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CHRISTIANITY, SCIENCE, AND THE HISTORY OF SCIENCE:
Some Historical Reflections on the Integration of Faith and Learning

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On the necessity of the integrative task

About an hour by rail east of Manhattan, just off the coast of Long Island Sound, lies the upscale suburb of Westport, Connecticut. Today a prestigious bedroom community for successful professionals and wealthy artists, in the last century Westport was a quiet, rural New England town of tidy frame houses, some predating the American Revolution, enough of which still stand to retain a sense of charm in spite of the strip malls, split levels, and traffic lights that have since appeared among them. My great-grandfather, Ebenezer Banks Adams, built one of those stately homes in 1838, one year after he became headmaster of the Adams Academy, where in the space of thirty years he prepared hundreds of boys to attend Yale College in nearby New Haven.1 When I visited the house for the last time several years ago -- it is no longer in the family -- I spent a pleasant hour or two browsing Mr. Adams's library, shelved in a small room over the front door, at the top of the stairs. Among several hundred Greek and Roman classics, grammars for various ancient and modern languages, histories of the world, and treatises on theology and moral philosophy, were about a dozen scientific texts, among them Brewster's Optics, Torrey's Botany, Comestock's Chemistry. Then I spied a copy of the second (1833) American edition of Bakewell's Geology. Although I was hardly surprised to find it -- like the others, Bakewell was a standard work for the period -- I immediately felt a sublime, controlled pleasure, not unlike that engendered by a sudden encounter with an old and dear friend. Forgetting the others, I lifted it gently out of its place, puffed away layers of dust, and promptly turned to the back of the book.

It was there, as I know it should be -- the famous appendix, on the "Consistency of Geology with Sacred History," an attempt to relate recent geological conclusions to the early chapters of Genesis by Benjamin Silliman, the first science professor at Yale, the leading science program in antebellum America. Yet, in the midst of my joy at seeing Silliman's piece exactly as it first appeared to the world and cradling it in my hands in a most appropriate setting, I was also profoundly sorry, for the distance separating Silliman's world from mine was all too apparent. The inclusion of explicitly theological material in a standard scientific text was commonplace in antebellum America, owing at least in part to Silliman's considerable influence, yet today it would almost certainly invite negative remarks. At the very least, it would be seen like the Adams house itself as a quaint reminder of an earlier time, when life was simpler and the biblical God was still someone whose people could believe in. If modernity has encroached on Westport, it has positively overwhelmed institutions like the Adams Academy and the college it served with a profound secularism, so much so that few tasks are more difficult to justify today to the broader culture than efforts like Silliman's to "integrate" Christianity and science, that is, to bring them together under one roof.

Alas, I am too poor a philosopher and apologist properly to justify the work of present-day Sillimans, to confront the modern secular mind with the philosophical and moral implications of its own position. I had best leave that for those who can do it more effectively.2 My aim is much more modest, simply to reflect on the relations between Christianity and science from my perspective as an historian of science, on the assumption that a better understanding of how we came to this pass may help us find the best path to take next. In the process, I will offer some suggestions, and raise some questions, often implicitly, about how the history of science itself interacts with the Christian faith. Thus, I will be talking about two sorts of integration: the integration of Christianity and science, and the integration of Christianity and the history of science. Often these two lines of inquiry will be hard to separate, but readers are alerted to the distinction nonetheless: caveat lector.

All the while, I will take it almost for granted that the integrative task is important, its message status in the secular academy notwithstanding. Indeed, for the Christian, the integrative task can be ignored only by refusing to do theology, for theology is best defined as thinking Christianly about the world, and science is surely about the world. Modern science, technology, and medicine raise many tough ethical problems for us that we
cannot hope to address adequately without having a theology of science. In addition, our own personal development as individual persons of faith cries out for thoughtful integration, since modern science raises a number of specific issues that challenge Christian faith (or are often perceived to do so). As lovers of the unity of truth, we should not tolerate what amounts to intellectual schizophrenia -- the separation of two parts of our brains, one for faith and the other for science and/or reason, one for Sundays and the other for the rest of the week.

It is important to recognize that this schizophrenia is so widespread because our secular academic culture wants it that way. This is not just another example of the gap between the scientific and humanistic cultures that C.P. Snow brought into prominence more than a generation ago; it is rather an example of the Enlightenment prejudice against faith come to full fruition. Taught to rely on reason and the senses instead of on faith (which is usually presented as opposed to reason and the senses), relatively few scientists today have a serious interest in theology, and it is scientists more than anyone else who control the public image of science. Indeed a good number of scientists are openly antagonistic toward religion, partly in response to the antagonism they have seen directed toward them by radical environmentalists and scientific creationists, but partly also because they have been taught not to trust theology, so they can hardly take seriously the possibility of constructive interaction between science and theology.

The integrative task is especially important for those of us who teach at seminaries and Christian colleges, where we serve as mentors for other Christians who need to answer their own personal questions about science and faith; it is vital for us to model integration for our students. Ideally, this will be done in a way that shows students that there are multiple options and encourages students to explore more than one of them actively, on their own, for the process of world view formation is intensely personal. Pedagogically, this means that lectures alone cannot suffice; significant amounts of reading, discussion, and writing are essential. It is especially helpful if students can see, among the faculty, examples of those who hold different views on how to relate science to faith. Students who are not exposed to this kind of diversity may be quick to identify integration with one particular way of doing it, and just as quick to abandon the whole enterprise when, later on, a seemingly insurmountable obstacle appears to lie along the one path they have been shown.

Christian faculty at secular institutions also need openly to discuss their faith in relation to science, for they, too, can mentor Christian students -- students who otherwise will assume that they must ignore or even contradict their faith when thinking about science. Furthermore, they can in this way offer nonreligious students and colleagues a witness to the wholeness of Christian thinking and living in an environment filled with the vapors of specialization and the fragmentation of the mind that usually accompanies it. Non-Christian students need to realize that the modern secular view of science as truth and theology as prattle is not the only way of understanding how scientific knowledge relates to other forms of knowledge: if Christian faculty do not take it upon themselves to demonstrate this, then who will? All Christian scientists, inside and outside the academy, at institutions both secular and religious, should seek to model the transforming power of Christian thinking about science and everything else. Their students, their colleagues, and even the general public will benefit from their witness; the whole culture needs the whole gospel.

It is not simply that people in the modern West often find religion irrelevant to science. For many, including a number of prominent scientists, Christianity and science have for centuries been engaged in open conflict, with science winning the war for cultural and epistemic territory. My own discipline, the history of science, has been instrumental in debunking this myth, which has specific ideological roots in the eighteenth and nineteenth centuries; it actually tells us more about the people who believe it than about the history it purports to relate. In fact, Christianity has often been a powerful motivation for the practice of science and medicine, and it
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has helped to mold science into the highly successful empirical enterprise that it has become in the last three centuries. Although it is important to recognize that world views must not be judged simply by their ability either to foster or to inhibit scientific activity, no world view actually in opposition to the scientific enterprise will have much influence in the modern West. The fact that Christianity is highly conducive to modern science is significant, if sometimes overstated.

No less important, much recent scholarship in the history of science helps to "de-mythologize" the common image of science as purely objective knowledge and faith as purely subjective belief, from which the conflict thesis easily follows. We now know that scientific knowledge is determined not by observations and experiments, but by the outcome of debates about how to interpret observations and experiments, debates that are influenced by a variety of factors -- philosophical, religious, sociological, political, and personal. It is now possible as never before to see both science and religion as containing deeply held, rationally structured beliefs, some of them not directly testable. Indeed, for many in the modern world, science itself wears the mantle of religion: it provides a creation myth, reveals our true nature as human animals, proclaims the promise of salvation, gives us every good and perfect gift, offers eschatological hope, and functions as the ultimate arbiter of truth.

Yet scientists are human beings like everyone else, subject to the same foibles and heirs of the same fallen nature. The proper response to this is not arrogance, but humility -- a quality, ironically, that is no more prevalent among theologians than among scientists. Although it is important to aim toward the establishment of truth, none of us can be certain that we have achieved it. As I like to remind my students, there is a big difference between what God knows to be the case, and what we think God knows to be the case. Humility, and the intellectual openness that accompany it, are the most important attitudes to bring to the integrative task. In practice, this means that no particular way of relating Christianity and science is going to answer all important questions satisfactorily. We must expect to encounter difficulties that have no clear solutions, and we must be careful not to hitch our theological wagons too tightly to any particular scientific or philosophical horses -- while at the same time we must recognize that, without particular horses, we can only stand still. (This is analogous to the fact that no one Christian tradition is always correct, yet without particular traditions we have no place to stand.) Above all, we must retain that combination of mystery and faith that breathes life into the dry bones of human existence.

An historical survey of integrative efforts

The integrative task in any discipline is really a set of answers to an old question asked by many, most famously by the Carthaginian father Tertullian: "What indeed has Athens to do with Jerusalem? What concord is there between the Academy and the Church?" As the phrasing implies, Tertullian's attitude toward Greek philosophy was generally negative, though he acknowledged a legitimate role for reason within the bounds of religion. Other patristic authors looked more favorably on pagan philosophy and literature, especially Origen, who required his students to read nearly every work available to them at the time, finding some truth in most of them. The views of early Christian writers range between those of Tertullian and Origen. The moderate position of Augustine, who considered reason a divine gift resting on the foundation of faith, was by far the most influential on later Christian thinking. Although he cautioned Christians not to devote too much energy to the study of nature, which cannot lead to salvation, Augustine recognized Greek scientists as reliable authorities on natural matters and wisely urged Christians not to subject themselves to scorn for ignorance of what pagan authors had to say about nature.

For most patristic writers, then, the presence of two valid sources of knowledge -- scripture and reason, including the conclusions of reason about nature -- was not in dispute. Much later, in the late Renaissance, it would become commonplace to refer to the two "books" of God, the book of God's word
and the book of God's works, but this terminology was already present in
Augustine, who urged believers in a sermon to study "the great book ... of
created things. Look above; look below you; read it, note it." Nor was
there much argument about the relative status of the disciplines devoted to
reading each of these two books, theology and science. For the first eleven
centuries of the Christian era, philosophy (including what we today call
science) was considered a "handmaiden to theology," a concept introduced by
Philo Judaeus in the first century A.D. and later used by Christian writers
such as Clement of Alexandria, Augustine, and Bonaventure.

The handmaiden model is the first of several models for relating the two
books of religion and science that we will consider. As we shall see, it
remains in use today, at least in some form, even though it is no longer the
dominant model. As a general rule, once a model has been introduced and
accepted in one particular era, it never fails entirely to find advocates in
any subsequent era, although other models may be much more widely endorsed.
The history of Christianity and science, we might say, involves the creation
of new models and the evolution of older ones, but not extinction; and
hybridization, resulting from cross-fertilization, occurs often, so that
models usually have several features in common with other models.

According to the handmaiden model, the proper role of scientific
knowledge was simply to help illuminate biblical references to nature, not to
stand on its own as an independent domain of inquiry; see figure 1 for an
attempt to depict this schematically. Thus, to quote Bonaventure, "all
divisions of knowledge are handmaids of theology," for "theology makes use of
illustrations and terms pertaining to every branch of knowledge." Theology
was regarded as the "queen of the sciences," a phrase that is fully
appreciated only when we realize that "science" meant any kind of properly
justified knowledge, regardless of the subject or the source. As queen,
theology was entitled to take only what was thought to be of spiritual value
from the pagan sources, discarding the rest as wrong or ignoring it as
irrelevant. This was often justified by an appeal to Exodus 3:22 and 12:36,
in which God told the Hebrews to "spoil the Egyptians" of their treasures,
such as when Pope Gregory IX ordered the expurgation of some of Aristotle's
books in 1231.

How did this model actually work in regulating the integrative task? A
particularly illustrative example is the amount of attention given in the
period to the writing of hexameral treatises (commentaries on the six days of
creation). An important exemplar is the Homilies on the Hexameron by Basil,
bishop of Caesarea, in which Aristotelian cosmology and physics were used to
help interpret the first chapter of Genesis -- though Basil forcefully denied
that the ideas of philosophers, which are often wrong, are important in their
own right. Basil followed Aristotle in placing the earth at the center of the
world and accepted his doctrine of four elements with their natural places,
but found it hard to reconcile Aristotle's belief in a single starry heaven
with the opening verses of the Bible, which seemed to speak of two heavens:
one created "in the beginning," the other a "firmament" created on the second
day called "Heaven" that separates the waters above it from those below it.
This led Basil to teach the existence of two heavens, separated by heavenly

Theology

Figure 1
The "Handmaiden" Model of Science and Theology
water, a conception that led medieval thinkers to their picture of three heavens beyond the sphere of the planets. For eleven hundred years the handmaiden model escaped serious challenge, owing in no small part to the fact that the bulk of Aristotle’s works were unavailable in the Latin West and, even elsewhere in the world, knowledge of Greek science was usually obtained second-hand, from handbooks and encyclopedias rather than from the original sources. Consequently, Christian scholars were not confronted with the full force of Aristotle’s sophisticated naturalism. On the other hand, they did have Plato’s Timaeus, a dialogue about the origin of order in the world by means of a godlike figure (the Demiurge) who imposed form on undifferentiated matter. Although the differences between Plato’s story and Genesis are significant, there are enough similarities that Plato was readily seen as a pagan prophet of Christianity; the presence of Platonic elements in the Pauline epistles was also important in this connection. Plato’s rejection of purely natural and nonontological modes of explanation, coupled with his belief in the immortality of the soul and the superiority of mind over matter within a dualistic system, made his highly attractive to Christian writers, above all Augustine. The relative ease with which Platonic elements could be incorporated into a Christian world view -- and vice versa, depending on who was doing the philosophizing -- gave considerable support to the handmaiden model.

That situation changed dramatically with the recovery of a large body of Greek scientific and medical works previously unavailable in the Latin West, a process that began in the eleventh century and culminated in the twelfth and thirteenth centuries with the appearance in Europe of universities dominated by Aristotelian natural philosophy. For the first time, Christian scholars were faced with a powerful, systematic body of natural knowledge, comprehensive in scope and secular in spirit. It represented what one scholar has called a “revolt of the handmaidens,” and Christian thinkers responded in various ways, especially those who taught at the University of Paris, which

had the leading theological faculty in all of Christendom. Some followed Bonaventure in condemning much of the new learning as heretical; others followed the radical arts master Siger of Brabant, a staunch Aristotelian who considered philosophy to be an autonomous discipline, perhaps even superior to theology. Seeking a middle course, Thomas Aquinas, a Dominican who taught theology at Paris, undertook an ambitious project to integrate Aristotle with Christian theology, resulting in a new expression of traditional theology in terms of Aristotelian categories, thus using reason to help understand faith. At the same time, he was careful to limit the scope of reason and to reject those Aristotelian tenets that seemed most threatening to the faith, especially the claim that the world is eternal. He also maintained that theological truths were in a higher realm than natural truths, accessible not by reason alone but by revelation augmenting reason. Thus, Thomas carried out his integration very much according to the handmaiden model.

In the late middle ages and continuing into the Renaissance, partly in reaction to the bold Aristotelianism that had gained on the universities, Platonism enjoyed a revival. Deeply interested in the application of mathematics to nature that is a central theme of the Timaeus, Renaissance neo-Platonists found it easy to see the world as the embodiment of God’s perfect geometrical design. As R. G. Collingwood pointed out many years ago, the belief that mathematical ideas could be perfectly realized in nature is not Platonic -- Plato taught that physical objects are imperfect “shadows” of the perfect forms -- it is rather a consequence of the Christian doctrine of creation: an omnipotent God would carry out the plan of creation to perfection. For Christian neo-Platonists like Nicolaus Copernicus, Galileo Galilei, and Johannes Kepler, God was eternally thinking geometric thoughts; by the right use of geometry, we could literally read the mind of God and discover the deepest secrets of creation.

During the period between Copernicus and Kepler, as scientists turned their attention increasingly to nature itself and gave less deference to traditional authorities, a new model for the relation between Christianity and
science rose to prominence. The catalyst was the gradual acceptance of
Copernican astronomy, which seemed to challenge the very words of Scripture by
assuming the motion of the earth rather than the sun. (In several places, the
Bible speaks of the motion of the sun through the sky, as if it were a real
motion rather than an apparent one, or else of the stability of the earth.)
Kepler and Galileo showed how the new hypothesis could be reconciled with the
Bible. In the preface to his most important book, The New Astronomy (1609),
Kepler used the Augustinian principle of accommodation to justify the
figurative interpretation of biblical references to the motion of the sun.
The Bible, he noted, speaks in a very human way about ordinary matters in a
way that can be understood, using ordinary speech to convey loftier
theological truths. Thus the literal sense of texts making reference to
nature should not be mistaken for accurate scientific statements. Galileo
made an identical argument just a few years later in his Letter to the Grand
Duchess Christina (1615). Unfortunately for Catholic scientists, however,
Copernicus' book was placed on the Index of Prohibited Books "until corrected"
in 1616 and remained on it until 1835 -- though it is not clear how much
impact this ban really had, especially outside of Italy. In the absence of a
similar ruling binding on them, Protestant scientists generally accepted the
argument of Kepler and Galileo. By the end of the seventeenth century, many
Protestant scientists were Copernicans, and many Protestant theologians seem
not to have cared. Indeed the principle of accommodation, which had made
heliocentrism theologically acceptable, henceforth was widely used by
theologians and scientists alike for understanding scriptural passages about
nature, and helped immensely to clarify the real purpose of biblical
revelation.

By accepting the new astronomy in spite of Biblical passages that seem
to contradict it, Christian thinkers were implicitly raising the status of
science from that of an obedient handmaiden to something like an equal partner
in the search for truth, although the ultimate supremacy of theology was still
admitted. Consider Galileo's premise that the meaning of Scripture is often
ambiguous, whereas nature speaks clearly and decisively. In order for both
books to agree, therefore, the theologian must allow a certain latitude of
interpretation to Biblical texts about nature. Once the truth about nature
has been determined by observing nature, the exegete can apply the principle
of accommodation to say that the real point of the passage is theological
rather than scientific. Because the Bible is for the vulgar, no less than the
learned, it speaks the language of ordinary appearances rather than the
language of theoretical science. In this case, then, the scientists showed
the theologians how they had to interpret the Bible, if a contradiction
between the two truths was to be avoided -- the handmaiden moonlighting as a
consultant!

Yet the principle of accommodation was hardly new. The scientists did
not invent it, nor was it crafted to meet a particular challenge from science.
Galileo got it explicitly from Augustine's treatise On the Literal
Interpretation of Genesis, a work about the larger subject of Biblical
hermeneutics written long before the controversy over the motion of the earth.
John Calvin, almost certainly writing without any knowledge of the new
astronomy, stated in the century before Galileo that "the Holy Spirit had no
intention to teach astronomy; and in proposing instruction meant to be common
to the simplest and most uneducated persons, he made use by Moses and other
prophets of popular language that none might shelter himself under the pretext
of obscurity." Elsewhere, Calvin allowed that the Bible might even contain
erroneous statements, if they reflect common beliefs and are used to make
correct theological points.

In context, then, the moves to re-interpret the Bible in light of
Copernicism must be seen as part of a broader issue of interpretation,
arising out of the fundamental theological problem of understanding how God
speaks to human beings in human language. The resources were already there
for Kepler and Galileo to draw on. Yet the fact remains that the acceptance
of the new astronomy underscored this problem, and ultimately brought from
theologians the admission that scientific conclusions could bear directly on
Biblical interpretation -- something most Christians take for granted today, but at the time a controversial idea. Other factors were also leading to a re-evaluation of the status of science, especially the desire by many scientists and intellectuals to see science become the engine of technological, medical, and social progress. A crucial figure here was the English statesman and essayist, Francis Bacon, principle author of what I will call the 'harmony' or "concordist" model of the relation between Christianity and science (see figure 2).

Figure 2
The Relation of Science and Theology according to Francis Bacon

According to this model, the book of scripture and the book of nature cannot conflict, since both have the same author, but they are about substantially different things and should be read separately whenever possible. Galileo said as much in his famous letter to Christina d'Medici, but for a definitive (though strongly gendered) statement we quote two passages from Bacon's

Advancement of Learning (1605), written several years earlier and deeply influential on English and American science for the next two and a half centuries:

Let no man upon a weak conceit of sobriety or an ill-applied moderation think or maintain, that a man can search too far, or be too well studied in the book of God's word, or in the book of God's works, divinity or philosophy; but rather let men endeavor an endless progress or proficiency in both; only let men beware..., that they do not unwisely mingle or confound these learnings together.

...our saviour saith, "You err, not knowing the scriptures, nor the power of God": laying before us two books or volumes to study, if we will be secured from error; first the scriptures, revealing the will of God, and then the creatures expressing his power; whereas the latter is a key unto the former: not only opening our understanding to conceive the true sense of the scriptures, by the general notions of reason and rules of speech, but chiefly opening our belief, in drawing us into a due meditation of the omnipotency of God, which is chiefly signed and engraven upon his works.

Two things are important to notice in this passage. First, Bacon places natural philosophy on the same level as theology: both are equally worthy of study, according to Christ himself (in Bacon's peculiar interpretation of Matthew 22:29), and indeed the study of nature can help us "conceive the true sense of the scriptures." Second, people ought to avoid "unwisely mingling or confounding" the two together. However, there is a significant exception, an area of overlap that presumably betokens wisdom rather than confusion. Because the study of nature can "open our belief" by "drawing us into a due meditation of the omnipotency of God," the doing of natural theology is an integral part of natural philosophy. Bacon did not mean that reason could lead a person into Christian faith; he expressly declared it impossible "to deduce the truth of the Christian religion from the principles of the philosophers, and to confirm it by their authority," and he regarded attempts to replace biblical religion with science as "disparaging things divine by mingling with things human."32 He meant only that it was a proper goal of science to refute atheism.33

Because it offered relative autonomy for science without detracting from the authority of theology, the Baconian model was very popular, particularly with Protestants, through the middle of the nineteenth century. Robert Boyle
epitomized the harmony model in its purest Baconian form, by aggressively pursuing an extensive program of natural theology, while generally avoiding the use of the Bible as a scientific text. More than a century later, however, adherents of this model were much less reluctant to cite scripture on scientific matters, no doubt because the age and origin of the earth had become topics of serious scientific discussion. Natural historians were perhaps the most enthusiastic proponents of the harmony model in antebellum America. Leading Christian scientists like Benjamin Silliman, Edward Hitchcock, Arnold Guyot, and James Dwight Dana saw in the books of nature and scripture essentially the same story, going beyond the general assumption of harmony to endorse a strong concordism, arguing for close parallels between Genesis and geology. Ignoring Bacon’s warning not to mingle the two books unwisely, they produced detailed schemes of harmonization, like that reproduced here from Silliman’s “Consistency of Geology with Sacred History,” in which the various creative acts of God are matched with specific geological evidence. Silliman’s basic strategy, also employed by Guyot and Dana, was to interpret the days of Genesis as creative periods of indeterminate length, thus giving geologists the vast quantities of time they were demanding; this is often called the “day-age” view. Hitchcock rejected this approach on exegetical grounds, endorsing instead the view of the Scottish theologian Thomas Chalmers, that a period of unknown length separated the original creation of the universe described in the first verse of the Bible from the creation of all present forms of life in six literal days, about 6,000 years ago; this is often called the “gap theory.”

These two hermeneutical strategies, both designed to harmonize an old earth with the Biblical story of creation, were the principle options available to even the most conservative Christians at the turn of the century. Indeed, the gap theory was explicitly recommended by C.I. Scofield in his edition of the Bible, which found wide use among fundamentalists in the first half of the twentieth century. The most prominent fundamentalist “authority” on science between the wars, Harry Rimmer, thought the gap theory was a perfectly acceptable option, though he had his doubts about the day-age view. Lately, however, the gap theory has fallen out of favor with most conservative Protestants, partly owing to strong attacks on its exegetical assumptions by those committed to scientific creationism. Not that the day-age approach is any more acceptable to creationists; John C. Whitcomb, Jr., who wrote The Genesis Flood with Henry Morris, explicitly rejects the whole concordist approach, which he calls “the double-revelation theory,” because it “fails to give due recognition to the tremendous limitations which inhibit the scientific method when applied to the study of origins.” For Whitcomb, then, the harmony model gives entirely too much status to science, at least on the subject of origins.

Sometimes scientific creationists are seen as adherents of the warfare model, because they vigorously attack many claims of contemporary scientists. While this aspect of their program is unmistakable, it actually derives from their conviction that no scientific conclusions are comparable in status to the statements of scripture, which, as the words of God, provide the only truly reliable knowledge about the origin of the universe. They are better understood, therefore, as contemporary advocates of the handmaiden model. Like Basil, they view Genesis as a scientific description of the cosmos and emphasize the absolute dominance of scriptural “truths” over the “mere theories” of “agnostic” and “atheist” scientists. They stress the subservient role of science to theology, including the value of using what they consider to be “true science” (the conclusions of scientific creationism) for apologetic purposes, to uphold the reliability of the Bible against evolutionists and biblical critics and to convince unbelievers to accept the gospel.

Even in the mid-nineteenth century, however, the harmony model had its critics, such as the classicist Taylor Lewis, author of The Six Days of Creation (1855). Although he accepted the day-age view and noted the existence of certain obvious parallels between Genesis and geology, Lewis poured contempt on the idea that scientific theories ought to be used to
interpret the Bible. The Bible, Lewis claimed, should be interpreted on its own terms as a literary text, without regard for the conclusions of scientists, which were only transitory truths in any case. Although Lewis was a conservative critic of the best science of his day, his objections have a surprisingly modern ring: most contemporary biblical scholars and scientists would agree that the meaning of a Biblical text has little or nothing to do with scientific matters. Not surprisingly, James Dwight Dana, the leading American geologist of his generation, took Lewis' book personally as a frontal attack on his profession. He replied in a series of four articles published in Bibliotheca Sacra over the next two years. Ruminating in his belief in the importance of drawing theological conclusions from geology, he wrote, "This placing in antagonism God's word and his works, is only fitted to make the young scout the forerunner; for they know the latter has its great truths, having the best of all evidence."

Although many of his professional colleagues appreciated Dana's defense of the harmony model, there was at least one outstanding exception. The Harvard botanist Asa Gray, the first public defender of Darwinism in America, expressed his dissent in his anonymous 1863 review of Dana's Manual of Geology, which contained a short section on cosmogony. Dana's cosmogony, Gray noted, is merely a summary of the views of Guyot, looking to a harmony of the Mosaic cosmogony with modern science, -- views which Professor Dana has adopted and maintained elsewhere more in detail, and which, under the circumstances, are naturally enough here reproduced. We regard them with curious interest, but without much sympathy for the anxious feeling which demands such harmony. We have faith in revelation, and faith in science, in each after its kind, but, as respects cosmogony, we are not called upon to yield an implicit assent to any proposed reconciliation of the two. This passage, I believe, is crucial for understanding the subsequent history of the harmony model. Gray was both an evolutionist and a Christian committed to a high Augustinian view of God's relation to the world. The strong concordism for which he had little sympathy cries out for a non-evolutionary view of human origins: if the Bible really is a reliable source about the early history of the planet, as the concordists of Gray's day assumed, then it is difficult to see how a fully evolutionary position could be acceptable.

Furthermore, Gray's conception of divine sovereignty did not require him to find evidence for God in the details of cosmogony.

This is precisely the path taken by a number of contemporary evangelical scientists, such as Richard Ruse, Riving Amundson, Howard Van Till, and some other prominent members of the American Scientific Affiliation, who are best described as theistic evolutionists. Although they accept the classic notion of two books with one author and agree that the two books do not conflict, they do not believe that the two books tell the same story in different languages. Instead, like Galileo, they view the Bible as a theological text that cannot be brought into scientific discussions at the level of basic facts and theories. For them, the proper role of scripture is at the level of foundational assumptions about the world, including assumptions relative to our ability as humans to comprehend the creation placed before us. As we will soon see, there are various ways of doing this.

Many of their secular colleagues in the academy hold quite a different view of Christianity and science. In their opinion, science = TRUTH and Christianity = superstition, a view which they believe the history of science supports. Indeed, in much traditional historiography, the relationship between science and Christianity has been described in terms of conflict, with Galileo's encounter with the Holy See serving as the paradigmatic example: reason versus authority, progressive science overcoming obscurantist theology in a battle for cultural and epistemological hegemony (see figure 3 for a diagram). The most famous statements of this position are two works whose titles say everything: A History of the Warfare of Science with Theology in Christendom (published in 1896, but based on lectures first given in 1869), by the first president of Cornell University, Andrew Dickson White, and History of the Conflict between Religion and Science (1874), by John William Draper, a chemist turned historian who taught at New York University. It is no accident that these two books were written at the time when Americans were just coming out of a great conflict that had torn the nation apart, at the time when
of Newton from casual reading, from books not written by serious students of
Newton's theological views, or what is worse from books written by scholars
who, in the Enlightenment tradition, regard Newton's deep and abiding interest
in theology as completely irrelevant to what counts, that is, his
accomplishments in physics. In fact, Newton's natural philosophy was
fundamentally influenced by his theological beliefs in a variety of ways; even
his understanding of gravitation itself was affected by his view of God's
dominion.9

This utter disregard for the significance of positive religious
influences on science is a key component of what historians of science call
"Whiggism," a term derived from the old-fashioned approach to British
political history, which was often blind to the importance of factors that did
not lead in a simple, linear fashion toward increasing democratization. When
applied to the history of science, it means (among other things) the refusal
to consider the importance of "non-scientific" influences (such as theological
beliefs) on science. Whiggism is the single most obvious characteristic of
most historiography of science prior to about 1970, and even now carries much
weight in certain circles -- for example, among professional scientists, whose
knowledge of the history of science is typically rather narrowly focused on
the Whiggish, linear story of the triumphal advance of science through
discoveries and new theories.

In the past two generations, however, most scholars coming into the
history of science have been trained as professional historians, not as
scientists (I speak here of graduate training only). Like their colleagues in
other branches of history, they have tended to reject simplistic, linear views
of history like Whiggism, in favor of accounts that are more sensitive to the
complexities of being human at a certain time and place. Furthermore, as
humanistically trained people, the new generation of scholars generally does
not view science as the ultimate form of human knowledge, and does not view
religion as irrelevant to science or to its history. Consequently, historians
of science have increasingly discarded the rhetoric of confrontation when
describing the relationship between religion and science. Metaphors of interaction have begun to replace the language of the battlefield. This new direction in historiography is obviously encouraging to evangelical scholars and wholly appropriate for us to participate in. All of my own scholarship is guided by this new paradigm.

This is not to deny the presence of genuine conflicts on the historical landscape; it is simply to affirm that whatever conflicts historians find cannot be reduced simply to a war between religion and science, or confined into a perpetual state of necessary conflict between religion and science to suit someone’s ideological goals. I illustrate this point in the classroom by writing on the blackboard the following inequality:

conflicts ≠ CONFLICT.

At the same time, it is now clearer that genuine harmony between religion and science has not been too common. Many episodes cannot be described accurately as harmonious; perhaps “creative tension” would be a better description of the overall historical situation.²

New Directions for Christianity and Science

If it is now possible as never before to get past the notion of warfare, and to undo the damage it has done, we are still left with the question of which models to use in the integrative task. Many conservative Protestants cling to the harmony model, especially the strong concordist form, for some good reasons: it promotes dialogue between science and theology; it underscores the essential truth that God is revealed in both nature and scripture, while clearly affirming the unity of truth; and it assumes a very high view of scripture. But we must beware making glib pronouncements of harmony, even apart from the fact that it misreads the historical record, taken as a whole. It also misrepresents the current situation to describe it as harmonious: the modern scientific community is overwhelmingly secular, and cares not a whit what its findings may imply about God. God does not figure at all into modern assumptions and methods.

The most telling objections to the harmony model, however, come from biblical scholarship and epistemology. Like Galileo and Taylor Lewis, we are forced to ask whether the Bible was ever intended to be a scientific book at all. According to the historico-critical method of biblical interpretation, which most evangelical scholars accept, we should determine the meaning of a biblical text by doing our best to discover what it meant to the author(s) and the hearers in the context of the time and place in which it was written. The Hebrews were a pre-scientific people, surrounded by pagan peoples who worshipped animals, trees, and heavenly bodies. Given that context, it is difficult to see why we ought to consider the hexameron to be anything other than a proclamation of faith in the only true God, the Maker of heaven and earth. To look for a scientific history of the world in a creation hymn certainly seems like barking up the wrong tree.

Even if we overlook the harmonetical problems with the concordist model, the epistemological problems are just as serious. Scientific truth is contingent, a fact that modern theologians greatly appreciate, since it is closely linked historically with Christian theology. This strikes at the heart of the concordist enterprise, which has always had the goal of putting two truths together into one. How can we relate unchanging truth to changing truths? Or, if we recognize the fact that our understanding of God has also changed over time, we must ask, how can we relate our changing perceptions of unchanging truth to other changing truths?

The best models for the modern situation, in my opinion, are those which assume the non-scientific character of special revelation while assuming the contingency of both scientific and theological knowledge. Many in our culture, including many Christians, endorse the separation model, which carefully delineates the methodologies, areas of competence, and boundaries for science and theology (see figure 4). Usually, it is said that science deals with nature and theology with God -- an obvious distinction in theory, but in practice not quite so clear, for it leaves wholly unsolved or overlooked the matter of divine action in the world. The separation model is best understood as a response on the part of both scientists and theologians
to past boundary disputes, and is attractive to many people because it rules out territorial conflict, at least in principle, and thus provides for many a satisfactory rebuttal to the warfare model. By relegating science and theology to separate domains, this model attempts to preserve the autonomy of meaning and values, whether or not they are seen as transcendent, for whatever their source, they do not arise from the conclusions of science and cannot be tested by scientific means. This is really a kind of Cartesian dualism of matter and meaning, reworked for modern minds by dropping talk about souls and bodies. (No less than modern thinkers, Descartes was powerfully motivated by a concern to preserve a separate domain of truth for theology, apart from mechanistic science.) When people today respond intuitively to sociobiology by denying that human values and moral beliefs are simply a natural result of our evolutionary history, they may well be basing their opposition on the separation model -- certainly, the result is the same as if they were.

But, we are forced to ask, isn't the separation model really just an example of the kind of schizophrenia we decried earlier? The answer depends on how the model is used, and how deeply it is held. If simply taken as a heuristic guide -- the constant reminder that one must not mix apples with oranges -- then it need not prevent one from forming a single, consistent view of the world from various components of knowledge identifiable as separate domains. In practice, this is often how the separation model functions. If, on the other hand, it is actually the basis of a formal metaphysical position, then it is difficult to see how a single picture of reality could ever be assembled, unless it is a dualistic picture; and many modern people, Christians and non-Christians alike, instinctively flee from metaphysical dualism. (This is not an argument, it is just an observation.)

A further difficulty with the separation model is that it says nothing about the relative value of the two realms it sets apart. One person might like the model because it allows them to say that neither science nor theology is "queen of the sciences", since neither one can pass judgment on the other. Another person might just as easily claim that, since theology is irrelevant to science, the scientist can live perfectly well without it; or, vice versa. Indeed, the prevailing view in our culture seems to be either that science and religion are engaged in conflict, or that they are completely separate things, with science actually much more important because it is more practical and less controversial.

One response to this situation is to adopt the complementarity model, so called because it views the relation between theology and science as analogous to the relation between particle and wave models in modern physics, which are said to be complementary because they give very different but ultimately compatible pictures of a single phenomenon. At first glance, the complementarity model appears to be just a variety of the separation model, because it also pays close attention to boundaries and differences in method and scope: the two pictures of reality will be very different. Actually the model goes beyond mere boundary maintenance to claim that science and theology
operate at different levels, with theology a more comprehensive and more important discipline than science. Theology and science are understood as different levels of description of a single reality, with science focusing on the "what" and "how" of a phenomenon and theology focusing on the "who" and "why". My attempt to diagram this (see figure 5) should be compared with my diagram of the handmaiden model (figure 1), which it resembles, except that here 'science' is writ larger to indicate that it is given the same respect and autonomy as theology.

![Diagram of theology and science relationship](image)

**Theology**

**Science**

**Figure 5**

Science and Theology as Different Levels of Description

This model assumes the legitimacy of both science and theology as forms of knowledge, but emphasizes differences in the sorts of truth they are seeking. It can also be compared with the harmony model, in that the unity of truth is affirmed; but it is not a concordist model, since the Bible is not relevant to science as science. Scientists, as scientists, need not know any theology; but theologians, as theologians, do need to know something about science, for theology is the most comprehensive discipline, as it were the 'science of everything.' Thus, the boundary line in figure 5 should be understood as permeable; insofar as science provides reliable knowledge of the natural world, it is relevant to the theologian, whose task is to understand the whole of existence. If the boundary is permeable in the other direction, it is at the level of fundamental beliefs, not at the level of facts and theories; theological beliefs can undergird the practice of science, providing a metaphysical framework within which the scientist can answer ultimate questions about the nature, scope, meaning, significance, and (at least in some cases) the methods of her discipline. Hence this putative diagram, which emphasizes the more comprehensive scope of theology while respecting disciplinary boundaries:

**Figure 6**

The Complementarity Model of Science and Theology

If complementarity is criticized, it is usually because it is said to
give short shrift to serious dialogue between theology and science, since it rules out the possibility of theological beliefs actually affecting the content of scientific theories and of scientific theories directly affecting basic theological beliefs -- which, indeed, may be its most attractive feature for many of its proponents. The final model we will consider, the dialogue model, might be pictured like the complementarity model, except that the boundary is more easily permeable in both directions; I have not drawn a separate figure to show this. The dialogue model is similar to the complementarity model, in that differences in content and scope are emphasized and levels of meaning are still carefully delineated. But adherents also emphasize the 'conversation' that takes place as people try to make holistic sense of what might otherwise be seen as largely separate pictures of reality, each on its own level.

The most vocal proponents of dialogue, such as Ian Barbour, Nancy Murphy, and Robert J. Russell, believe that dialogue ought to lead to doctrinal reformulation in theology -- a proposal that invites some scholars to revisit the problem of divine action in novel ways, while it provokes others to hold their noses and run toward the relative safety of the separation or complementarity models. Russell also believes that it should be possible in some instances to translate theological and/or metaphysical beliefs into specific scientific hypotheses that can be tested. His favorite example is that of Einstein's discovery that general relativity theory implied an expanding universe. Since this did not suit his belief in an eternal, static universe, Einstein added a term to his equations to alter the prediction of the theory. Later on, as observational evidence for an expanding universe began to be found, he reversed himself and chastised himself for trusting his beliefs rather than his equations. For Russell, however, this incident shows that extra-scientific beliefs can have testable consequences, and he praises Einstein for having the boldness to act on his beliefs, even though he was ultimately mistaken.

The most strongly established school of doctrinal reformulation is that of process theology, as represented by people such as Harbou, David Griffin, and Arthur Peacocke. Although process theology should be understood as a response to problems in traditional theodicy no less than a response to modern science, it purports to be a 'scientific' theology because it takes an evolutionary view of God as well as of the cosmos, abandoning static categories like perfection and immutability for dynamic, relational categories like love and persuasion. Indeed, many feminist theologians, among them Sallie McPague, are attracted to process theology for its emphasis on persuasive divine love rather than creative power and wisdom.

There are far too many problems with process theology to enumerate here, but at least three seem fatal to me. First, there is a fundamental inconsistency with modern science on the subject of ultimate origins, in spite of the fact that process theologians have consciously tried to take into account evolutionary biology. For true process theologians, it is simply not possible to admit that God made the universe ex nihilo, "in the beginning," as the traditional doctrine of creation holds, for such a God would really be omnipotent, but the process God has quite limited power. Consequently, they are forced to deny the obvious consonance between big bang cosmology and creatio ex nihilo. Thus, while process theologians are delighted to reformulate traditional theology to fit an evolutionary cosmos, they are not happy to reformulate their own theology to fit the big bang, a theory that seems as well confirmed as biological evolution. Christians who want to reformulate their theology along "scientific" lines are going to have to take the implications of both theories seriously. Second, process thinkers cannot consistently believe in the actual resurrection of Christ's body, which is clearly taught in the Scriptures and has been central to Christianity since the apostolic age. For, if God really raised Christ from the dead, then God can reorder nature -- in other words, God is not subject to the laws of nature, but has enormous power over nature. Such a God, surely, is omnipotent for all practical purposes. Thus, process theologians face a dilemma: either to deny Christ's bodily resurrection, in which case I find their claim to be...
Christian theologians highly problematic; or else to admit it, but then somehow to claim that God is nevertheless not omnipotent. Third, process theologians do not accept the heart of the Christian doctrine of creation, to wit, that God created the world freely, not out of any necessity, so that both the existence of the world and its particular nature are radically contingent -- that is, the world really might not exist and, given its existence, it really could have been another sort of world. God could have made heaven now, for example, but God chose not to do so. Once again, they cannot accept such a view of creation, because it would involve the tacit admission that God is omnipotent. Indeed, process theologians would have us replace the biblical God with Plato's Demiurge, who had no choice but to fashion the world, as a consequence of his own goodness and love, out of pre-existing materials and ideas that were co-eval with himself. This is Platonic idealism, not Christianity. Some process theologians, such as David Griffin, admit when pressed (as I have done, face-to-face, on occasion) that their notion of God is equivalent to that of the Stoics, who took God to be the World Soul, an immaterial mind indwelling the eternal world from eternity, but lacking the power to make the world or to "break" its "laws." For that reason, Griffin and others are happy to be regarded as "Christian pagans" rather than "Christian theists." I admire their honesty, but disparage their dismissal of theism.

As for the excesses of certain forms of feminist theology, I ask us briefly to consider what took place at a November 1993 conference in Minneapolis, sponsored by several mainstream Protestant denominations and the World Council of Churches. Called "Re-Imagining ... God, Community, and the Church," the conference was designed by and for radical feminists, including lesbians. It hardly needs to be said that biblical notions of sexuality and sin were ridiculed and rejected. But equally serious, in my judgement, was the wholesale reworking of the doctrine of creation, in which the world was literally sacralized and God was made over into what can only be described as a fertility goddess. At one point the women in attendance recited together

the following litany:

Our maker Sophia, we are women in your image, with the hot blood of our wombs we give form to new life ... with nectar between our thighs we invite a lover ... with our warm body fluids we remind the world of its pleasures and sensations ... with the honey of wisdom in our mouths we prophesy a full humanity to all the peoples."

It is impossible for me to read such language, intended for "Christian" worship, without revulsion. Nor can I appreciate the efforts of many feminist theologians to re-imagine the world as a divine being, a goddess who is violated by men digging into her private parts like so many rapists. No doubt this is partly because I am neither a lesbian nor a radical feminist, but I would like to think it is mostly because this is precisely the sort of theology that the first chapter of Genesis was written to oppose. A central theme of the hexameron is the de-divinization of nature. Neither the heavens nor the earth, neither the beasts of the field nor the fish of the sea nor the fowl of the air, were to be understood as anything but creatures. God's relation to the creation was an intimate one, but that of creator to created objects, not as one god to other gods or goddesses. And the God of Genesis fashioned the world from inert materials according to God's pleasure; unlike the gods of Egypt and Babylon, the biblical god did not give birth to the world or generate the world by sexual means. God "created;" God did not "procreate." Only the second person of the Trinity, according to an old creed, was "begotten" and not "made."

It certainly does matter how we speak of God's relation to the world in which we live -- whether the world was born, fashioned from pre-existent matter, or created from nothing. Not all metaphors are interchangeable. Some are suitable to convey a biblical understanding of God's relation to the world, and others are not. (The fact that some contemporary theologians either don't care what the Bible says, or else think that it can be made to say anything at all, is sufficient cause to disqualify them as Christian theologians.) Some are conducive to a modern scientific understanding of the world, and others are not. Some are actually suitable for both! My primary calling at Messiah is to help the church to understand this better, by
throwing a little historical and theological light on the relations between Christianity and science.

1. Classes were held from 1837-67 in a one-room building that is now a museum of the Westport Historical Society.

2. The Adams homestead, called "the Birds' Nest," was bought, completely renovated, and resold by Martha Stewart, who has written about it in Martha Stewart's New Old House (New York: Potter, 1992).

3. For some recent critiques of philosophical naturalism, see Nicolas Wolterstorff, Reason within the Bounds of Religion (SP, 1976), and his "Theology and Science: Listening to Each Other," forthcoming in Building Bridges: Readings in Science and Theology, ed. W. Mark Richardson and Wesley J. Wildman (Routledge); Roy Clouser, The Myth of Religious Neutrality.


5. This would be difficult to achieve at most Bible colleges and some seminaries and colleges, where adherence to a particular view of the Bible and/or a narrow interpretive framework would work against genuine diversity in the integrative task.

6. More will be said below. For my own review of some important scholarship refuting the conflict interpretation of the history of Christianity and science, see "Blessed are the Peacemakers: Rewriting the History of Christianity and Science," Perspectives on Science and Christian Faith 40 (1998), 47-52.

7. This is one reason why the most radical forms of environmentalism, which are essentially pantheistic, will not ultimately amount to very much; our culture is simply too scientifically oriented, both informally and formally, for any other outcome to be likely.

8. I am not claiming, as some have, that Christianity "caused" modern science; rather it was one of the most important factors in the development of science as we know it today. For more on this point, see Edward B. Davis, "Rationalism, Voluntarism, and Seventeenth-Century Science," forthcoming in Science and Belief: Proceedings of the First International Pascal Centre.
Conference, ed. Jitse Van der Meer (University Publications of America, 1995). Ironically, the outstanding characteristic of this historical interaction -- the conception of the world as a finite, contingent thing, the free creation of an omnipotent God, rather than an eternal, quasi-divine being or a necessary product of divine goodness and love -- has been rejected by many modern theologians, who nevertheless insist with profound inconsistency that the world is indeed a contingent creation.


14. Platonism in one form or another remains a viable Christian philosophy today, as the popularity of C.S. Lewis and Owen Barfield shows.


18. See, for example, his comments on Psalm 58:4-5, where he doubts that snake charming is genuine, although those verses liken the wicked to deaf adders that do not respond to the charmers. On Calvin’s views generally, see R. Hooykaas, *Religion and the Rise of Modern Science* (Grand Rapids: Eerdmans, 1972), pp. 117-22.


20. Ibid., book I, sec. VI, para. 16.


23. Whitcomb, *The Origin of the Solar System* (Phillipsburg, NJ: Presbyterian and Reformed, 1963), p. 9. The sole purpose of this booklet is to defend the plenary verbal inspiration of the Bible, which Whitcomb believes has been undermined by concordism. Ironically, one of Whitcomb’s proof texts is Matthew 22:29, the same passage Bacon used for the opposite purpose. It is not evident that Whitcomb is aware of this.


26. For a superb review of the damage done to historiography by the warfare model, see James R. Moore, *The Post-Darwinian Controversies: A study of the Protestant struggle to come to terms with Darwin in Great Britain and America, 1870-1900* (Cambridge: Cambridge University Press, 1979), part one. On the

27. For some relevant discussion, see my own essay, "Newton's Rejection of the 'Newtonian World View': The Role of Divine Will in Newton's Natural Philosophy," Fides et Historia 22 (Summer 1990), 6-20; reprinted in Science & Christian Belief 3 (1991), 103-117.


29. Because of the excesses of mechanistic science, the whole Cartesian program often gets bad press. In fact, his motives were good if the results less so.

30. I am not saying that big bang cosmology proves that the universe was created from nothing; that is an article of faith beyond proof. However, if the universe really was created from nothing, we should expect it to look something like the picture we get from the big bang, in which the known universe appears to have come into being at a particular point in the past. This point is stressed by Ernan McMullin, "Natural Science and Belief in a Creator," in Physics, Philosophy, and Theology: A Common Quest for Understanding, ed. Robert J. Russell, William R. Stoeger, and George V. Coyne (Vatican City: Vatican Observatory, 1988), pp. 49-79.

31. Quoted by John A. Huffman, Jr., "A Time to Be Silent and a Time to Speak," (Newport Beach, CA: St. Andrew's Presbyterian Church), p. 10. I have checked Huffman's account of the events in Minneapolis against other sources, and see no reason to doubt the accuracy of his report.