IS INTELLIGENT DESIGN HARMFUL TO SCIENCE?¹

Critics of intelligent design often worry that acceptance of an intelligent
designer in nature would be detrimental to science. Three claims have
been made that, if true, might suggest that scientists should be wary of
intelligent design. The first of these claims is that intelligent design inhibits
scientific inquiry.² The second claim is that intelligent design is a sterile
idea, and does not suggest any questions for investigation. The third claim
is that, intelligent design is not an appropriate approach in science because
it is religious in nature.³ What is the status of these claims?

The first claim, that intelligent design inhibits scientific inquiry, is
quickly falsified by a brief look at the history of science.⁴ Most of the
early pioneers of science believed in an intelligent designer. Many believed
specifically in the biblical creator. Yet this did not inhibit their curiosity nor
disourage them from pursuing scientific research. In fact, belief in an
intelligent designer was a stimulus to research for many of these scientists.
Indeed, today there are many successful scientists who believe the universe
originated by intelligent design. Thus, the idea of intelligent design has
been useful in the development of modern science. On the contrary, if
nature is all there is, why would one expect to find order and regularity in
nature? This criticism of intelligent design is false. Those who are inclined
to explore the world through science will do so whether or not they believe
in design.

The second claim is that intelligent design is a sterile idea, and does
not provide any questions to explore scientifically. Hence it is useless for
science, whether true or not. As noted above, this claim is falsified by the
number of early scientists who were motivated to pursue science because
of their faith in a rational God who created a rational universe. It is further
falsified by contemporary design advocates doing research stimulated by
the idea of intelligent design.⁵

The idea of intelligent design continues to stimulate scientific research
in certain areas. Design is a historical explanation; hence it is not likely to
have much application in exploring experimental questions in science.
Since most science is experimental in nature, belief in intelligent design is
unlikely to affect much of scientific inquiry. It could and does, however,
suggest ideas for research in historical questions. This can be illustrated
by comparing research questions in historical biology stimulated by
Darwinism with those stimulated by intelligent design.
Under the dominant evolutionary paradigm, three major types of questions are being asked:

a. What is the pattern of relationships among living organisms? Assuming the pattern is that of a single tree or bush, how are the various species connected within that single structure?

b. What processes have led to diversification of life within the tree/bush?

c. What is the history of the development of the tree of life in time and space?

Intelligent design poses the same categories of questions, but without the same assumptions about the answers. For example, design advocates are interested in the following questions:

a. What is the pattern of relationships among living organisms? If there are numerous trees or bushes, what are the boundaries of the various independent lineages?

b. What processes have led to diversification within each lineage, and what might be the limits of such processes?

c. What is the history of life in time and space? What similarities and differences might we find in comparing patterns in time and space among various independent lineages?

Other ideas for scientific inquiry could be derived from the implications of design, but these examples should be enough to refute the criticism that the idea of intelligent design does not provide any questions to explore.

The third claim is that intelligent design is a religious idea, and religious ideas are not appropriate in science, in part because they inhibit free inquiry. The argument that religious ideas are not appropriate in science is basically an *ad hominem* argument — the claim that an idea should not be accepted because of its source. The value of intelligent design should be examined on its own merits, not on the personal views of its advocates. Mere religious motivation, by itself, is irrelevant to whether design should be considered as an explanation of nature. Furthermore, some religious values are necessary for science. For example, honesty is a religious value, but scientists have found it indispensable for the practice of science.

Although there is always the danger that ideology will negatively affect free inquiry, this danger is not the fault of belief in intelligent design, but of negative social interactions among scientists. The reason given why religious ideas are not appropriate in science is that they are harmful to free inquiry. The implication is that free inquiry must be protected. But
how does one advance the principle of free inquiry by banning particular approaches because one finds them philosophically disagreeable? Critics of the general theory of evolution may find that materialistic ideology is currently affecting their ability to pursue free inquiry. In addition, Cornelius Hunter has cogently argued⁶ that evolution itself is religiously motivated. The criticism that intelligent design should not be allowed because it is a religious idea is self-contradictory and sounds politically motivated.

In conclusion, the major attacks against intelligent design do not appear to be valid, nor even self-consistent. It sometimes seems that intelligent design threatens the hegemony of materialistic philosophy, and the opposition is more concerned with protecting materialism than in promoting free inquiry.

Jim Gibson

ENDNOTES


5. For example, research conducted by the group Wort and Wissen in Germany, and the Baraminology Study Group at Bryan College in Tennessee.

ARTICLES

A BIBLICAL PERSPECTIVE ON
THE PHILOSOPHY OF SCIENCE

Leonard R. Brand
Professor of Biology and Paleontology
Loma Linda University

ABSTRACT

Christianity, with its rational God, provided the ideal culture for the rise of modern science. Philosophy of science, the understanding of how the scientific process works, has changed over time. The positivist philosophy had rather rigid ideas of how science confirms theories and demarcates the dividing line between science and non-science. This philosophy has given way to a more sophisticated view of science, which recognizes the weaving together of the careful, rational scientific process with the inevitable human choice or judgment that is involved in choosing experiments or hypotheses and in interpreting evidence. Science is a continuing search that makes progress but never reaches absolute truth. This leaves open the door to suggest that religious factors can legitimately interface with science, if the interaction is done carefully, to avoid hidden pitfalls. Many in science follow the philosophy of naturalism, which does not allow any explanations that require or imply supernatural causes at any time in history. Others suggest that religion can, in varying ways, contribute to the scientific process in very constructive ways. Three models of the relationship between religion and science are described, which differ in their view of the nature of theology and how it should or should not interact with science.

Modern science began in Christian Europe, and many great scientists in past centuries viewed their scientific work as thinking God’s thoughts after Him (Moreland 1989, p 24). This attitude toward the relationship between science and religion went into a serious decline, until it seemed that science had eliminated the possibility of theology as a source of knowledge. However, more recent thinking by philosophers of science has set the stage for suggesting a different view. We will be dealing in this paper with biblical Christianity, and will not discuss other religions.

CHRISTIANITY AND THE ORIGINS OF MODERN SCIENCE

At times in history scientific study was much more alive in other places than it was in the Western world, so why did modern science arise
in Western Europe instead of in China or elsewhere? There is reason to believe that Christianity provided the ideal culture for the origin of modern science (Polkinghorne 1994, Ratzsch 2000). The creation of the universe by a rational, intelligent God explains why the universe is so intelligible and open to our scientific investigation. Since Christianity offered such a rational God, this can explain why Christians expected the world to be understandable, and why it is worthwhile investing one’s energy and time into systematic investigation of nature. Science is based on the assumption that nature is uniform, with universal processes and patterns. For a Christian, these characteristics and assumptions of science are founded in belief that the universe was created by a rational God who is faithful and consistent. A secular scientist does not have such a foundation, and must generally accept these concepts as mere assumptions.

Science as an institution has now rejected the biblical creation account as its foundation, but continues to be successful. Will denial of the existence of a rational Creator eventually weaken science by undercutting its foundation? Or now that science is in motion does it have sufficient momentum to maintain its rapid progress? Time will tell.

THE PHILOSOPHY OF SCIENCE — CHANGING VIEWS ON HOW KNOWLEDGE IS ACQUIRED AND EVALUATED

As modern science developed in the 17th to early 20th centuries, scientists and philosophers encouraged a more objective and rational study of nature, by empirical observation, than had been practiced before. Some of Francis Bacon’s ideas about science were quite different from what came later. He thought entering into research with prior prejudices or theories should be avoided. Our task, according to Bacon, is to rid our minds of prior prejudices and theories, and then objectively collect data and let the data lead us to a true understanding of nature (Popper 1963, Ratzsch 2000). Bacon’s concept of science is now understood to be unrealistic, and the most naive part of Bacon’s philosophy was his belief that we can begin the scientific process by purging our minds of all bias or prejudices (Popper 1963). How would we know what ideas to purge? In actuality a mind purged of all “biases” would be an empty mind, not an objective mind.

In the traditional positivist philosophy of science two important issues were demarcation (determining the boundary between science and non-science) and confirmation of theories (how to determine if a theory had been verified). In the early 20th century logical positivism was the most influential school of thought. According to logical positivism, confirmation
of a theory can occur only by empirical data that verify, or indicate the truth of the theory. A theory is valid science, satisfying the demands of demarcation, if it can be verified by empirical observation. Everything that could not be so verified was nonsense. Thus, science was considered the only route to understanding; all other purported knowledge was not actually knowledge. This materialistic outlook considered the material and physical to be real, but rejected any human religious or ethical knowledge that could not be independently verified by science (Murphy 1990, Ratzsch 2000).

Positivism declined as it became evident that it could not effectively deal with some areas of reality, and that the verification criterion did not work. Karl Popper emphasized that just because a series of observations support (corroborate) a statement, this does not establish it to be true. We never know when new observations may demonstrate the statement, or at least part of the statement, to be false (Popper 1959, 1963; Ratzsch 2000). We may hypothesize that all crows are black, and support the statement by observation of 1,000 black crows, but then finding one white crow can prove the statement to be false. Of course most scientific theories are more complex than the color of crows, but no matter how simple or complex they are, we can never verify a theory or demonstrate it to be true, because there is always the possibility that it may in the future be falsified by new data.

In Popper’s philosophy of science, research begins with some observation or problem to be solved. Then the scientist thinks of a theory to explain the observation, and indicates what type of data would disprove or falsify the theory. As long as research does not falsify the theory, it remains viable. Thus we cannot truly verify theories, but we can identify false theories and by this process gradually improve our understanding of natural phenomena (Popper 1959, 1963). Popper’s philosophy answers the big questions of demarcation and verification in the following way. Any theory or hypothesis is scientific (meets the demarcation criterion) if it can, at least in principle, be tested, that is if it can be contradicted by empirical data. The confirmation criterion cannot be met by proving or verifying a theory, but simply by holding a theory only as long as it has not been falsified.

Popper’s falsification concept was an improvement over positivism, but falsification also has its limits. New data may appear to refute a theory, but further research may reveal that we misunderstood that new data, and the theory was not falsified after all. This is a very real problem, since it is not possible to falsify a theory with certainty. However, in principle the
concept of testing a theory by observations or experiments that have the potential to falsify it is still an effective technique, as long as we remember that falsification is not final. As our knowledge grows we may discover that the theory was actually not falsified. Science is always a continuing search that does not reach absolute truth.

Popper’s philosophy of science abandoned the rigid conception of rational criteria of the traditional view and recognized the human element in science. He saw that there is always a need for human choice or judgment in research (Ratzsch 2000). Science was no longer seen as resting on a solid foundation, but was compared by Popper (1959, p 54-55) to a building erected not on solid bedrock, but on piles driven into a swamp. They are not driven down to any natural base, but are driven in until “we are satisfied that the piles are firm enough to carry the structure, at least for the time being.” In this new view of science it was no longer reasonable to claim that topics outside of science were nonsense.

The human element in science became even more evident in the philosophy of Thomas Kuhn (1962, 1970), that “has placed humans and human subjectivity (in the form of values of the community of scientists) in the center of science” (Ratzsch 2000, p 50). Based on his study of the history of scientific theories, Kuhn concluded that scientists do not generally try to disprove their theories. Rather each scientist typically works within a scientific paradigm (a broad, explanatory theory; e.g., the theory of evolution). They do not try to test the paradigm, but assume it is true and use it to guide their exploration of new phenomena within the paradigm’s domain. This process Kuhn called normal science, because that is what scientists normally do.

As normal science progresses, anomalies may be discovered — phenomena that do not seem to fit the expectations of the paradigm. If these anomalies persistently defy efforts to resolve them, this can lead to what Kuhn called a crisis state for the paradigm. Science never abandons a theory or paradigm without another one to replace it, but a crisis may stimulate a few creative scientists to develop an alternate paradigm. At that point it is not clear which paradigm is correct, and the choice between the old paradigm (which has only failed with a few problems) and the new one (which has not yet established a track record) is often made for less than objective reasons. Such choices can even be described as a “conversion” process that leads a scientist to see things in an entirely new and different way from how he/she saw them before (Kuhn 1962, 1970). If the new paradigm replaces the old, a scientific revolution has occurred, and normal
science now proceeds under the new paradigm. The revolution process
cannot be defined by rigorous logical criteria, but as the result of a changing
consensus of opinion among scientists working in that field.

Further philosophical work has resulted in criticisms that parts of
Kuhn’s philosophy are not adequately supported by historical data
(e.g., Laudan 1977), but it is still recognized that science is influenced by
subjective human elements. Kuhn has responded to his critics (Kuhn 2000),
and there were other important philosophers of science in the 20th century
(e.g., Reichenbach 1951; Feyerabend 1978, 1987). Feyerabend (1978) went
so far as to urge that we should not try to define a scientific method,
because rational boundaries defined by a scientific method will inhibit
progress toward finding some legitimate new knowledge. We will briefly
consider the works of Laudan (1977) and Lakatos (1978), who have
provided sophisticated contemporary philosophies of science. Moreland
(1989) and Ratzsch (2000) have written helpful analyses of the philosophy
of science from a Christian perspective.

We will now turn to the philosophy of science developed by Lakatos.
He believed the history of science is best described as competition through
time between competing research programs. A research program consists
of a core theory, and a set of auxiliary hypotheses. The core theory is central
to the research program, and is protected from falsification by the “pro-
tective belt” of auxiliary hypotheses, in order to give the core sufficient
opportunity to be fully developed. When potentially falsifying data appear,
it is the auxiliary hypotheses that are modified or replaced. The theory that
all life has arisen by evolution is an example of a core theory, with its
protective belt of changeable auxiliary hypotheses of specific evolutionary
mechanisms.

A research program is considered progressive or degenerating ac-
cording to several criteria, the most important of which is whether it is
successful in predicting novel, hitherto unexpected, findings, at least some
of which can be successfully corroborated. Thus the choice between
competing research programs is not based on our ability to determine
which one is more true, but on the programs’ relative ability to increase
scientific knowledge. Both demarcation and confirmation are based on
this relative success at increasing scientific knowledge. Science is still
perceived as a rational activity, but it is now recognized that science is
affected by sociology, economics, and other very human factors (Murphy
1990, Lakatos 1978). Because of these human factors, theories at times
seem more strongly supported than they really are.
The history of science shows that a theory may be successful in stimulating scientific progress, and consequently be widely accepted by the scientific community, and yet later be rejected because the accumulating evidence no longer supports it. Consequently, if at a given time there is a strong consensus among scientists regarding the truth of a particular theory, this consensus may result from philosophical or sociological factors, rather than from a body of evidence demonstrating the truth of the theory (Kuhn 1970, Lakatos 1978). For example, could the scientific consensus that all life forms resulted from evolution, result from a common anti-supernatural philosophical commitment, rather than from the adequacy of the evidence?

Laudan’s (1977) philosophy of science has similarities with that of Lakatos. One of the differences is in terminology; Laudan uses the term research traditions instead of research programs. A research tradition is also evaluated by comparison with other research traditions, on the basis of its ability to increase scientific knowledge by predicting novel, previously unexpected, findings waiting to be discovered by diligent researchers.

The decisions as to whose philosophical concepts (Bacon, Popper, Kuhn, etc.) are better have been made primarily from study of the history of scientific ideas, how the participants in science evaluated those ideas, and how they made their choices between theories.

**IMPLICATIONS FOR THEOLOGY**

Since the Enlightenment, authority of any kind has no longer been accepted as a legitimate determiner of what is reliable knowledge. It could be argued that this has destroyed the rational credibility of Christian theism, since it depends on the authority of Scripture. This would appear to be true, unless we see reasons to believe that Scripture is worthy of more trust than human authorities.

The traditional, positivist, philosophy of science left no room for theology to influence science. The scholarly world still is generally skeptical of theism, but the views of philosophers of science in the 20th century have undercut rational objections to considering theology as a legitimate area of knowledge. Popper, Kuhn, Lakatos, and Laudan have revealed that science is influenced by many subjective human influences. They have also shown that the old demarcation and confirmation criteria do not work. There is overlap of science and other fields, and it is not possible to draw a sharp line between science and these other fields of inquiry (Moreland 1989, Ratzsch 2000). Theology and science are still, in important ways, quite
different, but I believe there are reasons to propose that theology and faith can play a legitimate role in influencing science.

In fact Laudan claims that it may be “irrational and prejudicial” to exclude philosophical, religious and moral issues from scientific decision making (Laudan 1997, p 132). The problem of evil, in the form of pain and suffering, according to Laudan, “is at its core an empirical problem par excellence: how can one maintain one’s belief in a benevolent, omnipotent deity in the face of all of the death, disease, and natural disasters which are a daily element of our experience” (Laudan 1977, p 190)? As we will see, the solution of this problem is crucial if theism is to be defensible to many people in this scientific age.

Laudan also argues that Judeo-Christian theology makes many historical claims about the existence of persons and the occurrence of events that should be testable by empirical methods (Laudan 1977). If it could be shown that ideas arising from theism, e.g., can be progressive in advancing scientific knowledge, then contemporary understanding of science would have difficulty denying the validity of such ideas. This interaction between science and religion must be carefully defined or it could be a source of problems, and we will now focus on this topic.

WHAT SHOULD BE THE RELATIONSHIP BETWEEN SCIENCE AND RELIGION?

There are various ways to define the types of possible relations between science and religion (Barbour 1990, Murphy 1990, Peacocke 1993, Ratzsch 2000), but I will compare a set of three models for this relationship. The three models differ in how they view theological knowledge. In Model 1, theological “knowledge” is not really knowledge, and is not allowed to influence scientific thinking. In Model 2, theological and scientific knowledge are both accepted, but are kept separate. There is still little influence of theology on scientific thinking. Model 3 encourages integration; religion can, and should, influence scientific thinking. The models are:

1. Separate domains. No relationship is allowed between science and religion; they remain isolated from each other. The philosophy of naturalism dictates that science reject any explanations involving the supernatural. Religion is at most an emotional experience and is not relevant to scientific issues.

2. Parallel but separate. This model seeks to understand the relationship between science and religion, because they are both accepted as sources of truth. However, religion is not allowed to influence
science. The search for truth is not an integrated cooperation between religion and science, but religion and science remain separate, searching in parallel to each other. Science, in practice, follows methodological naturalism, which means that science, purely as a practical method, never considers any divine action as a possible explanation of any phenomena (although it does not deny the possible existence of God).

3. *Interaction, with God having priority in our thinking.* This model encourages active interaction between science and religion in topics where they make overlapping claims, because both are accepted as sources of cognitive knowledge about the universe. Allow feedback between them, to encourage deeper thinking in both areas and provide an antidote to carelessness on both sides. Both religion and science can make factual suggestions to the other, which can be the basis for careful thought and hypothesis testing. This model respects the scientific process, but also recognizes truth in Scripture. It aims to be an open-ended search for truth, not bound by the rules of naturalism. Although it may appear that the Christian using this model is bound by theistic rules, in actuality we do not need to fear that open-minded scientific study of God’s creation, in the long run, will contradict God’s message in Scripture — the Christian can afford to be fair with the evidence.

There are no clear lines between these three models; no doubt there can be some options between these three, but the data in nature and in Scripture limit the number of viable options. A number of prominent writers can be confidently placed in one or the other of these models, and they will illustrate the differences among the models.

**MODEL 1: SEPARATE DOMAINS**

This first model isolates scientific explanations from any religious influence, and is characteristic of many authors who have written on the subject of creation and evolution. This entirely secular approach appears to be the closest to what could be regarded as an “official” description of science as practiced in the 20th century and the beginning of the 21st century. The philosophy of naturalism dominates this model, which does not allow science to accept any hypothesis that requires or implies any supernatural influence in the universe at any time in history.

Naturalism comes in two versions: philosophical naturalism denies the existence of God, but methodological naturalism does not make any
claims against the existence of a god. It is just a method of science that does not allow explanations invoking miracles. In either case the practical result is the same: neither philosophical or methodological naturalism allow consideration of any hypothesis that implies, e.g., that life has been created by God, or that there has been any other divine intervention in history. This philosophy has at times been expressed very candidly: “If there is one rule, one criterion that makes an idea scientific, it is that it must invoke naturalistic explanations for phenomena, and those explanations must be testable solely by the criteria of our five senses” (Eldredge 1982, p 82, emphasis in original). In a later book (Eldredge 2001) the author softened that statement some, but the concept is still basically the same. Richard Dawkins (1986, 1996, 1998) is an outspoken advocate of the belief that life is the result of the blind forces of physics, with no purpose in mind. In practice, the philosophy of naturalism leads to the claim that given enough time and research, all things can be explained without reference to God. In other words, nothing can count as evidence against the claim.

Some other anti-creationist authors avoid expressly advocating naturalism, but the material they present is clearly based on a theory of origins resulting from a naturalistic scientific framework (Kitcher 1982, Futuyma 1995, Ruse 1996, National Academy of Sciences 1999). Following a naturalistic model to its logical conclusions implies that pain, suffering and death are a natural result of the laws of nature, and there is no other meaning for them to be found — we need to grow up and live with this. Gould (1999) also advocates the separate domain concept.

So far I have discussed this model only from the standpoint of science, isolated from religious influence. The other side of the relationship is also important: what would religion be like if isolated from any scientific influence? I will not discuss this in detail, but it should be pointed out that scientific study has helped us to revise a number of ideas that were once a part of religious beliefs, and realize they are not really supported in Scripture. For example, we now recognize that species of animals are not fixed and unchangeable (the Bible does not say they are), and the sun does not revolve around Planet Earth (the relevant Bible passages are not addressing the structure and functioning of the cosmos, but are incidental to some other topic; this parallels our own incorrect statements about the sun rising).

CRITIQUE OF MODEL 1: SEPARATE DOMAINS

In evaluating this model, a critical question is whether science is an open-ended search for truth, wherever the evidence may lead? Or is it a game, defined by a set of rules, that seeks to find answers as far as it can
go *within* those rules? For many scientists the relevant rules in the study of origins are defined by naturalism, and even if life was actually created by God, the rules determine that science can never consider that hypothesis, no matter what the evidence indicates. Creationists are often accused of being unwilling to allow their creationist beliefs to be considered as a hypothesis, subject to possible refutation by the evidence. Here is a possible reply that illustrates the one-sided nature of that criticism — I will consider my creationist beliefs as a hypothesis to be tested, to the same extent that the philosophical naturalist will allow his/her naturalistic beliefs to be a hypothesis to be tested. I will argue that science as a rule-bound game that cannot consider some hypotheses is not a legitimate scholarly exercise.

That may sound naive, but I am well aware that any quick refutation of either view will not be forthcoming — the universe is too complex to yield easy answers to such big questions. And in principle, modern understanding of the philosophy of science does not provide rational support for the exclusion of some hypotheses from consideration, even if it will be very difficult for science to come to grips with those hypotheses.

The application of naturalism to the origins of life and of the diversity of organisms is being challenged by scholars in the Intelligent Design (ID) movement, led by Phillip Johnson and others (Behe 1996; Moreland 1989, 1994; Dembski 1998, 1999; Johnson 1991, 1995, 1997, 2000; Dembski & Kushiner 2001). Ratzsch (2001) concluded that a correct understanding of the philosophy of science allows the scientific legitimacy of intelligent design. Advances in molecular biology make it increasingly difficult to justify excluding the hypothesis that life requires an intelligent inventor — that idea must be at least open for candid discussion. If science is going to be an open-minded search for truth, it cannot arbitrarily exclude some hypotheses. A book by Pennock (1999) aimed to refute the scientific status of ID, and claims to have done so. However, for a creationist who accepts at least microevolution, speciation, and the evolution of languages within several created language groups, Pennock’s book contains little or nothing in the way of substantive scientific arguments. It is primarily one long argument that naturalism is the only valid philosophy, and science is the only way to find truth. In written criticisms of ID that I have read, this type of philosophical rather than substantive scientific response is common.

**MODEL 2: PARALLEL BUT SEPARATE**

I mean by the *parallel but separate* model. Murphy has doctorates in philosophy of science and in theology, and the other three authors have doctorates in a field of science as well as in theology. Though these writers do not agree on everything, they share important elements in their basic theology and in their approach to the relationship between science and religion. They believe in God as the ruler of the universe, and in Jesus

<table>
<thead>
<tr>
<th>ERA</th>
<th>PERIOD</th>
<th>EPOCH</th>
<th>EVENTS</th>
<th>TYPICAL FOSSILS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quaternary</td>
<td>Holocene, Pleistocene</td>
<td>* Human fossils</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tertiary</td>
<td>Pliocene, Miocene, Oligocene, Eocene, Paleocene</td>
<td>*</td>
<td>Western USA Mts</td>
</tr>
<tr>
<td></td>
<td>Cretaceous</td>
<td>66 my</td>
<td>*</td>
<td>Dinosaur</td>
</tr>
<tr>
<td></td>
<td>Jurassic</td>
<td>245 my</td>
<td>*</td>
<td>Reptile</td>
</tr>
<tr>
<td></td>
<td>Triassic</td>
<td></td>
<td>*</td>
<td>Amphibian</td>
</tr>
<tr>
<td></td>
<td>Permian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pennsylvanian</td>
<td></td>
<td>*</td>
<td>Reptile</td>
</tr>
<tr>
<td></td>
<td>Mississippian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Devonian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Silurian</td>
<td></td>
<td>*</td>
<td>Triile</td>
</tr>
<tr>
<td></td>
<td>Ordovician</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cambrian</td>
<td>570 my</td>
<td>*</td>
<td>Major modern animal phyla</td>
</tr>
</tbody>
</table>

*Figure 1. The sequence in which various groups of fossils appear in the geologic column, with ages as determined by radiometric dating. (From Brand 1997).*
Christ as God’s supreme revelation to humankind. They seek to understand God’s revelation and how it gives us hope and salvation.

They also accept the entire theory of evolution and of the origin of life from nonliving material as understood by science today. They agree that evolution through hundreds of millions of years has been God’s method of creation, including the evolution of humans and apes from common ancestors (theistic evolution). In their belief system there was no literal Garden of Eden or Adam and Eve. There was no time when humans lived as innocents in a perfect paradise, and there was no fall into sin as many Christians believe. Although they do not discuss the concept of Satan, their theology does not seem to have any place for such a being. Evil, pain, and suffering did not result from human sin, but are a natural part of the evolution process (death, disease, predation, extinction, etc., are seen in the fossil record for over 500 million years, in conventional geologic time, before human fossils appear; Figure 1).

These individuals object to allowing religion to influence science, at least in areas of importance to this present discussion. Even though they claim to be supportive of some version of a Dialogue or Integration model of the relation between science and religion (Barbour 1990, Murphy 1990, Peacocke 1993, Polkinghorne 1998), they interpret this relationship very differently from my version of the interaction model. For them, science must generally proceed without interference, and religion seeks answers only to questions that science cannot address. Religion and science are kept separate, but actually they are only partially separated by a one-way door. In their system religion can learn from science, but science does not learn from religion, and religion does not “correct” science. The two are parallel in that both are taken seriously as a search for truth, but they are separate in that religion does not influence science. Thus in practice they actually accept methodological naturalism, but are different from Model 1 in that they do see the search for religious truth to be a valid scholarly exercise.

Nancey Murphy (1990) could be considered to be an exception to the above paragraph. She claims to contribute to an interactionist relationship between science and theology, and describes ways in which this interaction can occur. She also describes her own effort to show how ideas from theology can function as a rational scientific research program (we will return to this later). However, in, e.g., evaluating truth claims about the origins of living things and the history of the universe, she does not seem to allow theology to influence science.
But we can ask how this system can work, since Scripture and science in some cases speak to the same issues and say opposite things. Three examples are the creation of life, the creation of humans, and the fall into sin. Their answer is that it only seems as if the Bible and science disagree, but we must understand that the Bible is only presenting spiritual insights. It is a serious mistake if we interpret the events literally. A phrase they often use to describe this situation is that Scripture is to be “taken seriously but not literally.”

What does it mean to take something “seriously but not literally?” In a conversation regarding a topic that is not just emotional or entertaining, but has some substantive content, what would I mean if I take a friend’s statements “seriously but not literally?” In that case I am probably, in fact, not taking him seriously at all, but am relegating his ideas to some type of metaphorical statement. If you are discussing with your teenage children the meaning of sex and the types of relationships in which sex will be constructive or not constructive, will you be pleased if they take you seriously but not literally?

The following are some qualifications that are needed in this discussion, or it could be misunderstood. There are things in Scripture that even the most conservative among us will probably not read literally; for example the parable about Abraham and Lazarus (Luke 16:19-31). That parable has features that do not appear intended to be taken literally. The same could be argued for a number of other details in Scripture. In this paper I am concerned about basic Christian beliefs, not details. I also argue that the context of a biblical statement must also be considered. For example in Genesis 1 the topic being presented is the origin of living things, and this is the context for its description of the creation of Adam and Eve. In other places Scripture speaks of God stretching out the heavens like a tent (Psalm 104), but this is only incidental to some other topic. The topic is not cosmology, and it is not surprising that the verses include descriptions that do not seem literal.

Also, if a child comes running and tells us that the yard is washing away from a flood (perhaps a broken water pipe), we may indeed take him seriously but not literally. Whether it is appropriate to take a descriptive oral or written statement seriously and literally will often depend on our confidence in the level of understanding of the author of the statement. Whether we accept biblical statements about such things as a one-week creation event literally will be greatly influenced by our view of God’s relation to Scripture. Is the creation week as described in Genesis 1 the
naive understanding of Moses, or did God more directly instruct Moses, to be sure we are not misled about how and when life began? In other words, what is the nature of inspiration?

If Scripture is to be taken “seriously but not literally” this implies that God has not chosen to communicate in ways that would convey timeless propositional truth for all eras of human history in spite of cultural differences (certainly the God of the universe has the wisdom to know how to do that if He chose to). The decision to interpret Scripture in this way has often been made on the basis that scientific conclusions are the standard for judging biblical statements, and scientific findings rule out literal interpretations of Scripture. In this situation I maintain that “seriously but not literally” is a way to accept scientific conclusions about origins, rather than challenge those conclusions, while trying to salvage something from Scripture. But is this approach facing reality? If science is correct in all its conclusions about origins, is Scripture worth salvaging, or has the Bible’s message simply been refuted?

This may not seem relevant to the philosophy of science, but it is relevant to epistemology in general — how do we find truth? In my reading in the sources cited in this section, it seems clear that the decision to take Scripture “seriously but not literally” even when it affects core Christian beliefs is based on contemporary scientific interpretations. If we believe science’s conclusions that all life forms have resulted from a long evolution process, we cannot simultaneously believe that these life forms were literally created in the manner described in Genesis. The authors cited here believe that in any situation of this type, science trumps Scripture. But I suggest that the scientific tentativeness advocated by recent developments in the philosophy of science, and by science’s inability to devise a credible naturalistic theory of the origin of life, should encourage us to periodically reevaluate such a firm commitment to unquestioning acceptance of contemporary scientific interpretations. Otherwise we are descending into a realm of scientific dogma that cannot be questioned.

One’s philosophy of science matters to a Christian, because it can strongly impact theology. The application of the “parallel but separate” model has led to a theology that attempts to deal with the empirical problem of pain and suffering, but reaches a very different conclusion from traditional Christian thinking. We will consider whether that conclusion is worthy of being taken seriously (and literally).

In the references listed above for Peacocke, Polkinghorne, Barbour and Murphy it is accepted that life arose through the laws of nature, and
life then diverged into many different categories of plants and animals through the action of “chance and law” — mutation and natural selection. They recognize that Darwinian mutations occur by chance, meaning that the mutation process does not know what the needs of the organism will be. Mutations just happen, for good or for ill, but then the natural selection process preserves mutations that are beneficial in that organism’s environment, and weeds out other mutations.

These authors accept the materialistic belief that this process has produced all of life, and has led to the evolution of conscious and then self-conscious beings, and finally to spiritually aware humans. This conclusion is, of course, contrary to a literal reading of Genesis, but they warn that any kind of literal reading of Genesis is a seriously defective view, and that Genesis must be taken “seriously but not literally.” “Science can get on with its own task without needing a kind of spurious help from religion” (Polkinghorne 1994, p 21-22). They advocate that theology, in this scientific age, must use the same criteria of reasonableness as science itself uses (e.g., Murphy 1990). Religion, they say, does not have access to any privileged source such as revelation. Genesis is only considered as “theological writing,” and the Genesis story asserts that “all that exists does so because of the will of God”, but the story is not to be interpreted literally (Polkinghorne 1994, p 50). The Garden of Eden is an analogy of the innocence of our hominid ancestors before they became self-conscious and conscious of God. The biblical Fall into sin was actually the turning toward self, after humans evolved to the point of being aware of God and of self (Polkinghorne 1998, p 64), or “Adam’s story is Everyman’s journey from innocence to responsibility and sin” (Barbour 1990, p 206).

At least some of these authors believe that God was involved in the origin of the universe and life, but only at levels not detectable by science, such as in the subatomic world of quantum mechanics. They have found a “gap” small enough for God to work, without apparent danger of this becoming just another “god of the gaps” argument. But allowing God to work at that level does not help to explain God’s relationship to pain and suffering.

How can this theology explain pain and suffering, disease, death, natural disasters like earthquakes and floods (natural evil), and cruelty, concentration camps, and murder (moral evil)? All four of these authors explain it in essentially the same way. They have concluded that if God had imposed His will on the world, nature and humankind would not have been free. The only way God could give the world the gift of freedom
was to let the world “make itself”, allowing it to develop in its own way through the operation of chance and law — mutation and natural selection, and/or through the operation of the uncertainty (quantum mechanics and the Heisenberg uncertainty principle) that functions at the microscopic and subatomic levels. The uncertainties in these processes were what allowed freedom to emerge in nature generally, and in human freedom specifically. But the chance element in this process not only produced the freedom necessary to realize the full potential of self-conscious, God-conscious beings, but the same process also of necessity produced the natural evil that is so destructive. Freedom and evil came as a package deal, and “even god cannot have one without the other” (Peacocke 1993, p 125). A new generation arises only through death of the previous generation, and this is the only way, in their evolution-derived living world, that higher levels of animal life can arise. This, they say, is the only way that humankind could originate, with our freedom and with all the pain and suffering that inevitably accompanied it, that not even God could prevent. “Most of the suffering in nature (that is not caused by us) is natural; it simply needs to be present in order for there to be life at all, especially for there to be life like ourselves” (Murphy 2002, p 54). Barbour even says that “Christ was a focal point of God’s activity and self-revelation...a new stage in evolution...part of the continuous process that runs back through Australopithecus and the early forms of life” (Barbour 1990, p 211).

This concept has many theological consequences. Death and evil were not the result of any human action, since there was no Adam and Eve and no human Fall. Thus the classical explanation of the redemptive work of Christ in saving us from the effects of sin is not correct. Those stories are not considered to be literally true. These authors then explain that God does not walk away and leave us to suffer, but He suffers with us. Jesus hanging on the cross was God (but, for some authors, in a merely human form) suffering with us in our pain and suffering.

CRITIQUE OF MODEL 2: PARALLEL BUT SEPARATE

A series of problems makes the above scenario unsatisfying. First of all, their conclusion that pain and suffering are inevitable natural results if God allows us to have freedom is an unavoidable consequence of their assumption that life is the result of evolution. But I have not found evidence in the writings of these four authors to indicate an awareness of the weak points in the Darwinian theory. They make the mistake of accepting Darwinism as a package deal, without recognizing that different parts of the theory could have very different levels of support from the evidence.
The evidence for microevolution and speciation is very convincing, but these authors also explain all increase in complexity of life as the result of law and chance — mutation and natural selection. The underlying genetic process in this proposed large-scale evolution depends on some important unsupported assumptions.

The laws of nature are critical for the existence and uniformity of the universe and the existence of life. However, life is also entirely dependent on another critical factor — the information coded in DNA and proteins. This information is like a series of written instructions for making biological molecules, and making them at the right place and right time. These instructions are like the words and paragraphs in this article — there is no law in nature that specifies whether D should come after E or H should come before M. Such order in DNA or on this page only results, as far as is known, from the operation of intelligence — the information has to be invented.

Evolution claims that mutation and natural selection can accomplish the same result without intelligence, but this is strictly an ad hoc hypothesis, and is the most serious weakness in evolution theory. Natural selection can only accomplish anything constructive if chance just happens to provide the right mutations when they are needed. It is not at all clear that this is a realistic hypothesis (Spetner 1998, Brand 1997, Behe 1996). The natural genetic changes (e.g., resistance to insecticides) or laboratory mutations often cited as evidence for evolution of new features tend to turn out, on closer inspection, to have other explanations (Spetner 1998) that are not consistent with the evolution of new biological information.

The history of science shows a series of apparently well-supported theories that changed considerably or were rejected because of accumulation of new evidence. Has that self-correction process ceased, and are our current biological theories in no danger of being refuted? Peacocke, Polkinghorne, Barbour, and Murphy may be building their theology on a scientific basis that will eventually leave them sitting on shifting sand.

Their belief that God can only give us freedom through the operation of the uncertainties of the subatomic world of quantum mechanics and/or the operation of chance in mutation and natural selection, is strictly an assumption. What evidence do they have that there is any connection between these chance processes and the freedom of choice exhibited by humans, or any other type of freedom in nature? It seems likely that human free will operates through the features God built into the amazing complexity of our brain cells. Free will is the result of a brain invented by a super genius.
The world of cancer, earthquakes, accidents, death, child abuse, and Auschwitz is not “free” at all; it is just dysfunctional. If evolution, with its inevitable result of pain and suffering was God’s way of creating, this is inconsistent with the Christian view of a God who has a personal concern for individual humans, and who intends to restore creation to a harmonious state. I propose that either the basic concepts in Genesis should be accepted as the true and literal description of the history of life on Earth, or else I have to wonder why Scripture and its “god” would be of any interest to me. If such a god were hanging on the cross in solidarity with our suffering, is he worthy of my worship, or merely of my pity? The conclusions reached in this parallel but separate model have been imposed upon Scripture by a particular philosophy of science and religion.

Those who have proposed this theology have thought through the issues very carefully, and have described the theology that logically follows if the fossil record resulted from the evolution of life forms over many millions of years (theistic evolution; progressive creation also leads to substantially similar theological conclusions), rather than a literal creation week followed by the Fall into sin, and later by the geological catastrophe described in Genesis. I cannot fault their principal conclusions, provided their philosophy is correct. But is their approach the only intellectually respectable way, or is there a viable alternative? We will consider this next.

**MODEL 3: INTERACTION, WITH GOD HAVING PRIORITY IN OUR THINKING**

Many scholars of this generation, including committed Christians, have rejected any notion of encouraging active interaction between science and religion. I understand their reasons for this, and I also reject some common types of interaction. Moreland (1989) and Ratzsch (2000) discuss some of these problems also. However, I hope to show that there is a better way for such interaction to proceed — one that avoids the pitfalls, real or imagined, that can derail attempts to constructively integrate faith and science. Below we will take some time to discuss these pitfalls, because understanding how to avoid such pitfalls is a key to defining a better integration method. We will then discuss the method by which I find that ideas from Scripture can in very practical ways contribute to scientific progress.

We will first compare the interpretation of Scripture in Models 2 and 3. The interpretation of Scripture used by scholars in the parallel but separate model is likely to include several or all of the following: 1) God may have
impressed Bible authors to write, but He did not communicate to them the ideas or “facts” they wrote; 2) the human mind, in this age of advanced learning, is quite capable of judging the truth of biblical statements; 3) many of the “events” described in the Bible were symbolic or allegorical, not literal, historical events. Examples of the latter could include the 7-day creation, a global flood with an ark full of animals and people, the Israelites’ miraculous crossings through two bodies of water, Jesus’ miracles, Jesus’ bodily resurrection, and a literal, personal devil. If this approach to Scripture is correct in its interpretation of core concepts of Christian theology, it would make little sense to look to the Bible for insights in Earth history, or in many other scholarly areas of research.

The interaction model that I will propose takes Scripture more literally than Peacocke, Polkinghorne, Barbour, and Murphy are willing to do. This more conservative approach to Scripture claims that “the language of the Bible should be explained according to its obvious meaning, unless a symbol or figure is employed” (White 1888, p 599). “It (the Bible) was designed for the common people, and the interpretation given by the common people, when aided by the Holy Spirit, accords best with the truth as it is in Jesus” (White 1882-1889, p 331). “A sense of the power and wisdom of God, and of our inability to comprehend His greatness, should inspire us with humility, and we should open His word, as we would enter His presence, with holy awe. When we come to the Bible, reason must acknowledge an authority superior to itself, and heart and intellect must bow before the great I AM” (White 1892, p 110). This approach accepts the events described in the Bible as actual historical happenings, including the miracles and God’s literal communication of ideas and facts to at least some Bible writers such as Moses, Daniel, Paul, and John (not through verbal inspiration, but communication of thoughts). This approach affirms the basic propositional nature of revelation (Nash 1982, p 43-54).

The interaction model I am proposing will be of most interest to one who is at least willing to seriously consider the possibility that God has communicated some propositional truths to Bible writers, who have communicated them in language understandable to modern humankind.

My own area of training and research is in evolutionary biology and paleontology, and I will discuss the integration of faith and scholarship mainly in these fields, but similar principles could be applied to many other disciplines. In spite of current thinking in much of the scholarly world, I choose the more conservative approach to biblical interpretation as the more realistic one. This approach must be used with wisdom,
prayer, and careful thought, or it can lead to simplistic ideas like a common fundamentalist belief in verbal inspiration of Scripture. I will not attempt in this paper to defend my conservative view of biblical interpretation, but will only discuss the application of that concept in integrating faith and scholarship, which I and some others find to work very well.

**CHALLENGES TO BE OVERCOME: THE PITFALLS**

The attempt to integrate faith and scholarship introduces a tension. Religious belief, for a conservative, is based on authority, and there is a tension between authority and free inquiry. If we allow theological knowledge to inform our scientific interpretations, some will say we could be biasing our conclusions. The nervousness of Christian thought leaders about the idea of seeking a relationship between science and religion cannot be lightly brushed aside (Brand 2000). Any suggested method for interaction of science and faith must be developed with great care, and must have an answer for the following five concerns.

1. *Religion may introduce biases into our science.*

   Can religion introduce biases into our scholarly search for truth? It seems likely that it could. One solution is to decide that the Bible must be put aside when we think about science. Then religious biases will not trouble us, and we can be more objective. There is a problem with that solution, which is illustrated by an episode in the history of geology.

   When the discipline of geology was taking form the geologists Hutton (1795) and Lyell (1830-1833) each wrote books in which they developed a paradigm of geology that rejected the catastrophism of their day (the belief that many rock formations were formed very rapidly; for some early geologists this was based on the Bible), and replaced it with the theory that all geologic processes occur very slowly and gradually (gradualism). Lyell’s influential book constricted geology to a completely gradualistic paradigm until the mid 20th century. Historical analysis of Lyell’s work has now concluded that the catastrophists in Lyell’s day were the more unbiased scientists, and Lyell took a culturally derived theory and imposed it upon the data (Gould 1984).

   Lyell’s strictly gradualistic theory was bad for geology. It closed geologists’ minds, preventing them from considering any hypotheses that involved catastrophic interpretations of geological data (Gould 1965, Krynine 1956, Valentine 1966). The authors just cited still prefer to explain geology in a millions-of-years scenario, but they are simply recognizing the evidence
that many sedimentary deposits were catastrophic in nature. Lyell’s paradigm prevented geologists from recognizing the evidence for these catastrophic processes until Lyell’s serious bias was recognized and at least partially abandoned. The evidence for catastrophic processes was there in the rocks before, but if the ruling paradigm says it is not so, it will probably not be recognized.

This episode reveals that bias is not a religious problem. It is a problem that we all have to contend with, no matter what philosophy we adopt. The idea that religion introduces biases, but scholarship that leaves religion aside is objective, is naive. We may read our pet ideas into the Bible, between the lines, and misunderstand how to relate Scripture to nature. However, those who do not take Scripture seriously (or literally) have their own problems with other biases, and these are no less significant than the biases that can result from religion. An effective model for integration of faith and science must include a bias-control process.

One factor that greatly affects a person’s objectivity is his/her willingness to seek, and take seriously, input from others. If two persons with differing views are involved in the same type of research, they are each likely to notice things that the other may overlook. Consequently they will both probably be more successful if they seek to learn from each other. I believe that responsible efforts at integration of religion and science can contribute to this process, by the method described below, to the mutual benefit of both science and religion.

In summary, religion can introduce biases into our science, but so can any other philosophical approach. The answer is to be aware of the problem and consciously and critically analyze our efforts at being objective, and to communicate with others regarding our ideas. Awareness of different points of view on an issue generally improves our ability to recognize our biases and to reach a defensible conclusion.

The reverse of this is also true — if we do not seek to integrate science and faith it is unlikely that we will adequately understand the areas where science and religion speak to the same issues and seem to be in conflict. If we do not put forth serious effort to challenge conventional thinking and develop a positive synthesis of science and faith, we are likely to accept conventional thinking without knowing whether or not it is based on a solid foundation.

2. Science may disprove our Christian belief system.

There could be a fear that science will finally disprove our Christian belief system if we try to integrate faith and scholarship. Are we confident
enough to accept that possibility? It is possible that some of our specific beliefs about origins that involve details not given in Scripture may be wrong, and it is better for us to learn that. Ideas that are truly God-given biblical truths, on the other hand, will not be disproved. Nature and revelation will not ultimately contradict each other, for both came from the same God. It is often more comfortable for us to keep our beliefs close to our hearts and not let science look at them, but if we do that we will miss opportunities for discoveries that can vindicate our trust in the Creator and help others to learn to trust Him also, while possibly also revealing that some of our ideas are wrong and not biblical.

Of course many would say that the above scenario has already happened — scientific data on such topics as the age of life on Earth have already disproved the Genesis story. However, as we use science to study questions of origins and biological history, we need to be aware of a danger. Science has for so long used naturalistic thinking to explain all the data, that it takes diligent, careful study to see past those deeply entrenched interpretations and find new, more correct, ways to understand the data. Also scientific research typically does not yield its secrets quickly or easily. It often takes years of effort to resolve a difficult scientific puzzle, and only the persistent researcher will succeed. A researcher with a settled confidence in Scripture will at times have to stubbornly trust the God of the Bible until he/she finally is able to understand the data (and some of our questions will probably not be answered on this earth). That is what other scientists do when they face difficulties in finding a fit between the data and conventional scientific theory. They typically have confidence that the theory will ultimately solve its problems. That is why Lakatos’s research programs include a core theory which is protected from disproof by the protective belt of auxiliary hypotheses.

Experience suggests that we will continue to find strong evidence of the Creator’s hand in biological history and earth history, but we will also struggle with solutions to some difficult puzzles. Radiometric data, e.g., seems to point strongly to a very long time for life on Earth, but some other evidence, in addition to Scripture, gives me reasons to question that age. I believe there is reason for much continued study of this topic.

In summary, it is my observation that those who warn against attempts to integrate science and faith are often persons who do not believe that the Bible gives facts, but only “spiritual truths”. On the other hand, if we have confidence in the truth of Scripture we need not fear honest research, but we must avoid superficial efforts or they could lead us in wrong directions.
3. We may hold religious positions that are ultimately not biblical, and scientific disproof of these positions will discredit our faith unnecessarily.

The problem here is our tendency to read into the Bible, between the lines, our pet ideas, or ideas that have become culturally ingrained but are actually not in the Bible. For example in Darwin’s time there was widespread Christian belief that all species of animals and plants were created just as they are now, with no change since the creation. In reality this idea cannot be supported from the Bible, but came from Greek philosophy, and the concept was “read into” such general phrases as “after his kind.” Scientific research has produced abundant evidence that at least some biological change does occur, refuting this supposedly biblical concept and further weakening the faith of some persons.

Nevertheless, if we hold beliefs that are not biblical, don’t we want to find that out? Scientific knowledge at any given time includes many beliefs that will later turn out to be false. That does not keep scientists from pursuing research, and ideally they readily admit when they discover new data that change some scientific belief (especially if it challenges some other scientist’s beliefs, rather than their own!). Religious scientists can pursue research with the same confidence and openness to change in our humanly devised ideas about details that are not given in Scripture.

Problems are caused by some creationists who devise very speculative theories about origins, that go way beyond what is given in the Bible, and proclaim these as TRUTH. When scientists encounter these careless and embarrassing theories, it makes our faith look bad. The problem here is not the effort to integrate science and faith, but the careless and uninformed way that it was done. The solution is not fear of research or fear of the effort to integrate science and faith, but careful, well-informed study, and also an honest attitude in areas where we do not have adequate answers to difficult data.

4. We face the danger of returning to god-of-the-gaps thinking.

Another concern is that we may drop back into the old god-of-the-gaps reasoning of an earlier era. In British natural theology of pre-Darwinian times it was thought that the direct action of God should only be invoked in processes for which we cannot find a natural explanation (God can be found where there are gaps in our understanding). The problem with this approach is that as science found explanations for more and more processes in nature, these gaps were filled and God was pushed farther and farther away and finally dispensed with altogether (or so it seemed). In reality
this was a logical fallacy, because to describe how something works does not explain how it came to be. Our increased scientific knowledge has increased our understanding of how God’s marvelous inventions work, but has not shown how those inventions were produced or at what level God’s sustaining hand still operates. The problem with the god-of-the-gaps approach was that as more scientific explanations were found, it tended to undermine faith in God. Thus the concern about falling again into the god-of-the-gaps fallacy is valid, and deserves an answer.

It is important not to fall back into that trap. It is not necessary to do so if we carefully examine our logic in our integration efforts. One difference today from previous centuries is that in some areas of science we have learned enough for our arguments to be the opposite of the god-of-the-gaps. For example in molecular biology the more we learn, the more difficult it is to explain origins without a Creator. Instead of God being needed only where there are gaps in our knowledge, the more data we collect, the more evident it becomes that we need God in our explanations. In other words, some gaps are widening because of our increased knowledge, not because of our ignorance.

Fear of the god-of-the-gaps fallacy should not frighten us away from efforts to integrate science and religion into a meaningful synthesis. It is important that we be aware of the nature of various logical fallacies, like the god-of-the-gaps, and avoid them by careful self-evaluation of our logic and by paying attention to other scholars’ criticisms of our ideas. Just because a task requires navigating around pitfalls is not a good reason to refuse to tackle the task. Ask any of the great explorers about that.

5. Religious explanations (“God did it”) may discourage scientific investigation.

An additional concern about integrating science and faith is that the conclusion “God did it” may eliminate any further need or incentive for scientific research, and consequently is bad for science.

The way some persons approach this subject does have that effect. However, it does not need to be that way. A biblical position does suggest that some current scientific research is not worthwhile, but it can also suggest new approaches to research that can, and already are, resulting in productive science. The examples discussed below illustrate this concept, and show how an active interaction between science and Scripture can challenge us to more careful and diligent research in both science and in our religion.
These new approaches result from asking questions that others are not asking, including questions that challenge or ignore assumptions based on a paradigm that denies biblical concepts. The assumptions of a discipline may be necessary to provide a framework for interpreting evidence, but if they are never challenged they may also have the side effect of protecting some concepts from rigorous thought and research. Many, and perhaps all, disciplines can benefit from careful scholarly work that digs deeper and seeks to identify significant questions that are not being asked.

Those who accept a non-creationist history of life, with life on Earth for ~4 billion years, have a tendency to argue that even if it is hard to explain the origin of life-forms, the long time spans allow seemingly impossible things to happen. This can have the very same effect as relying on “God did it” to solve all problems. I will argue that relying on time to work the miracles is, for many persons, shielding the study of life origins from rigorous thought. Dawkins (1986, 1996, 1998) is a good example of this problem.

In summary, an effective method for integrating faith and science must encourage research in science and also more careful Bible study, stimulating growth of knowledge in both areas. That may seem like a tall order, but keep reading.

THE INTERACTION MODEL FOR INTEGRATION OF RELIGION AND SCIENCE

This model begins with the assumption that science is an open-ended search for truth, and is not willing to accept any rules that will restrict the search. Science as a game, following an arbitrary set of rules, does not interest me. One such arbitrary rule, the philosophy of naturalism rejects any hypotheses that imply supernatural intervention in the universe at any time, past or present. But the absence of unique events (supernatural or otherwise) should not be assumed, but should be a hypothesis to be tested. If we wish to consider whether there were such interventions, and to examine evidence relevant to that question, naturalism must be set aside so that the search can proceed unhindered.

Nancey Murphy (1990) claims to have demonstrated that theology can use the scientific method. She starts from the position that in this age of scientific reasoning theology must justify its knowledge claims by showing that theology’s methodology is consistent with scientific reasoning. She chose Lakatos’s philosophy of science as the most sophisticated one available, and applied it to her examination of “a theological
school (the Roman Catholic Modernist movement from roughly 1890 to 1910) in order to see whether Lakatos’s theory of scientific rationality allows for a reconstruction of the rationality inherent in its development” (Murphy 1990, p 88). She showed that it is reasonable to interpret the Modernist movement and the development of its belief system as a core theory (“Genuine Catholicism is the true faith and reconcilable with modern thought”) with a belt of protective auxiliary hypotheses. She showed how the core belief remained intact while the auxiliary hypotheses changed as various scholars developed the thinking of the Modernist movement. From this study she concluded that theology does meet the standard of scientific rationality as represented in Lakatos’s philosophy of science.

However, she seems to have missed the point in this research. Showing that theologians follow a Lakatos-like method does not validate theology as a method for seeking truth. Theology is of value if it works in revealing convincing truths about God and human destiny. Murphy’s research is only an analysis of the philosophy and sociology of religion, not of the application of theology to analyzing truth claims.

Murphy recognizes that her application of Lakatos’s theory of research programs “is not as helpful as it might be in illustrating how the main business of theology is to be carried on in its light” (Murphy 1990, p 175). Later she mentions how the theologian Pannenberg uses his theology to offer reinterpretations of data in anthropology. She says “the prediction and corroboration of some fact previously unanticipated by the anthropologists at this point would go a long way toward establishing the scientific respectability of Pannenberg’s theology” (Murphy 1990, p 178). This is the most relevant example of Murphy’s thesis that theology can stand up to the standards of the scientific method, because Pannenberg made a prediction that can be tested by science, and thus can test truth claims. This case is an example of my own suggestion of how religion can suggest hypotheses or make predictions that can stimulate scientific research. Murphy’s approach differs most from mine in her claim that “In philosophy of religion the important point of contention is still whether it is possible to be a rational theologian. Here the game is won by anyone who can show that theology is in the same ball park with science” (Murphy 1990, p 208; emphasis in original). I answer that science is not the standard for judging theological method. Theology is of little value unless God has communicated truths to us. If He did, then theology goes far beyond science and reveals things that science could never figure out on its own. In this process, science may help us to see where we have read something into Scripture that is not there.
Plantinga (1997) urges Christians to use all the information available to us, including what we know as Christians, in seeking an understanding of our scholarly disciplines. Others have also suggested that statements about the world can be derived from Scripture and can be tested by the methods of science (Moreland 1989, Ratzsch 2000). My purpose here is to develop that concept. The primary distinguishing features of this model are 1) science and religion challenge each other in areas where they are in conflict, motivating more careful thought and research in both areas. Religious concepts are not tested by science, and scientific concepts are not directly tested by religion, because we may misunderstand the information from both sources. By keeping them temporarily separate in our mind, and letting each persistently challenge the other we are forced to dig deeper in both science and religion and not accept superficial explanations. Other features of the model are: 2) religion can be a source of ideas, hypotheses, or predictions that can be a stimulus for scientific research, and 3) these ideas are pursued and tested with scientific research. The scientific process used will be the same as that used by others, and will differ only in 1) the questions that are asked; 2) the evidence likely to catch the researchers attention; and 3) the range of explanations open for consideration. This is partly illustrated in Figure 2.

There are definite limits to what science can do in this integration process. Science cannot study supernatural processes, such as creation, or Jesus’ miracles. Science can only do research on effects or processes that can be observed, or that have occurred and left evidence behind. If some unique event (miraculous or otherwise) has influenced such events, science can study any evidence that was left behind, and historical records could be used to make predictions regarding such events. It does not matter where those ideas and records came from (even from the Bible). The source of an idea or hypothesis does not influence the scientific legitimacy of the idea. If it can be evaluated by the scientific process, it is a valid scientific idea (Popper 1959, p 31, 32; Moreland 1989, p 229; Cromer 1993, p 148).

If we know God as a personal friend and learn to trust Him and His Word, we are more likely to use Scripture to effectively assist us in our scholarly thinking. That step may seem too subjective to be part of a philosophy of science, but both science and theology must deal with subjective elements. The viability of this method depends on whether we can make it work to suggest testable predictions or hypotheses. Meanwhile if we interact with other scholars with various views, that interaction
provides bias-control and can help us avoid simplistic attempts to relate Scripture to the natural world.

This approach is not just a theory, but some of us have been using it for years and find that it works very well. Incorporating the following steps is effective in achieving results while controlling the biases that can result from any worldview: 1) actively search for and utilize insights from Scripture in developing hypotheses pertinent to our discipline, and pursue research attempting to test these hypotheses; 2) be aware of the work and thinking of those who have a different worldview; 3) whenever feasible, submit our work for publication and peer review; 4) become friends with those in a different worldview, and perhaps even do collaborative work with them. This requires the confidence and independence of thought to not accept whatever our collaborators think, while maintaining a constructive dialogue that can reduce the likelihood of superficial thinking. A
number of examples of this research approach could be described (e.g., see Brand 1997, 2006), but here we will consider just two examples.

EXAMPLES

Walls of Jericho — When the walls of Jericho fell down, as described in Scripture, the result would be a pile of rubble. If we can now identify the ruins of Jericho, we can study that pile of rubble. Science would probably not be able to determine whether the walls fell from an earthquake or from a divine push. However, before beginning the archeological study we could use biblical information to predict that the walls fell down suddenly, rather than disintegrating gradually through time, and then test this hypothesis or prediction with the methods of science.

Fossil whales of the Miocene/Pliocene Pisco Formation of Peru — The Pisco Formation in Peru contains a large number of fossil whales, buried in a deposit of diatoms and other sediments. Diatoms are microscopic organisms that float near the surface of lakes and oceans. Upon death their silica skeletons sink, and in modern oceans they form accumulations of diatomite a few centimeters thick in a thousand years. It is assumed that ancient (fossil) diatomite deposits formed at the same slow rate — a few centimeters per thousand years, which is consistent with radiometric dates indicating a time frame of several million years for the Pisco Formation. My biblical worldview predicts that geological deposits like this formed in a much shorter time frame — a maximum of hundreds or thousands rather than millions of years.

Geologists have published on the overall geology of the Pisco Formation, and paleontologists have studied the whales and where they fit into evolutionary scenarios. Apparently no one has previously asked how it can be that sediment which accumulated at the slow rate of a few centimeters per thousand years can contain complete, well-preserved whales, which would seem to require rapid burial for their preservation. Our worldview with its predictions of short time periods opened our eyes to see things that others had not noticed. When I saw the Pisco Formation the incongruity of the well-preserved whales as opposed to the presumed slow rate of diatom accumulation hit me right between the eyes. Our research there during several summers, by a team of geologists and paleontologists, has indicated that the whale carcasses were not in any type of special situation that could favor preservation of animals over extended time periods before burial. Our evidence points to rapid burial, probably within a few weeks or months, not thousands of years, for any given
whale, and suggests some processes that can help to explain how ancient diatomites may have accumulated much more rapidly than is usually assumed.

In this research we have presented several papers at the annual meetings of the Geological Society of America (attended by 5,000+ geologists and paleontologists) and at an international paleontological conference in Spain. These presentations provided opportunity for interacting with other scientists who deal with these topics. We have published two papers (Esperante-Caamano et al. 2002, Brand et al. 2004) and have several more manuscripts in preparation. The best scientists in the field have opportunity to evaluate our work, and will be eager to point out any mistakes. That is a powerful incentive to keep us from being careless. Of course we will not discuss biblical insights at the geology meetings or in our publications, as that would not be relevant for the audience. We will discuss scientific work only, and if the data support our conclusions our work will stand up to the criticisms of scientific reviewers.

In the research described above, the research method used was not different from the method employed by other scientists. The data potentially available to us, the data we used, the laboratory methods for analyzing samples (XRD, XRF, scanning electron microscopy, examination of thin sections, etc.) were the same as for anyone else. The only differences were in the questions we asked, the types of evidence most likely to catch our attention (primarily affected by the questions we asked), the range of possible interpretations considered (these will include a much shorter time frame than many scientists would prefer), and the predictions made by our worldview.

Our predictions and hypotheses must be tested in the same way as anyone else will test scientific predictions and hypotheses, and these tests will have to stand up to the normal scientific peer-review process. Although other earth scientists did not recognize the need to reevaluate the rate of accumulation of diatoms in the Pisco Formation, the reviewers of our manuscripts, in the fields of taphonomy and diatom studies, agreed that the data supported our conclusions.

It must be emphasized that this model does not introduce a different scientific process of data collection or analysis or data interpretation. The novel feature is simply taking Scripture as a source of valid information, and using that information to suggest new hypotheses to be tested, and new questions to be asked, that probably would not have occurred to us otherwise. It opens our eyes to see things that we might otherwise have overlooked. At that point it is then up to us to use science to rigorously
test these novel ideas, and see if they will stand up to the best scientific procedures and bias control of peer review.

In the above examples information from Scripture influenced hypothesis-formation in science. The process also goes the other way. Experience in geology research has led some of us to recognize that a common assumption among conservative Christians is actually not taught in the Bible — the assumption that all or most of the fossil record formed during the global flood of Genesis. It is not unbiblical to suggest that part of the record formed before and part after the flood.

Some may argue that the process described above does not introduce anything new, since philosophers of science already recognize that the source of an idea does not determine whether it is a valid idea for guiding scientific research. It also could be claimed that biblical content is still contributing nothing to science, since in my approach the hypotheses must be tested by standard scientific methodology. However, this criticism fails to recognize some foundational realities in science as normally practiced. Although philosophers have recognized that hypotheses can come from any source, including religion, it normally doesn’t happen. Most scientists never use biblical insights, based on a literal understanding of Genesis, to suggest hypotheses testable by science. Only a few persons do this, and when we do so and utilize careful scientific methodology for testing the ideas, it typically results in constructive scientific progress. The nature of the questions we ask has a decided effect on scientific work — more important than the details of the research method itself. When we allow biblical insights to open our eyes to see things in new ways, and then rigorously test our ideas, it allows discovery of things that others are not finding (see also Brand 2006). I predict that there is a wide open potential for new understandings in paleontology and geology when this approach is put to work.

THEOLOGICAL IMPLICATIONS OF THE INTERACTION MODEL

This philosophy for integrating science and religion yields a consistent, rational explanation for the origin of life and of pain and suffering. A conservative reading of Scripture portrays a cosmic conflict between God and a created being, called Satan. God created the universe and life to function harmoniously, and humans were initially innocent and sinless. But humans and other intelligent cosmic beings were not made as obedient computers; their brains were designed by God with the ability to make free choices. Satan and humans made the wrong choice, and sin, pain,
and suffering for the human race resulted from this choice. The suffering thus initiated has affected not only humans, but their sin also had the unfortunate and initially unrecognized effect of giving Satan permission to exert his influence on the earth and on all life on Earth. The ultimate result has been pain, death, disease, and changes in Earth’s geological structure, producing natural disasters such as floods, earthquakes, and storms. These were not punishments for sin, but were the natural result of sin and the allowing of Satan to exert his influence on Earth and its inhabitants. Jesus’s death and resurrection in some way gave Him the right to redeem humans from their sin, and give the gift of eternal life, on a recreated planet, to those who accept the gift. This gift will be received when the cosmic conflict is ended and it has become evident that God’s way is best after all. This is important because God honors our freedom of choice, including our freedom to choose to accept the consequences of our choice. In eternity He will not force us to obey, but the history of the cosmic conflict will convince those who have accepted eternal life that it would be foolish to rebel again. These theological concepts cannot be studied by science, but they are affected by one’s philosophy of the relationship between religion and science. For me personally, the coherent explanation of pain and suffering resulting from my application of Model 3, in contrast with the explanation offered in Model 2, is a powerful argument in favor of the epistemological approach underlying Model 3.

Of course this philosophy requires that humans actually originated in a creation event that predated the formation of the sequence of fossils in the fossil record. If pain, suffering, death, and geological hazards like earthquakes and volcanoes resulted from human sin, then humans could not have evolved from ape-like ancestors near the end of geological history, but had to have been in existence from the beginning of life’s history on Earth.

This challenges some of science’s contemporary interpretations, and predicts that a number of significant phenomena are yet to be discovered, especially in the areas of geology, paleontology, and radiometric dating. For example, as far as science understands, Earth’s crust and the mantle that it rides on are very viscous, and only move extremely slowly — currently about 1-4 cm per year (Burchfiel 2004). This concept is often cited as evidence that a biblical time frame from creation to the present is impossible, because the rapid continental movements required by that time frame are impossible. But we are told that at the time of Jesus’s return “The whole earth heaves and swells like the waves of the sea. Its
surface is breaking up...Mountain chains are sinking. Inhabited islands disappear” (White 1888, p 636; cf. Revelation 16:20). Such crustal fluidity and rapid movement is very unrealistic if current geophysical interpretations are true. Yet God has told us that when He involves Himself in physical processes on Earth, things may function quite differently from what we have observed in our lifetimes.

When Jesus told a man with a withered hand to stretch it out, and it was healed, and when Jesus, at his arrest, healed the soldier’s severed ear, God had to create healthy tissue at that moment. Majority scientific opinion would have us believe such a thing to be impossible. But if God has communicated trustworthy statements to us (and what other conclusion could be consistent with the way Jesus intimately related to us by His life?), then these statements about Earth’s crust and Jesus’s instant creations support the interaction model for integrating religion and science. They do so by giving us insights into how far some physical and biological processes can vary from modern observed processes, when God brings His influence to bear on them.

Many scientists object strongly to such proposed divine interventions that do not follow the normal course of natural processes. However, if these interventions did occur (and Scripture says or implies they did), should science pretend they did not happen, or is it better for science to recognize them? Perhaps the reason Scripture tells us about the creation and flood and gives us insights into the amount of time represented is because God knew we would have trouble correctly interpreting the complex evidence from the ancient past without these insights.

If we do not seek to learn from God’s communications to us and even use them to inform our science, then science, not God, has priority in our thinking, and our science will lead us in incorrect directions. Our understanding of philosophy of science has direct relevance to this issue. Modern understanding of the philosophy of science reminds us that we cannot verify theories — science does not know for sure what are the limits of truth about the universe. It is not realistic for science to insist that its current understanding of geophysics, e.g., is correct and complete, and that there are no new physical principles yet to be discovered — even principles as radical as rapidly moving continental crust. Science cannot at this time support such a hypothesis of rapid continental movements, but it also cannot legitimately deny the possibility that there might be undiscovered physical principles that would allow that hypothesis to be true.
CONCLUSIONS

It seems that Christianity with its rational, consistent God provided the context for modern science to develop. However, beginning with the Enlightenment science became defined in a way that denies theology any legitimate right to influence science or even to claim to have knowledge. Twentieth-century philosophers of science found the older philosophies of science increasingly unworkable, as they realized how human science and scientists are. With this new realization that a clear line cannot be drawn between science and non-science, it is now recognized that denial of theology as a possible source of knowledge is unrealistic. This opens the door to suggest that the integration of religion and science is a worthwhile goal. Religion can suggest hypotheses for science to think about, as well as the reverse.

In spite of these developments, many scientists interpret nature within the framework of naturalism — no hypotheses are allowed that would imply any divine intervention any time in history. This philosophy does not grant any knowledge status to religion (separate domains for science and religion). A second model for the relation between religion and science (parallel but separate) accepts both religion and science as sources of truth, but religion is still not allowed to influence science. As a result, living things, including humans, are believed to be the result of evolution. There was no Adam and Eve and no Fall into sin. Thus the Christian doctrine of salvation also is rejected. Pain, suffering, and death are interpreted as the necessary result of the generation of life through evolution, and even god couldn’t prevent that.

The third model (interaction) accepts both science and religion (Scripture) as sources of knowledge, and recommends an active effort to integrate them. When they conflict, this stimulates more careful study of both, seeking to understand them better and search for an interpretation that is in harmony with both. Since God has given us Scripture, it contains insights that go beyond what science can offer; insights that we would not likely discover with science alone. This model supports an interpretation of the origin of pain, suffering and death that is rational and consistent, in contrast with the other models.

There is an important relationship between religion and the philosophy of science, since an incorrect philosophy will lead us away from biblical truth, if we are logically consistent. A correct philosophy of science facilitates a constructive integration of religion and science, making use of all that we as Christians know from Scripture. We can even utilize that
knowledge to open our eyes to potential new discoveries in science. Christians have an exciting opportunity to follow God’s leading in this integration process, to demonstrate to a skeptical modern world that Christianity speaks not just to the emotions, but also reaches the mind and challenges it to reach beyond a mere human view of the universe, and to grasp a truly harmonious understanding of its origin and destiny.

REFERENCES


GEOLOGY: DEBRIS FLOWS MOVE MUD RAPIDLY


**Summary.** Numerous vertebrate fossils are found in the Upper Cretaceous Maevarano Formation of northwestern Madagascar. Fossils are concentrated in the upper 14 meters of the formation, and include fish, frogs, lizards, snakes, turtles, crocodiles, dinosaurs, birds and mammals, sometimes with spectacular preservation. Most of these well-preserved fossils are covered with fine-grained sediments interpreted as debris flows. The widespread and repeated debris flows are attributed to heavy, seasonal rains flooding semiarid floodplains. The suggestion is made that large numbers of vertebrates died near the end of the dry season, and were quickly covered by muds from heavy, seasonal floods. The Maevarano Formation is the uppermost terrestrial Mesozoic deposit, and is overlain by the Cretaceous marine Berivotra Formation.

**Comment.** Well-preserved fossils indicate rapid burial, while fine-grained sediments are typically interpreted as accumulating slowly. In this instance, the excellent condition of the bones and the inferred nonmarine nature of the depositional environment strongly indicate massive rapid mudflows covering scores of square kilometers.

ORIGIN OF LIFE: COMPOSITION OF PREBIOTIC ATMOSPHERE


**Summary.** Tian and co-workers propose a model in which the escape rate of hydrogen from Earth’s early atmosphere might have been two orders of magnitude slower than previously thought. Balancing slow hydrogen escape and volcanic outgassing would have maintained a substantially reducing atmosphere containing hydrogen and carbon dioxide. Tian *et al.*’s

*Other annotations are available on our website: www.grisda.org*
model posits an anoxic atmosphere in which UV radiation would not be absorbed by atomic oxygen thus lowering the exobase temperature significantly below current levels. This lower exobase temperature — perhaps similar to that of the CO₂-rich Venrian and Martian exobases — would leave only the slower hydrodynamic process, driven by solar EUV flux, for hydrogen escape. In a hydrogen rich atmosphere, prebiotic organic compound formation, mediated by electric discharges, could have created an organic soup ocean with amino acids concentrations of ~ 10⁻⁶ M.

In an accompanying article, Chyba reviews evidence that led to the abandonment by most scientists of the Miller-Urey atmosphere, rich in methane and ammonia. He mentions that although the H₂-CO₂ rich atmosphere of Tian et al. is less favorable for organic production than a Miller-Urey one, it is far better than previous model atmospheres with low H₂ concentrations. However, Chyba also points out that the ocean may still not have been a hospitable place for prebiotic chemistry. The condensation of amino acids into proteins requires the removal of water and is therefore strongly thermodynamically disfavored in aqueous environments. Furthermore, in an early ocean as saline as that of today, salt inhibits key prebiotic reactions.

Comment. The key assumption, from which Tian et al. deduced a slower H₂ escape rate, was that the early Earth’s atmosphere contained no oxygen. However, oxygen is the most abundant element in Earth’s crust. Furthermore it is also overwhelmingly present, combined with hydrogen, in the hydrosphere. Tian et al.’s scenario for the early Earth comprises therefore a solid crust replete in oxygen, a large liquid ocean in which oxygen is overpoweringly present, but improbably surrounded by a gaseous atmosphere devoid of oxygen. Chyba states that older models of Earth’s evolution, which postulated abundant metallic iron in the mantle, acting as an oxygen sink, are not tenable because it now seems unavoidable that the iron was largely sequestered in the core from the start. The presence of the large ocean also effectively guarantees significant oxygen in the atmosphere because UV photolysis of H₂O in the upper atmosphere releases oxygen. Direct observations from the moon during the Apollo 16 mission revealed that substantial amounts of hydrogen were leaving Earth’s atmosphere due to photochemical water dissociation. Jupiter’s moons Europa and Ganymede have surface water in the form of ice and both are known to have atmospheres containing oxygen. Recently, it was found that the rings of Saturn, which are largely composed of ice, also have their own oxygen atmosphere. It seems far more likely that Earth’s atmosphere has
always contained a substantial amount of oxygen. At best, Tian et al.’s atmosphere could lead to only a very dilute prebiotic soup, but even this would be abolished by atmospheric oxygen.

(Written by John C. Walton, D. Sc. and Timothy G. Standish Ph.D.)

ENDNOTES

1. Below the exobase, a particle with kinetic energy greater than its gravitational potential energy, will, due to atmospheric density, lose that energy in collisions with other particles before it can escape.


PALEONTOLOGY: MESOZOIC BIRD FOSSIL RECORD


Summary. The fossil record of birds begins with *Archaeopteryx* in Upper Jurassic Tithonian Solnhofen limestone. Understanding of the Mesozoic record of birds has not changed greatly since the announcement of *Archaeopteryx* in 1861. The rapid discovery of Mesozoic bird fossils, including many new genera, since 1985 has produced no widely accepted birds below the Tithonian.

Fountaine et al. argue that because the general pattern of bird fossils has not changed despite these new fossils, examples of which have been found on every continent, the still small sample size gives an accurate picture of the real fossil pattern. This pattern is the sudden Upper Jurassic/Lower Cretaceous appearance of diverse “basal” bird groups while Neornithes (modern bird) fossils appear in relatively small numbers and low quality in the Cretaceous. The paucity of good modern bird fossils in the Mesozoic is attributed to real biological factors; these birds were not as abundant as the kinds of basal birds that were fossilized.

Comment. In 1859 Charles Darwin excused the fact that the geological record lacks numerous intermediates by appealing to its “extreme im-
perfection.”¹ When Archaeopteryx first appeared, it was thought to be one of the “missing links” Darwin’s theory both predicted and needed for support. Since then it has become evident that Archaeopteryx is one member of a diverse group of birds which appear in the fossil record suddenly in the Upper Jurassic/Lower Cretaceous.² Instead of being evidence for evolution, Archaeopteryx along with other birds found near the Jurassic/Cretaceous boundary represent another instance of sudden appearance in the fossil record. These sudden appearances of profoundly diverse members of living groups run counter to the gradual evolution Darwin proposed.

Order evident in the fossil record also presents a problem for creationism should the majority of the fossil record be attributed to the Flood. Both Darwinists and creationists can come up with tentative explanations for the order and pattern of the record, but, if Fountaine et al. are correct, neither side can appeal to the imperfection of the Mesozoic bird record.

ENDNOTES


PALEONTOLOGY: RECOVERY OF PROTEIN FROM FOSSILS


Summary. Osteocalcin is the second most abundant protein in bone and appears to interface with both hydroxyapatite (Ca(PO₄)₂OH) crystals and the most abundant bone-protein, collagen. Nielsen-Marsh et al. tested bone samples from 4 Neanderthal specimens: 3 from Iraq and one from Croatia. Two of the Iraqi specimens, Shanidar 2 and 6, contained detectable amounts of osteocalcin, one of them in sufficient quantities for direct protein sequencing of the C-terminus. In addition, osteocalcin from modern chimpanzees, gorillas and orangutans was sequenced. All sequences were compared with each other and previously published sequences from humans, a monkey (Macaca fasicularis) and cows.

Comment. That osteocalcin or any other protein could survive for significant periods of time, especially given the environment in Iraq, seems
remarkable. Both specimens in which ostocalcin was found have been putatively dated at 60,000\(^1\) and even 75,000\(^2\) years old. Clearly some proteins are more stable than others, as collagen was not detected. The N-terminus of ostocalcin, which is thought to interact with collagen, was also absent. Unfortunately the C-terminus sequence provides no information about Neanderthals as it is identical in all the species examined.

The more variable N-terminus of ostocalcin was compared in all species other than Neanderthal. Interestingly, the human and gorilla sequences are identical except for a posttranslational modification of proline-9 to hydroxyproline. Chimpanzee and Orangutan ostocalcin each differed from the human sequence by different single amino acid substitutions. The chimpanzee substitution of Pro-15 with Thr most parsimoniously requires a C → A transversion at the first position in the Pro DNA codon. While the data provided is extremely limited, it is not consistent with the hypothesis that chimpanzees shared a more recent common ancestor with humans than gorillas.

ENDNOTES

1. http://www.mnh.si.edu/anthro/humanorigins/ha/shanidar.html

PALEONTOLOGY: SOUTH AMERICAN DINOSAUR


Summary. Dromaeosaurus — a group of theropod dinosaurs thought to be related to birds — have until recently been found unambiguously only in continents thought to be derived from the post-Pangaean supercontinent Laurasia. Now a quite complete South American specimen named *Buitreraptor gonzalezorum* has been described. This dromaeosaur is important because it is the first good specimen found on a continent thought to have been part of the other supercontinent resulting from the breakup of Pangaea: Gondwanaland. Thus, if common ancestry of all dromaeosaurs is true, even though this fossil was found in Cenomanian (Upper Cretaceous) deposits, it logically requires a Pangaean ancestor confirming that dromaeosaurs did have enough time to evolve into birds.

Comment: The fact that putative ancestors of birds show up in strata above the Upper Jurassic limestone in which *Archaeopteryx* specimens
have been found has long been a problem for the theory that birds evolved from this particular dinosaur group. The temptation has been to appeal to, as Charles Darwin put it, the “extreme imperfection of the fossil record.” In terms of hard evidence, *B. gonxalexorum* does nothing to address this problem and in fact makes it worse.

The fossil evidence does not show that a common ancestor of dromaeosaurs from both Laurasia and Gondwanaland ever existed. In fact, finding dromaeosaurs on the remnants of both super continents confirms yet another super-gap in the fossil record as it is conventionally understood. Pangaea is thought to have broken up during the Lower Jurassic while dromaeosaurs do not show up until well into the Cretaceous. According to conventional dating this leaves a gap of something more than 50 million years with no fossil record of dromaeosaurs evolving from their common ancestor. In addition, it still fails to show them evolving into birds. In defense of the theory that all dromaeosaurs came from a common ancestor, one could hardly argue that fossil dinosaurs are uncommon in Jurassic strata.
PROBLEMS WITH TIME


Reviewed by Aaron Corbit

A Matter of Days is astronomer Hugh Ross’ attempt to resolve long-standing disagreements among Christians over the length of the Genesis “days.” Ross, a self-described Old-Earth Creationist, is better described by Ariel Roth’s “Progressive Creationist” definition: someone who believes “God performed multiple creation events spread over long periods of time. The degree of progression that we find from bottom to top in the fossil record reflects successive creative acts.”¹ Believing both science and Scripture are on his side, Ross accepts much of the evidence for Earth and life’s antiquity while promoting the “Day-Age” creation week interpretation.²

Ross develops numerous biblical and scientific lines of reasoning. Asserting that the limited Hebrew vocabulary necessitated that words have multiple literal meanings, he justifies translation of the Hebrew “yôm” — translated “twenty-four hour day” by most Christian and secular biblical scholars — as “undetermined period of time.” He then stretches to explain away contextual clues that contradict this long-age interpretation.

Ross also claims that several Genesis passages demonstrate creation week “days” must exceed twenty-four hours. In Genesis 2, Ross notes that the “evening and morning” phrase associated with all the other days is absent from the description of the seventh day. He interprets this omission to mean the Genesis seventh “day” has not yet ended and we live in the age of God’s rest from creating. The failure of science to observe emerging new species is presented as verifying this interpretation. Given the many years since God stopped creating, the other creation “days” must be similarly long periods of time. Ross also uses the end of Genesis 2, arguing that Adam couldn’t have time to name all the animals and become enough
acquainted with nature to realize something (Eve) is missing from his life all within a 24-hour sixth day. ³

Seeing the Big-Bang as God’s initial creative act, Ross believes everything about the universe, from its finely tuned physical constants to the vast age of Earth and life, was designed by God to specifically support human civilization. This includes the long ages of decay and death which, he says, were necessary to provide, among other things, the petroleum and other resources that our civilization uses. He does not believe God created a perfect, death-free universe, only that God created a “very good” ⁴ universe. Rather than restoring Earth to its original perfect form, Ross believes God will create a whole new universe with different physical laws which make possible the biblical claims of no decay, death, or shadows.

Ross expresses disdain for Young Earth Creationists (YECs), characterizing them as narrow-minded, mean-spirited extremists with irrational hatred of Old-Earth Creationists (OECs). This he attributes to their misunderstanding of evolution as the root of all evil and those who believe that Earth is old as akin to evolutionists. Such sentiments Ross condemns as un-Christian because they turn scientific-minded people away from Christianity. Moreover, Ross claims, the YEC model, with rapid speciation of Noah’s ark animals after the flood, is more Darwinian than the OEC separate fiat creations model. Because YECs allow for these major changes in living things they must, says Ross, stubbornly cling to their short chronology or full-blown evolution is possible.

While Ross gives the impression that his model ties up all the loose ends, bringing science and the Bible into perfect harmony, it has some major weaknesses. He mischaracterizes all YECs as believing the universe is young. For YECs who believe God created living things during the creation week and that the universe was created at some undetermined prior time, Ross’ astronomical evidences for an old universe lose their relevance.

As other authors have noted, OECs like Ross have problems relating the Genesis creation sequence to the geological fossil sequence. The fossil record shows sea creatures, land animals, and then birds. However, Genesis has sea creatures and birds appearing before land animals. Ross interprets Genesis “sea creatures” to mean “sea mammals” and Genesis “land animals” as “land mammals,” thus placing mammals at creation’s end and topping the geological column. ⁵ But this places birds and sea mammals, created during the same “day,” 110 million years apart; in the Upper Jurassic and Eocene respectively.
Ross asserts the “death” mentioned in Romans 5:12 applies only to humans, raising questions about the nature of human immortality before sin. If decay and death are inescapable qualities of our universe — pre-ordained as extensions of the law of entropy, would immortal pre-Fall humans have even been possible? He says that Romans 8:19-21, “explains that God [since the beginning of creation], not Satan, subjected the creation to this law [of entropy, suffering, and death], not in punishment but in hope and promise of the freedom that lies ahead.”

This baffling interpretation ignores that the “creation waits in eager expectation” to be “liberated from its bondage to decay,” clearly implying that decay is evil. A loving God would hardly subject creation to something from which it wants to be liberated.

These problems pale in comparison to the biggest problem: Ross’ understanding of what it means for the Bible to be “free of contradiction and error — doctrinally, historically, and scientifically.” Ross tests the OEC and YEC models using the scientific method which also doubles as his method for Bible interpretation. Since his OEC model more closely matches his assessment of the current scientific evidence, it must be right. He ignores the possibility that his assessment of the scientific evidence might be wrong! When Ross declares the Bible free from scientific error he really means that he has interpreted the Bible to conform to his understanding of science. Thus he elevates his understanding of science over the authority of the Bible.

At first glance Ross’ view of creation may seem appealing; allowing some scientific respectability while retaining “biblical inerrancy.” However, on examination the cost of his beliefs are too high: God designing animals to die, the Sabbath a long age that has not yet ended and Scripture held subject to the very human discipline of science.

ENDNOTES

2. The “Day-Age” model holds that each of the days in the Genesis narrative are representative of long periods of time.
5. Ross, p 236.
7. Romans 8:19-21.
INHERIT THE WIND: MYTH VS REALITY


Reviewed by Joe Francis — The Masters College, California

The 1925 Scopes trial is among the most documented political events of the last 80 years. In 1999, George magazine designated it as #4 in a listing of the “100 greatest defining political moments” of the 20th century. Although old black-and-white photographs of the trial give the appearance of a long-forgotten era, the popular media have essentially frozen this event in time with a steady stream of articles, plays, movies and books. The story is resurrected often, especially when the creation/evolution issue surfaces in the public arena. In addition, hundreds of books have been written about or refer to the Scopes trial. What then can yet another text on this subject contribute?

According to the authors, their book is required to counter the many “mistaken assumptions and oversimplifications concerning the Scopes trial [which] still abound.” As their subtitle suggests, “the true story of the Scopes trial” has been overshadowed by urban legends and contrived folklore. Both authors are experienced journalists eminently qualified to correct the “mistaken assumptions and oversimplifications” propagated about this event in the popular press.

The central theme of the text is an engagingly written historical account of the Scopes trial. The first chapter (“Desperate Dayton”) provides an intriguing backdrop to the events of 1925, describing the “glory” coal-mining days of Dayton in the late 1800s. But a series of “unfortunate events” almost led to its complete demise. Enter George Rappleyea: a young business man and manager of one of the few remaining active coal operations in town. In the local newspaper he noted an advertisement sponsored by the ACLU who were looking for a test case to challenge the state’s anti-evolution
education statute. Hoping to boost Dayton’s economy, Rappleyea assembled a group of town leaders who decided that their town could benefit from being the site for the test case. They invited teacher and high-school football coach John Scopes to a meeting to devise the plan, and the drama unfolds.

The historical narrative is interrupted periodically by chapters covering philosophical issues surrounding the evolution/creation debate. These inserted chapters disrupt the story and readers may be tempted to skip them. Furthermore, the authors appear to have shortened some of the historical chapters to accommodate the philosophical chapters. For instance, in Chapter 6, which describes the second day of the trial, the authors mention Darrow’s two-hour speech, but fail to summarize what Darrow was trying to communicate, leaving the reader at a loss as to its significance.

The philosophical chapters deal with important topics, each of which is worthy of more thorough treatment. A chapter on Darwinism and natural evil (Chapter 9; “The Stakes”) makes some interesting and valuable points. However, oversimplification of events and philosophical positions weakens these points. The authors attempted to show that evolutionists have always been of the same mindset with respect to natural selection: “From Darwin’s time forward, evolutionists rallied against any ‘religious’ challenge to random mutation and natural selection as ‘unscientific’ and ‘unprovable’” (p 73). However, the role of natural selection was not widely accepted as a mechanism of evolution by many evolutionists during much of the first half of the 20th century. This disagreement over natural selection is what, in part, helped foster the development of the evolutionary synthesis (or neo-darwinism) which occurred from 1920-50. Additionally, one can find disagreement regarding the sufficiency of natural selection as an arbiter of evolutionary change in contemporary evolutionary literature.

In Chapter 14 (“The Evolution War”) the authors argue that the Scopes trial had a negative influence on biology education and textbooks for decades after the trial. While subsequent high-school biology texts may have been influenced by the Scopes trial, the evolution content of the popular high-school biology texts was poor before the trial began. In fact, the high-school biology course was created in the early decades of the 20th century and therefore the texts were in their early stages of development. Olasky and Perry also point out that an increase in the evolution content of the texts did not occur until the 1950s and imply that the play “Inherit the Wind” and the “space race” largely influenced this. However, once again, this is only part of the story because there is strong evidence suggesting that the resurgence in the evolution content of biology curriculum was largely influenced by the growing acceptance of neo-Darwinism.
and several major discoveries in biology including the elucidation of the structure of DNA.

Four chapters near the end of the text describe the Intelligent Design (ID) movement and portray it as the long-awaited challenge to evolution. It is true that the design movement has had some success in stimulating dialogue regarding origin issues. However, the authors once again only tell part of the story; creationist organizations and scientists have been active within the scientific community for much of recent history, establishing several peer-reviewed journals and scientific meetings like the International Conference on Creationism. Kurt Wise, paleontologist at Bryan College in Dayton, suggests that if the Scopes trial was held today or within the last few decades, there may have been a different outcome, because William Jennings Bryan would have had many experts to choose from including scientists involved in the intelligent design movement and those active within creationism.5

*Monkey Business* is a text worth reading, but also serves as a reminder that much more work needs to be done if the mistaken assumptions and oversimplifications that abound regarding the Scopes trial are to be overcome.

ENDNOTES


LITERATURE REVIEWS

Readers are invited to submit reviews of current literature relating to origins. Mailing address: ORIGINS, Geoscience Research Institute, 11060 Campus St., Loma Linda, California 92350 USA. The Institute does not distribute the publications reviewed; please contact the publisher directly.

NEW AND IMPROVED?


Jerry Bergman, Northwest State College, Ohio

Origin by Design is a well-written, well-illustrated review of the scientific evidence supporting the young Earth, flood geology, creation worldview. Each of the 33 chapters in this 464-page book can be read as a stand alone brief review of the specific topic being covered. The chapters cover a broad range of subject matter, are not oversimplified, and are accessible to educated non-specialists, providing excellent background information to explain the issues involved. Both creationist and Darwinist perspectives are treated respectfully and professionally with heavy reliance on the scholarly literature. Arguments are rarely overstated and are illustrated with hundreds of photographs, graphs, and drawing — unfortunately, though, no color was used.

All of the authors are scientists who are presently, or were in the past, associated with the Geoscience Research Institute which also publishes Origins. Their expertise is reflected in several chapters on geology and geochronology that discuss strengths and problems with both conventional understandings and evidences for a young Earth. Other chapters deal with paleontology and biological change, and one features Coffin’s own research on Yellowstone Petrified Forest. A final section on biological change covers the problem of Darwinism, biological similarity, evidence for design in life, and the problem of speciation.

The overview of paleontology is especially good. Darwinists claim that the fossil record is one of the most persuasive evidences of macro-evolution. The most important conclusion from the fossil record noted was that the evidence supports the sudden appearance of complex animals, a topic discussed in some detail (see p 204-269). Common theories that
try to explain this problem for Darwinism were reviewed. This section also discusses problems in interpreting the evidence, as illustrated by past mistakes in paleontology — such as putative worm trails that turned out to be tracks produced by particles or pebbles (p 263), or even the claim of a new fossil species that was later shown not even to be an organism!

The origin of humans is covered in some detail and included an especially useful discussion of fossil putative human ancestors. Textbooks and popular books often give the impression that the hominid fossil record is adequate to draw clear conclusions, and that unanimity of opinion exists about its interpretation. But the authors note that the scientific literature gives a far different picture — controversies exist everywhere. Newly discovered fossils regularly result in the claim that a complete rewrite of the evolutionary history of humans is required. The study of human origins is much more interesting when one is aware of the controversies and different experts’ interpretations.

This text is not only a valuable reference and a summary of the field of origins from a creationist perspective, but also could be used as a text for Sunday school — or Bible school. It references the Scriptures where appropriate, usually not as proof texts, but to help explain the Scriptures. The major evidence relied on, by far, is the empirical findings as reported in the scientific literature.

My main complaint is that the book should have covered the topics reviewed in more depth. Areas not covered include a review of the work done utilizing biochemical comparisons to determine evolutionary trees, the concept of irreducible complexity, discussions of Intelligent Design, and the wide variety of problems that have been discussed extensively in creationist literature, including apoptosis, telomerase, transpositions, Junk DNA, and similar. Of course, this requires another volume. The discussion of mutations, although brief, was very useful (p 414-416).

One frustrating aspect of the book is that references for quotations frequently lack page numbers. For example, on p 270 a quote from G. G. Simpson was given. I was only able to locate the quote by reading Simpson’s “History of Life” chapter in his *The Evolution of Life* starting on p 117 until I came across it on p 149. A few sections were also misleading, such as p 388 which underestimates the early support for Darwinism by church leaders and understates the hostility from biologists. I noticed very few mistakes (which, unfortunately, are far too common in books on creation). I also found very few typographical errors — and those I did note were minor — such as one on p 388 that incorrectly cites
the date of Darwin’s *Origin* book as 1959. The references give the correct date, 1859 and a 1958 reprint (p 395).

*Origin by Design* is one of the best general reviews I have read on this topic. For those wanting to give a single book on young-Earth creationism to a neophyte (or a person seeking a good general review of the topic), I would highly recommend this volume.