately warn of the likely cultural milieu facing Christian thinkers and the benefits of seeking a Christian community of like-minded individuals. Collectively, these sections should guide freshmen into nurturing environments where minds can be honed while avoiding potential insular thinking.

The author has made a valuable contribution in a book that would better be titled "Is Christian Thinking Possible?" The style is often rhetorical and, although the straw-man style wanes after several pages, the technique is appropriately pitched to the target audience. The book would make an ideal gift for a high school graduate.

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

## SCIENCE EDUCATION

**TIME FOR SCIENCE EDUCATION: How Teaching the History and Philosophy of Pendulum Motion Can Contribute to Science Literacy** by Michael R. Matthews. New York: Kluwer Academic/Plenum Publishers, 2000. 439 pages. Paperback; $39.50. ISBN: 0306458802.

Until the latter part of the eighteenth century, the inability of sailors to accurately determine their longitude often led to a shipwreck or starvation at sea. Dava Sobel's *Longitude,* which tells the story of how John Harrison constructed a clock capable of solving the "longitude problem," was a bestseller. As she explains, "to learn one's longitude at sea, one needs to know what time it is aboard ship and also the time at the home port or another place of known longitude—at that very same moment." The fascinating story of how this feat was accomplished is also the basis for Matthews' book, but his emphasis is on teaching about the pendulum and timekeeping.

In the first chapter, Matthews states: "It is apparent to everyone that something has gone wrong with science education." His statement is backed up by statistics about scientific literacy that are both troubling and unsurprising. These are followed by a discussion of possible responses to this crisis. Matthews rejects the option of simply teaching science awareness and advocates "the dual goals of learning *of* science (scientific facts, theories, and methods) and learning *about* science (scientific methodology, history, philosophy, and cultural implications)."

The book describes in detail the technological advances, such as a pendulum immune to temperature fluctuations, that led to an accurate chronometer. In addition, it explains how the scientific description of pendulum motion was developed by such luminaries as Galileo, Huygens, and Hooke. There is an interesting discussion of how strongly the pendulum influenced Newton's physics. Richard Westfall is quoted as saying that "without the pendulum there would have been no *Principia.*"

Two chapters are devoted to discussing the broader influences that the pendulum and clocks had on culture. The clock metaphor was used in both philosophy and theology. For example, in theology the concept of a "clockwork universe" with God as clockmaker was used in design arguments. Some other philosophical issues related to the pendulum are idealization (Galileo discounted air resistance and friction), falsification (Huygens suggested a length standard using the pendulum which was based on the false assumption of uniform gravitational attraction), and reductionism (the debate about the relationship between time and its measures stretches back to ancient Greece).

Matthews' opposition to constructivism in education is clear from the outset, but it most strongly stated in the final chapters on pedagogy and science education. Supporters of constructivism will be challenged by his critique. He claims that constructivist curricula ignore history because of the emphasis on discovery by the student. Matthews is also critical of the assumption that students can construct their own knowledge through observation. He writes: "Students are not going to learn the fundamentals of Newtonianism by looking at or merely playing around with things." His harshest condemnation is that "constructivism has in many areas functioned more as an ideology than a learning theory, and although fitting comfortably with Western individualism and relativism, it has had unhappy educational and cultural ramifications."

This book does contain some incorrect statements about physics. The worst example is the statement that, "If modeling clay is put on the two pendulums, thus converting the collisions into perfectly inelastic collisions, *momentum is not conserved* and neither the first nor the second pendulum move upon collision" (emphasis added). However, Matthews gets most of the science right and the mistakes do not detract greatly from the book's value. The book is not intended as a textbook, so hopefully those who decide to teach about the pendulum will also make use of the hundreds of references it contains.

Matthews makes a compelling case that the pendulum is an ideal topic for science classes from grade school through college because of the connections that can be made with other areas. The popularity of *Longitude* helps make Matthews' point that the science of the pendulum is very interesting when presented in its historical and philosophical context. Sobel's book is an excellent complement because it has more information about the competing methods of determining longitude and the personalities involved. Matthews gives many specific suggestions about how pendulum motion can be taught in an engaging way, but he also challenges the reader to imagine how the teaching of other topics could be improved in similar ways.

*Reviewed by Alan J. DeWeerd, Assistant Professor of Physics, University of Redlands, Redlands, CA 92373.*

# Letters

## Comment on Book Review: *Trust Us, We're Experts: How Industry Manipulates Science and Gambles with Your Future*

Recently (early September 2002), it was reported that tons of U.S. food aid that could prevent starvation of millions in Zimbabwe was rejected because that government does not want genetically modified corn although the starving masses wanted the food with the support of the U.S. aid specialists. Soon thereafter I was shocked and dismayed to hear a distinguished minister in a sermon refer to this incident as an example of scientists telling people "Trust us; we're experts" which the minister felt was demeaning to the "people" and a display of arrogance by scientists. I believe the minister has a distorted view that could have been derived from reading the review of this book by John W. Burgeson in a recent issue of *PSCF* (vol. 54, no. 3 [September 2002]: 195–6).

The book under review, *Trust Us, We're Experts*, is authored by two journalists associated with a nonprofit organization on one side of a continuing battle in the U.S., and the book attacks individuals and other non-profit organizations associated with the other side of this battle. The truth is being sought by the reviewer but he is reading only one side. The battle is litigation unique to the U.S. in which the driving force is the plaintiff's bar (the American Trial Lawyers Association, ALTA) and money—enough to provide contingency fee income in the many millions and even billions of dollars into some law firms and bankrupt large firms with damage to their employees and stockholders.

During my career I have helped defend industry against allegations that low-level electromagnetic energy is hazardous and has caused all kinds of ailments in people from headaches to cancer. The origin of these beliefs is poor-quality science, which is then amplified in the media and then exploited by the plaintiffs' bar and the ALTA. Eventually in the courts there would be scientists on both sides with two different stories. The system then allows a jury, whose composition is the result of lawyer games and debate, of ordinary citizens to listen to these scientists and decide whose science is more believable. (Truth is really not the object in courts). If you want to know historically what kind of science has been allowed into the courts read the book, *Junk Science in the Courtroom*, by Peter Huber, a book cited and attacked in *Trust Us, We're Experts*. I worked with Peter Huber on a few occasions and greatly appreciate his contribution to modern society. His book helped in the drive to reform how science is injected into the courtroom through the milestone decision of the U.S. Supreme Court in the *Daubert v. Merrell Dow Pharmaceuticals* case (1993), which mandates all judges to keep junk science out of the courtroom using all means, including engaging scientific consultants. Unfortunately it was not soon enough to prevent the bankruptcy of Dow Corning after a $4.25 billion settlement of breast-implant cases with a judge-stipulated contingency fee of $1billion, considerably lower than the usual percentage. This happened despite the fact that the good science was on the side of

# Letters

Dow Corning, as convincingly detailed in the book, *Science on Trial,* by Marcia Angell (1996). It is interesting that the breast-implant controversy is not covered at all in *Trust Us, We're Experts.*

Twenty-five years ago, I was engaged in a national debate on whether or not a new technology, the microwave oven, was "safe" and whether its sale should be allowed. On one side were people, like some cited approvingly in *Trust Us, We're Experts,* who called for "zero leakage" – a precursor to the currently faddish Precautionary Principle, which is lauded in *Trust Us, We're Experts.* They argued that the microwave oven was not proven safe, which is, of course, an impossible goal. (See the writings of A. Weinberg, R. Wilson and the Harvard School of Public Health, also criticized in the BUR). My allies and I pointed out that based on science (i.e. that which is known) there are no hazards at the leakage levels permitted by the FDA. We, including academics, were attacked in the media with innuendo and all the tricks of the media and I note that attacks on people like Dr. John Graham, formerly of the Harvard School of Public Health, are included in *Trust Us, We're Experts.* Finally in 1977 on *60 Minutes,* the TV program, Mike Wallace interviewed key players (including me) in the debate. At the end he posed the question of whether after many years we would be sorry we had not listened to those alleging danger, which would show up in the form of cataracts, cancer and other latent illnesses. It is now twenty-five years later and scientists who held such views have in some cases been barred from testimony in courts. On the other hand, the microwave oven is one of the most appreciated appliances in the home as shown by national polls.

In my career, I have interacted with two Christian CEOs of notable companies. I ask the reader the following question. In case of a conflict between the authors of the BUR and these two CEOs, whom would you believe? At the minimum I hope you do not swallow all that is in the BUR, hook, line and sinker.

The larger issue is the existence of poor-quality science today.[1] This makes it difficult to ascertain the truth, especially in environmental matters. I would hope that the ASA would address this problem examining all sides of controversial issues. It is my hope that the newly created affiliation in ASA, CEST (for Christian Engineers and Scientists in Technology) will play a key role in insuring that ASA hears the views of Christians who develop and operate technology for the benefit of humankind.

**Note**

[1]This subject is too vast and complicated to elaborate here so I here mention only two references that touch on different aspects of the problem.

Robert Bell, *Impure Science: Fraud, Compromise and Political Influence in Scientific Research* (New York: John Wiley & Sons, 1992)

Robert L. Park, *Voodoo Science: The Road from Foolishness to Fraud* (New York: Oxford University Press, 2000)

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## Theological and Scientific Problems: A Response to John A. McIntyre

I trust it is inadvertent, but McIntyre, "The Historical Adam" (*PSCF* 54 [2002]: 150–7) presents as telling an argument for universalism as can be found. If God chose a non-ensouled first Adam to be transformed, and his fall imposed guilt on all members of the race without their doing anything, then God's choice of a Second Adam who was righteous must transfer redemption to all members of the First Adam's race without their doing anything. This must include believing.

There is a further problem. If Adam was the first creature to whom God gave a conscience and thereby made him religious (p. 153), then either that conscience was distributed to the entire race, or else all but some of Adam's descendants perished in Noah's Flood. But there were many human groups continuously occupying sites in the Americas, Asia, Europe, Africa, and Australia for tens of thousands of years, excluding the second option. Yet the former option requires that their God-consciousness cannot antedate 4000 BC. However, Glenn Morton has collected solid evidence of religion long before this date. See www.glenn.morton.co.uk/shaman.htm;/mankind.htm; www.glenn.morton.btinternet.co.uk/rossrev.htm; /rtbanthro.htm. I have to conclude that McIntyre's ingenious interpretation is not compatible with his PCA membership, and contradicts the anthopological evidence.

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## Response to David Siemens

I thank David Siemens for his evaluation of my article "The Historical Adam." He raises two points.

His first point is that the article says that [Adam's] "fall imposed guilt on all members of the race without their doing anything." Since Siemens mentions my membership in the PCA, I will respond with the statement of the Westminster Confession (Chapter VI.3) concerning the effects of Adam's sin:

> They [Adam and Eve] being the root of all mankind, the guilt of this sin was imputed, and the same death in sin and corrupted nature conveyed to all their posterity, descending from them by ordinary generation.

The Confession states that the guilt of Adam's sin was "conveyed to all their posterity"; there is no indication that the posterity did anything to acquire their sin. The Confession (Chapter XVI.1) then proceeds to restrict the saving of souls to the work of the Spirit of Christ in the hearts of the elect:

> The grace of faith, whereby the elect are enabled to believe to the saving of their souls, is the work of the Spirit of Christ in their hearts.

All men are lost without doing anything; only some are saved through their belief.

Secondly, Siemens notes that Adam's acquisition of a conscience in 4000 BC appears to rule out God-consciousness before 4000 BC. However, this problem of the transfer of Adam's sin to humans living before Adam is addressed in "The Historical Adam" on page 154:

> Adam's disobedience of a direct command of God, not to eat of the tree, led God to declare all humans to be sinners. Just as, across space and time, Christ's act of obedience made Abraham righteous (Gen. 15:6), so did Adam's act of disobedience make the prehistoric American Indians and Australian aborigines sinners. And just as there was no biological connection between Christ and those he "made righteous," there was also no biological connection between Adam and those he "made sinners."

Since the eating of the tree of the knowledge of good and evil was an integral part of Adam's sin, the effect of eating of the tree (obtaining a conscience) was also transferred to those living before Adam along with the guilt of Adam's sin.

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## Physical and Nonphysical Aspects of Nature

Walter Thorson's philosophy of science attempts to give naturalism in science a crucial theological basis (*PSCF* 54 [2002]: 2-21). His intention is to combat the philosophical or metaphysical naturalism assumed in the scientific world view, which Thorson describes as atheistic/materialism. However, is a philosophy of science necessary for the practicing scientist to carry on his or her scientific work successfully? Surely, one can take a minimalist approach to science whereby irrelevant philosophical suppositions are eliminated from what constitutes the true scientific enterprise and so give rise to what one may properly call unadulterated science.

Thorson indicates that "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). This definition may be too encompassing since it includes all of creation and it would be best to limit the subject matter of science to the physical aspect of reality. The physical data that is constitutive to science is collected, in principle, solely by physical devices. The latter may include, at times, humans as merely physical "detectors." If physical devices cannot detect or measure something, then that something is not the subject matter of science. Thorson recognizes that "the central problem of biology and cognition *logically transcend* a merely mechanistic, physical account of the phenomena involved" (p. 3). However, one wonders how one would perform unambiguous measurements in this "logically distinct aspect or level of creation" proposed by Thorson.

The finite nature of the human mind is evident by the need to understand reality by a process of analysis. This process of taking things apart has resulted in a multitude of disciplines as manifested in the existence of many departments in our institutions of higher learning. It is clear that each kind of knowledge deals primarily with a certain aspect of reality and, as such, it is based on a specific type of evidence used to establish the truth or falsehood of given propositions in that field. It is foolish for a scientist to require the same kind of evidence appropriate to establish truthful statements in science from a theologian, who has its own source of evidentiary data. The academic disciplines of science and theology are certainly distinct.

Humans are detectors of both the physical (science) and the nonphysical (self, the spiritual, information, etc.) aspects of reality. Accordingly, knowledge and experience of the physical and spiritual worlds overlap in humans and thus need be integrated into one. It is hard to see how to implement Thorson's introduction of a theological basis to his "naturalism" that integrates the biological and spiritual aspects of humans.

There are different levels of inferences that can be made from the data collected by physical devices. It is acceptable to do science by insisting that one limits oneself to purely materialistic explanations. However, higher forms of inferences provide a venue for integrating physical and nonphysical kinds of knowledge. Materialism presupposes that the whole of creation can be explained solely on the basis of matter/energy. This represents a higher level of inference than that prescribed by unadulterated science and represents a particular metaphysics. Intelligent Design, as presently understood, represents a similar higher level of inference, which Thorson characterizes as a legitimate theological reflection. Of course, one ought never to forget that human rationality characterizes the whole of reality by mental models, abstractions, and constructs that have their counterparts in the real but are not identical to them.

William Olive Martin noted: "Mathematical, metaphysical, and even theological propositions may be instrumental to the search for true generalizations [laws of nature], but in no case can they possibly be constitutive as evidence."[1] The theological basis of Thorson's naturalism may be ultimately what is needed as science attempts to encompass more of the whole of reality and tries to deal with the fundamental question of what life is, the human self, and human rationality. However, if theological propositions are only instrumental and not constitutive as evidence, in what sense can such propositions be useful in science? It may be that these questions are truly beyond the reaches of science no matter how science is defined. One would then have the curious paradox of humans as living, rational beings that successfully describe the physical aspect of reality yet may never be able to develop a scientific theory of what life, or reasoning is.

Human consciousness and reasoning summarize all physical data into laws and create the mathematical theories that lead to predictions. However, the human element that creates the theories is totally absent from the laws and theories themselves. Accordingly, human consciousness and rationality are outside the bounds of science since they cannot be detected by purely physical devices and can only be "detected" by the self in humans. One wonders if the notions of information, function, and purpose, urged

by Thorson for life scientists to consider, can provide explanations of such nonphysical aspects of creation.

Thorson argues in Part II 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 in not an adequate basis" (p. 3). I have emphasized the nature of the subject matter of science as data collected by physical devices in order to preserve the objectivity so crucial to science. Thorson's observation indicates, therefore, that life is not detectable by purely physical devices and thus life cannot be reduced to the purely physical. Of course, the functional logic of Thorson must be defined operationally; otherwise, it is incapable of providing clues to the scientific description of nature.

Thorson indicates 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—as the Scriptures consistently teach" (p. 12). The epistemology suggested by the above definition of science implies that purely physical devices cannot detect God and so God is not the subject matter of science; however, God is "detected" or known by humans who are endowed with consciousness and rationality.

Clearly, the true nature of life, human consciousness, and rationality points in a direction other than the physical. It is not clear, however, that Thorson's functional logic, even if it accounts for most of biological science, would suffice to explain the nonphysical aspects of humans. In a recent letter I noted:

> Unraveling the mysteries of nature requires conscious, intelligent beings. But no humanly conceived theory of nature, however complete, can ever encompass all that exists or the creation process that brought everything into being. This ontological problem is best answered by supposing the existence of a Creator, which must be conscious and intelligent to an infinitely higher degree. I believe this idea is the underlying rationale for advocates of intelligent design to infer an Intelligent Designer.[2]

It seems like a truism that if conscious beings with intelligence are required to "decipher" nature, then the Creator of all that exists must possess these properties to an infinitely higher degree.

Clarifying the true nature of science will not diminish the power of the scientific enterprise to successfully explain the physical universe. However, it will certainly prevent us from equating all of human knowledge with that derived from science. Max Planck said: "God is the beginning of every religion and at the end of the natural sciences." Consequently, the honest pursuit of scientific knowledge will reveal the truth in Scripture: "In the beginning was the Word, and the Word was with God, and the Word was God. He was in the beginning with God. All things came into being through Him, and apart from Him nothing came into being that has come into being" John 1:1–3. These verses suggest that the whole of reality is so interlocked that a complete knowledge of even the simplest element of creation, say, a mere electron, would correspond to a unified understanding of the whole. In "Flower in the Crannied Wall," Alfred Lord Tennyson wrote:

> Flower in the crannied wall,
> I pluck you out of the crannies,
> I hold you here, root and all, in my hand,
> Little flower—but if I could understand
> What you are, root and all, and all in all,
> I should know what God and man is.

### Notes

[1]William Oliver Martin, *The Order and Integration of Knowledge* (Ann Arbor, MI: The University of Michigan Press, 1957), 214.
[2]Moorad Alexanian, "Seven More Views on Intelligent Design," *Physics Today* 55 (2002): 10–11.

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## Our Response to Pain and Suffering

The question of why does God allow pain and suffering often comes up in *Perspectives on Science and Christian Faith* and I find that the answers generally are shallow and pass over the topic. In other words, we do not really have an answer. It leaves the feeling that this life is all we have, eternal life is a dream, and we want justice here. That is not the Christian faith. Jesus never received justice in this world, and we as his disciples are asked to follow Him. I take a very different approach to the question.

Who are we? How did we get to be the persons we are now? We begin our life as a baby and possibly inherit some character features from parents and grandparents. Our brains are preprogrammed for language learning and to accept moral teaching. We also have the ability to think, to choose, and to make decisions. We are "a blank page," as we begin our life. As the baby grows up it is subject to many influences in life. Its character is formed by the decisions the person makes and by the pain, suffering, and trials with which it has to cope. When life is easy and decisions are poor, the character declines; when life becomes difficult but the right decisions are made, the person's character is enhanced and the he becomes strong like a rugged oak tree standing alone. It is when we suffer unjustly that we truly become strong great persons.

God wants us to become great, strong persons, and he uses pain, suffering and difficult assignments to develop our character, the persons that we really are. When life is too easy, humans become like jelly fish. This is what is happening to our civilization today. Also, God did not make us to be robots but he wants us to serve him of our own free accord.

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

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

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## American Scientific Affiliation

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



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