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Science and Religion in Western History: Models and Relationships

ALAN PADGETT

This chapter presents a brief survey of the interrelationships between science and religion in Western history. It begins by looking at three models of such relationships in the historical literature: conflict, harmony, and complexity. Each of these earlier models is found wanting, the first two for being too simple and the last one, complexity, for not putting forward any concrete model at all. Instead of these very broad models, the author proposes and gives brief historical overviews for three areas where some modest historical generalizations can be supported: the level of the individual scientist, the interaction of institutions, and the history of ideas where science and worldview intersect.

The dialog between science and religion is a fascinating and important one, which I have been privileged to participate in these last twenty years or so. In teaching issues in religion and science in many different contexts, I have often found an historical approach to be the best one. My more limited experience in the philosophy departments at Chinese universities, especially Peking University, also teaches me that history is an important way for Chinese scholars to enter into an intellectual topic. For this reason, my first chapter will be a brief overview of Western science as it has developed historically in relationship with religion. My particular focus among the many religions of the world is Christianity. This focus on the Christian religion arises from my own limitations, for this is my main area of expertise, but also from the long encounter of Christian faith with modern science. Christianity has encountered modern science fully because of the roots of modern science in Europe. So this first chapter will focus on the Christian religion in historical interaction with the development of science in the West. As we shall see, this movement has been in both directions, with Christian theology providing foundational assumptions for certain key scientists, and scientific discoveries challenging theology to revisit and revise its conclusions on several matters relating to a Christian understanding of the world, that is, the doctrine of creation.

An Overview of Historical Approaches

The growing interest in religion and science among scholars and the educated public has spawned a wonderfully rich literature on the history of science and religion. Differing theories of the relationship between theology and science have often motivated differing approaches to the history of science and Christianity. Of particular import, in terms of its influence upon recent thought, is the *conflict model*. The most famous and influential works from this perspective were written in the nineteenth century by John William Draper (1811–82), *History of the Conflict between Religion and Science* (1874); and Andrew Dickson White (1832–1918), *A History of the Warfare of Science with Theology in Christendom* (1896).¹ Both are historical overviews of the conflict or warfare between science and theology, and both works stress the inevitable victory of science, reason, and the forces of light over the backwater obscurantism of priests and churches – such was their narrow view of the matter. Both are written from a dubious historical perspective in which science and religion are in conflict. Despite questionable historical reliability and oversimplifications, this conflict model still has powerful intellectual defenders two centuries later, such as Richard Dawkins.² On the other side of the spectrum, historians of science have argued that the Christian worldview (and theology) provided the intellectual milieu in which natural science developed, and without which we would not have seen the rise of early modern science as we know it. Important versions of this approach have been put forth by A. N. Whitehead, Michael B. Foster, Robert K. Merton, Reijer Hooykaas, and Stanley Jaki.³ The problem with both of these approaches, that is both the conflict and the harmony approach, comes from interpreting the complex history of natural science and Christian thought in one-sided, all-or-nothing, categories. The realities and specificities of history have been more complicated, leading recent historians – notably Herbert Butterfield, David Lindberg, Ronald Numbers, and John Headley Brooke – to put forward a “complexity thesis.” On this third view, the relationships between theology and science have been too complex for any overarching generalization of either warfare or support to be plausible. This third approach, that is, the complexity thesis, is becoming the standard view among historians of science today.

Simplicity, Complexity, Modesty

The theses of conflict and harmony have the value of simplicity, but they do not fit with the historical data. This is a problem for any theory! As for the third model of complexity, while no doubt an improvement on the two simpler theories, the complexity thesis has the problem of not being a proper thesis. It does not add to our fund of historical knowledge. Its strength is also a serious weakness. It is not really an hypothesis, but rather the simple observation that things are complex. It puts forward no positive proposal. While the history of science and Christian thought is indeed complex, and no simple hypothesis will fit all the data, it is possible to propose a *modest thesis of support* between the creational theology of Western religion and the development of natural science in the early modern period, while at the same time recognizing the many areas of conflict and even complete independence. We must first look at various elements of these complex phenomena, before we can proceed to make any headway with even the most modest of generalizations.

In studying the history of religion and science, three areas of interaction are especially important to distinguish. There is the most concrete and specific domain, that of the individual biographies and changing perspectives of particular scientists. Here the complexity thesis is particularly valuable. A second area would be that of social institutions, both scientific ones and Christian religious institutions (including churches and their governing bodies). Finally, there is the history of ideas, and the interaction between creation theologies that were monotheistic (i.e., Jewish, Christian, and Muslim), and the developing philosophies and paradigms of particular scientific disciplines in Europe.

Separating out these three areas, it is possible to make modest historical generalizations about the development of natural science in the West, and its interaction with Christian theology. First we can make a claim about individual scientists. Many working scientists, in their own particular perspectives, found support for their scientific endeavors from their theological faith. In other words, many (but my no means all) of the men and women who were instrumental in the development of specific scientific disciplines were in fact believers, and found in their faith an important impetus to scientific exploration. Copernicus, Kepler, Galileo, Descartes, and Newton would all be examples of this common pattern. It is equally true that the scientists often felt it necessary to revise their religious beliefs in the light of their scientific discoveries, or based upon their scientific assumptions. Galileo proposed reading portions of the Bible in ways that did not conflict with the new astronomy he was advocating, for example, while Descartes rejected the possibility of miracles because of his understanding of God's immutable character as the author of the laws of nature.⁴ At the same time it is important to note that individual scientists also found conflict between theology and their growing scientific understanding of the world. Charles Darwin is an example of a scientist who came to believe that a scientific worldview is incompatible with traditional theological belief.⁵ Despite such examples, for many if not most of the particular natural philosophers or scientists from the middle ages to the middle of the nineteenth century, religious belief of various types provided a larger philosophy of life within which they pursued their scientific endeavors.

Having noted the importance of a theistic worldview for the work of individual scientists in the past, we can move to the larger stage of the history of ideas. As a general rule, my second modest generalization is that the various sciences developed historically in the larger context of a Christian worldview, which included a particular notion of nature as God's creation, ordered by the divine law. As John H. Brooke correctly notes, "In the past, religious beliefs have served as a *presupposition* of the scientific enterprise. . . . A doctrine of creation could give coherence to scientific endeavor insofar as it implied a dependable order behind the flux of nature."⁶

Now we have to turn to a much more complicated domain, that of institutional history. In this area of interest, at the level of institutional history, the relationships between science and religion are much more mixed. The development of natural science (or natural philosophy as it was once called) has never been a major goal of the Christian Church as an institution. On the other hand, the Church has long valued learning, and established institutions to further teaching and learning of all types – but especially religious instruction. At best we can say that the Church has founded schools, colleges, universities, and hospitals where scientists were able to do their work. In Western history, both the hospital and the university had specifically Christian foundations. The major universities of Europe and North America were founded on Christian principles and by Christian leaders. These include Paris, Oxford, Cambridge, Heidelberg, Harvard, Yale, and Princeton. By the

nineteenth century, however, Western universities had for the most part become mostly secular or pluralistic. The same story can be told about hospitals, all of the earliest ones founded by Christians. Thus in an indirect way, the Church supported the work of scientists by creating hospitals and universities. But the specific work of natural philosophy and natural science has usually been of little concern to Church leaders.

It is important also to see that many times the institutional Church, along with leaders of popular Christian movements, have opposed scientific discoveries and the views of certain scientists. In a few extreme cases, they oppressed or killed the “heretics” who were seeking to advance human knowledge. The examples of Copernicus, Galileo, and the Scopes trial in Dayton, TN are sober reminders that Christian organizations have sometimes opposed scientific inquiry. Fortunately, these examples are few and far between. If we had to make a modest generalization, one could claim that many Christian institutions have provided some limited support for scientific inquiry, but just as often a kind of benign neglect was evident on the part of Church leadership. At the same time, and more famously, on occasion the organized Church or a key Christian leader has opposed scientific discovery and the freedom of scientists to publish their ideas abroad. The case of Galileo is probably the most famous of these.

The long and complicated history of interaction between science and theology in the West supports a complex conception of their relationships. For institutions, the story is a mixed one, with the university in particular being an important Christian contribution to the development of natural philosophy, and later, natural science. At the level of worldviews, the specific paradigms of the various sciences arose in the intellectual context of a theological understanding of the natural world as God’s creature, ordered by the will of the Creator into reliable structures which could be discovered and predicted. Finally, for many individual scientists, Christian faith often provided a motive for their scientific efforts, but this was hardly uniform among them all. Having considered what I believe to be a plausible, modest generalization of support for science by the Christian religion, we can now move on to the historical narrative itself of religion and science in the West.

Historical Developments

The relationships between Christian theology and natural science in the West have been complex, involving numerous interactions over the millennia. The roots of Western science reach back through the Middle Ages to the classical period. All of what we now call science started out as philosophy, specifically natural philosophy. The greatest of the classical natural philosophers was Aristotle (384–322 BC), and much of classical and medieval natural philosophy is a development of the Aristotelian tradition, as modified over time. Important contributions have also come from Neo-Platonism and Stoicism, as these were integrated into the larger Aristotelian tradition. This integration took place in a long series of commentaries on the scientific works of Aristotle. Natural philosophers would present their own views in commentaries, which interacted not only with Aristotle but with other commentators before them. The scientific revolution of the seventeenth century both borrowed from, and developed over again, this tradition in natural philosophy.

During the classical period, the Church was not particularly interested in natural philosophy. Greek philosophy was important only as a tool to prepare the way for the gospel, and the theologies of Plato and Aristotle were explicitly rejected by the Church.

In commenting upon the early chapters of Genesis, however, the best theologians also drew upon natural philosophy to provide an integrated understanding of creation. Basil the Great's *Hexameron*, a commentary of the first six days of creation, is the most influential of these works among the Greeks.⁷ In the Latin West, Augustine's *Literal Commentary of Genesis* also drew upon natural philosophy in expounding the meaning of Scripture for his time and culture.⁸ For both Basil and Augustine, the word of God takes priority over the secular learning of natural philosophy. Nevertheless, the Bible must be understood as the truth, and interpreted in a manner consistent with the truth known from any area of study, including the wisdom of natural philosophy, when that is relevant. For the Church in this period, science rightly understood (and placed within its proper limits) was a servant. This has come to be called the "handmaiden" metaphor, with theology being the queen of the sciences. The Church as institution was not particularly interested in promoting scientific study, but it did sometimes use the result of scientific learning. For the most part the Church ignored natural philosophy.

The exception to this rule is one who stands head and shoulders above any other early Christian thinker as a natural philosopher: John Philoponus (around AD 570).⁹ Philoponus was a natural philosopher in his own right, and entered fully into the tradition of commenting upon Aristotle. A Christian Neoplatonic scholar of Alexandria, Philoponus taught a kind of natural philosophy influenced by his Christian worldview. He argued against the eternity of the world on philosophical grounds, and was also critical of Aristotle's views on motion. He was an exception to the general rule of Christian scholarship using rather than adding to natural philosophy in this period.

The Middle Ages were a time of consolidation in learning.¹⁰ The Church contributed to the continuation of science in three ways. First, monasteries, schools, and cathedrals were especially important in the West as repositories of the learning of the Greeks and Romans. The handmaiden metaphor made the learning of the classical period important to theological reflection, and monks laboriously copied Greek and Latin books over the centuries. Second, the invention of the medical hospital, which seems to have arisen in the Byzantine empire, provided an institutional home for the development of medical knowledge and anatomical research which would flower in the Renaissance. Third, the foundation of universities in Europe created a center for learning and research, which aided in the development of medieval and renaissance natural science. This was especially true when the Aristotelian tradition again was discovered in the Latin West in the twelfth century, as the new universities were being established.

Both Byzantine and Muslim empires developed important areas of science, medicine and mathematics from the fall of Rome to the rise of Western universities. These were for the most part carried out in the Aristotelian tradition. This large literature was then translated into Latin, and became the basis for natural philosophy in the Arts curriculum of the medieval university. Two medieval philosophical movements proved important in altering this Aristotelian tradition, toward the philosophical framework of early modern science. First, voluntarism (in natural philosophy) insisted the basic principles of nature are not eternal and necessary, but rather the free creation of the First Cause. In the natural philosophy of the Middle Ages, God was identified as the first or primary cause of everything that exists. Second, nominalism in metaphysics moved natural philosophy away from metaphysical speculation toward an empirical investigation of the world. Finally, some natural philosophers like Thomas Bradwardine of Oxford (c. 1295–1349) developed the geometrical and mathematical description of the natural world, very much in debt to Greek and Arabic

mathematics. All of these developments in the Arts faculties took place in relative isolation from the theology faculty, except for the foundational presupposition of a First Cause, who was the lawmaker behind the fundamental principles of nature. The handmaiden metaphor allowed for the development of a semi-independent natural philosophy during the medieval period.

The scientific revolution of the sixteenth century borrowed from and fought against this earlier medieval tradition. While the Middle Ages made the scientific revolution possible, the new methods provided a real break from the past. What did not disappear during this stage was the larger theistic worldview of the scientists. A good example of this comes from the work of Copernicus himself. A Polish canon and church administrator, the intense labors of Copernicus (1473–1543) were in the service of the liturgy of the Church. There was a need to revise the Church calendar, especially the accurate prediction of holy days like Easter. It was for these reasons that Copernicus organized and defended his proposed model of the solar system, that is, for a more accurate prediction of things like the winter solstice.

It is not Copernicus, however, but Galileo Galilei who is arguably the first significant modern scientist. The earliest developments in modern science took place in astronomy and physics, and Galileo was in the front rank of the scientific revolution on just these subjects. He exemplifies the new methods of science, which would be experimental, empirical, and mathematical. Galileo, however, was also a life-long Catholic, and believed that his discoveries could and should be brought into harmony with the teachings of Scripture.¹¹ Here he ran into significant problems with the anti-Protestant forces in the Roman Catholic Church during the Counter-Reformation. The Church alone had the right to establish the meaning of Scripture, they thought, not individuals like Galileo. The Copernican “heresy” was condemned in 1616, and Galileo was later condemned for promoting it, after promising not to. In condemning her own sons, Galileo and Copernicus, the institutional Catholic Church was in reality condemning her own assumption of power. Here we find the fuel for the false claim that the Church has always opposed science. In Protestant lands, science fared a bit better. The Lutheran astronomer Johannes Kepler (1571–1630) was free to publish his theological, philosophical, and scientific speculations without reproof from his Church. Kepler was a mystic and a mathematician. His defense of Copernicus and the new astronomy drew upon Christian truth, geometry, and natural philosophy in equal measure.

With the success of the natural sciences arose a more mechanistic understanding of the natural world in the seventeenth century. Especially important for this new understanding was the work of the French philosopher and mathematician, René Descartes (1596–1650). Yet Descartes was profoundly theistic in his understanding of the fundamental principles of nature. For him, God is the ultimate source of the material and the laws or principles of the natural world. What Descartes excluded was any appeal to God’s special action within the natural sciences.¹² Although this mechanistic worldview is sometimes called “Newtonian,” we should remember that Issac Newton himself (1642–1717) was neither a Deist nor a materialist, but a Christian theist. Newton wrote as much about the Bible as he did about physics, and was a deeply influenced by his (non-Trinitarian) religious faith in developing his new natural philosophy on mathematical grounds.¹³ This larger theistic framework for the development of natural science would soon be challenged by a mechanistic picture of nature which excluded God’s hand in creation.

The mechanistic picture of nature which resulted from early modern science and Enlightenment philosophy challenged the common Christian view that particular, specific acts of nature were the special acts of God. Such “miracles” were often dismissed as superstition.

Rather, for those scientists and philosophers who embraced both the Christian God and the mechanical philosophy, God acted only through the laws and principles of the natural world, including the basic structures of objects and organisms. The influential scientist Robert Boyle (1627–92) is a good example of one who combined a deep reference for the Creator with a strong impulse to study creation according to the methods of the natural sciences, that is, keeping supernatural events out of the explanatory focus of natural philosophy. This division in fact goes back to the distinction between natural philosophy and theology in the Middle Ages, but the seventeenth and eighteenth centuries saw a new and powerful revival of it.

The challenge to Christian thought in the eighteenth century did not in fact come from science, but rather from anti-Church and anticlerical forces in the Enlightenment. The wars of religion between various factions of Christian Europe made the appeal to tradition and authority (necessary to Christian theology) appear to be absurd. Reason and science were the new substitutes for divine revelation. It is not science itself, but the appeal made to science, nature, and reason by Enlightenment thinkers, which resulted in new worldviews which were at odds with historic Christianity. The Deist movement, which began in England, appealed to reason, science, and nature as superior sources of religious insight. Deism was popular among philosophers more than among working scientists during the eighteenth century. The American Benjamin Franklin (1706–90) is a good example of a politician, philosopher, and scientist who was also a Deist. In France, it was easy for scientists and philosophers in the Cartesian tradition, such as the Baron d'Holbach (1723–89), to propose a completely materialistic *System of Nature* (1770) which dispensed with God altogether.¹⁴ By eliminating God from the explanations of science, scientists in this materialist tradition thought they were also eliminating God. In this same materialist tradition as d'Holbach, the work of the mathematician and astronomer, Pierre Simon de Laplace (1749–1827), was likewise theologically motivated, or we had better say, a-theologically motivated. In promoting scientific knowledge they also mixed in their materialistic philosophy which was implicitly (or explicitly) anti-theistic.¹⁵

The late eighteenth and nineteenth centuries saw a tug-of-war between those who thought both science and reason in general were opposed to Christian faith or indeed any religious “superstition,” and those who sought to use science and reason in defense of that same faith. Both Thomas Huxley (1825–95) and Sigmund Freud (1859–1939) belong to the first group. Huxley was a popular defender of Darwin, who felt that evolution was incompatible with traditional religion. He coined the term “agnostic” to describe his lack of faith in God, which he distinguished from atheism.¹⁶ Freud's explanation of religion simply assumed that a scientific worldview makes theology false. God could be nothing more than the psychological projection of our need for a father-figure.¹⁷

The second group of intellectuals during this period used reason to defend religious belief. Among them was a long tradition of British “natural theology,” which sought to demonstrate the wisdom of divine Providence in the creation of organisms. William Paley (1743–1805) was the best known, and his book *Natural Theology* (1802) was required reading for those entering Cambridge University. One scholar on the Cam, Charles Darwin (1809–82), the son of a liberal Anglican minister, first encountered biological science in this explicitly Christian context. His theory of biological evolution soon undermined the natural theology he was raised on, since the apparent design of a biological organism could now be subsumed under the larger umbrella of mechanistic forces of nature. There seemed to be little left for God to do. Yet specifically Christian opposition to Darwinian evolution

(as opposed to scientific critique) hardly occurred in the nineteenth century. For the most part, biologists and geologists of faith were able to accommodate long geological ages and some form of organic evolution (often a different version than Darwin's) in their Christian worldview. Indeed, the most important defender of Darwin in America, Asa Gray (1810–88) of Harvard University, was an explicitly Christian scholar, who wrote letters and essays (even to Darwin) about the religious implications of evolution.¹⁸ Darwin himself struggled with a continued belief in the providence of God, in the light of the personal suffering in his own family, and the larger problem of death and mutation necessary to his theory of *The Origin of Species* (1859).

God was gradually pushed out of the explanatory scheme of natural science in the modern period. The growing specialization and professionalism of the sciences meant that the theological framework which gave birth to early modern science could now be dispensed with. The sciences were their own justification for the specific mode of rationality and domain of inquiry they perpetuated. God did not enter into the paradigms of the sciences. Particular scientists could be religious or not, depending upon their own larger philosophies of life, but this did not affect their discipline. Still, some Christian believers who embraced the new evolutionary theory could welcome this development. In the words of Aubrey Moore of Oxford (1848–90), "Darwinism appeared and, under the disguise of a foe, did the work of a friend." Modern science forces us to think of God as involved everywhere in creation, or not at all. "Either God is everywhere present in nature or He is nowhere."¹⁹ What modern science could not allow was a God who was "an occasional visitor," that is, a god of the gaps who shows up now and again in natural history. While it took Christian scholars many years to accommodate biological evolution, among academic theologians today Moore's viewpoint is the dominant one.

Recent Developments

The nineteenth century ended culturally with World War I, the "war to end all wars." Following World War I and the end of the era of optimism in Europe, three theological movements arose out of the trenches. There was the conflict between the old liberal or modernist theology and the new fundamentalism coming out of the USA. A third theological movement was European in origin, and neither modernist nor fundamentalist. This new dialectical theology or "neo-orthodoxy" as it was sometime called, had its chief proponent in Karl Barth (1886–1968).

Liberal theologians like Aubrey Moore were willing to accommodate Darwinism and divinity. Some of the earliest fundamentalists of the first decades of the twentieth century were willing to accept some form of evolution. But as the conflict between modernism and fundamentalism heated up, the literal interpretation of the Bible, especially Genesis and Revelation, became increasingly important to the popular leaders of fundamentalism.²⁰ Before the end of the 1920s, more than twenty state legislatures in the USA would debate anti-Darwinist legislation for public schools. The fundamentalist – modernist conflict thus moved from the churches to the schools. Once again institutional Christian forces (this time the popular fundamentalist movement) would seek to oppose the freedom of scientific inquiry. To be fair, the fundamentalists did not think of Darwinism as a legitimate science, but their primary motivation was clearly Biblical rather than scientific. In Dayton, Tennessee, at the infamous "Scopes Monkey Trial" (1925) the anti-Darwinian legislation

was put to the test, in a nationwide publicity stunt. Conservative Protestants have continued to oppose organic evolution on religious and scientific grounds ever since. Even those who are Young Earth creationists, however, accept the other areas of natural science as valid and important sources of knowledge.

Unlike liberals and fundamentalists, the new dialectical theologians were decidedly uninterested in science. Karl Barth's famous rejection of any and all natural theology led to a growing distrust of any attempt to bring science or philosophy together with the revelation of God in Jesus Christ.²¹ The neo-orthodox emphasized the independence of theology from other domains of human knowledge, because of its basis on the Word of God.

Liberals who sought to bring together theology and science into a larger understanding of the world were often influenced in this period by a movement known as process philosophy. An important figure in this school was the French priest and paleontologist, Pierre Teilhard de Chardin (1881–1955), who blended evolution, cosmology, and Christology into an evolutionary theology that brought him into conflict with his superiors in the Society of Jesus. The philosopher A. N. Whitehead was the major influence in America in process thought. Process philosophy appealed to liberal Christian scholars just because it provided a rational way to bring God, philosophy, and science into harmony.

The history of the complex interactions between science and theology do not admit of any simple model. In the modern period, the institutional support of the Church was no longer needed for the development of science. The theological presuppositions which had made science possible in the early modern period were abandoned as a common faith in the sciences by the professional guilds. Individual scientists could, of course, continue to find theology important and true, but this was not necessary for their specialization *per se*. Science and theology became independent intellectual disciplines.

The single most important work to challenge this *status quo* at mid-century was neither religious nor scientific. It was the revolutionary philosophy of science text by Thomas Kuhn, *The Structure of Scientific Revolutions* (1962). Drawing on the work of philosophers and historians of science, Kuhn argued that changes in natural science were not based on facts and logic alone. Science was also based on tradition, and on "paradigms" of shared values, rationalities, and perspectives which gave shape to each of the scientific disciplines. Science was based upon epistemic values and metaphysical presuppositions which it owned, but could not justify. Science was not a complete worldview, but rather depended upon these larger perspectives for the working assumptions by which it carried out its task. This idea brought science into closer contact with philosophy and religion. This postmodern turn in the understanding of science allowed room for a Christian worldview (and theology) to enter once again into dialogue with science.

Contemporary Proposals

In the latter decades of the twentieth century, one sign of a postmodern turn in the larger Western culture included a desire to bring science, morality, and spirituality into closer conversation. Natural science was not seen as a hermetically sealed off realm of logic and facts, but another human, communal, and historical quest for understanding. As such, science could be brought into dialogue with religion. A remarkable resurgence of interest in such a dialogue was the result. Books, conferences, societies, and even professorial chairs were devoted to the new dialogue between science and religion. Prominent among

those pressing for greater interaction between science and theology were scientists who themselves began to explore theological issues. The idea of a natural scientist turning to theology for answers captured the popular imagination, as well as the funding dollars of Sir John Templeton and the Templeton Foundation. Physicists like Ian Barbour and John Polkinghorne, and biologist like Arthur Peacocke and Theodosius Dobzhansky brought their scientific background and knowledge into the theological conversation, to the enrichment of both.²² Numerous proposals about how theology and science should now be interrelated have come out of the current literature and the worldwide dialog between science and religion. Unlike the earlier historical models we discussed above, these viewpoints should not be confused with descriptive analyses of how science and theology have in fact related in history. Rather, these are current proposals for the ongoing relationship between science and religion. Given the large literature on this topic, I can only provide here a few suggestive types.²³

A. *Science falsifies theology.* This is the old scientific materialism again. The popular science writer Richard Dawkins, known for his compelling presentation of biological evolution, exemplifies this atheistic position.

B. *Scientific explanation needs theological completion.* The recent attempt by Intelligent Design author Michael Behe to insert direct intelligent design into the explanatory scheme of biology, is an example of the view that science cannot explain all regularly occurring natural phenomena. The door is open for God to re-enter the natural sciences as an explanation of particular events.

C. *Science and Theology are independent.* The prominence of linguistic philosophy, and neo-orthodoxy, makes this option a popular one among mainstream theologians. It was recently given a boost by the influential evolutionary biologist Stephen Jay Gould, in his argument for a principle of NOMA (Non-Overlapping Magisteria) regarding religion and science.

D. *Dialogue, Consonance, or Complementarity.* Theology and science, as intellectual traditions and academic disciplines, do have something to say to each other in this model, but no attempt is made to bring a larger unity or consistent worldview to bear on their differences. Each is allowed to be in conversation, yet remain independent. A good example of this is the work of psychologist Fraser Watts, lecturer in theology and science at Cambridge University, who argues for complementarity between theology and science. Also in this general type would be the Scottish theologian Thomas F. Torrance, who brought the theme of natural theology back into the Barthian theological tradition.

E. *Mutuality, Interdisciplinarity or Integration.* This type of proposal suggests that theology and science should be brought into a larger harmony at a philosophical or interdisciplinary level. The notion of integration would bring them both into a harmonious metaphysical synthesis, while the less ambitious models of mutuality or interdisciplinarity allow theology and the special sciences to mutually influence each other in the quest for truth, while yet remaining distinct. A good example of integration is Ian Barbour, while interdisciplinary and postfoundational rationality are being championed by J. Wentzel van Huyssteen, a professor of theology and science at Princeton Seminary. My own work in this field has sought to develop a "mutuality model" for science and theology.

Which of these proposals, if any, will be the most influential for the twenty-first century has yet to be seen. What is clear is that a great diversity of views will continue to be proposed

by theologians, scientists, and public intellectuals interested in the interaction of faith and science. The strong interest and growing literature in science and theology shows no sign of abatement in the near future. This bodes well for those interested in continuing the dialogue between science and theology.

Notes

- 1 A. D. White, *A History of the Warfare of Science with Theology in Christendom*, 2 vols. (New York: Appleton, 1922 [1896]); John W. Draper, *A History of the Conflict between Religion and Science* (New York: Appleton, 1898 [1874]), both books now online at books.google.com (accessed 01/15/09).
- 2 Richard Dawkins, *The God Delusion* (New York: Houghton Mifflin, 2006). For a good response to Dawkins and the “new atheism” found in similar authors (e.g., Sam Harris, Christopher Hitchens), see John F. Haught, *God and the New Atheism* (Louisville: Westminster John Knox, 2008).
- 3 See A. N. Whitehead, *Science and the Modern World* (New York: Macmillan, 1925); Cameron Wybrow, *Creation, Nature and the Political Order in the Philosophy of Michael Foster* (Lewiston: E. Mellen, 1992) which reprints the relevant essays by Foster from the 1930s; Robert K. Merton, *Science, Technology and Society in Seventeenth Century England* (New York: H. Fertig, 1970 [1938]); Reijer Hooykaas, *Religion and the Rise of Modern Science* (Grand Rapids, MI: Eerdmans, 1972); and Stanley Jaki, *The Road of Science and the Ways to God* (Chicago: University of Chicago Press, 1978).
- 4 See Galileo’s *Letter to the Grand Duchess Christina* (1615) in Galileo Galilei, *Discoveries and Opinions of Galileo*, ed. Stillman Drake (New York: Anchor Books, 1957) and René Descartes, *Principles of Philosophy*, part 2, §36 & 37, in *Philosophical Writings of Descartes*, trans. J. Cottingham et al., 3 vols. (Cambridge: Cambridge Univ. Pr., 1984–1991), 1: 240–241.
- 5 On Darwin’s own religious views see chapter 8 “Religion,” in vol. 1 of Francis Darwin (ed.), *The Life and Letters of Charles Darwin*, 3 vols. (London: J. Murray, 1887), 1, pp. 304–17, online at darwin-online.org.uk (accessed 01/15/09).
- 6 J. H. Brooke, *Science and Religion* (Cambridge: Cambridge University Press, 1991), p. 19; see also Christopher Kaiser, *Creational Theology and the History of Physical Science* (Leiden: Brill, 1997).
- 7 Basil the Great, *Hexameron*, Eng. trans. In *Nicene and Post-Nicene Fathers*, second series, ed. P. Schaff et al. (New York: Christian Literature, 1895), 8, pp. 91–3, 97.
- 8 See the English translation by John H. Taylor: Augustine, *Literal Meaning of Genesis*, 2 vols. (New York: Newman Press, 1982).
- 9 On Philoponus, see the fine online article by Christian Wildberg, “John Philoponus,” *Stanford Encyclopedia of Philosophy* (<http://plato.stanford.edu>), accessed 01/15/09.
- 10 On medieval natural science, see in particular Edward Grant, *The Foundations of Modern Science in the Middle Ages* (Cambridge: Cambridge University Press, 1996) and *God and Reason in the Middle Ages* (Cambridge: Cambridge University Press, 2001). The paragraphs on medieval science above draw heavily on this and other works by Grant.
- 11 See Galileo, *Letter to the Grand Duchess Christina*.
- 12 Descartes, *Principles of Philosophy*, §36.
- 13 On Newton’s religious views see James E. Force and Richard Popkin (eds.), *Newton and Religion* (Dordrecht: Kluwer, 1999).
- 14 Paul Henri Thiery [Baron d’Holbach], *The System of Nature*, trans. H. D. Robinson, 2 vols. (New York: Matsell, 1836) online at books.google.com.
- 15 On LaPlace and his philosophical views see the excellent biography by Roger Hahn, *Pierre Simon LaPlace, 1749–1827: A Determined Scientist* (Cambridge, MA: Harvard University Press, 2005).

- 16 Among many works by Huxley, see T. H. Huxley, *Science and Christian Tradition* (New York: Appleton, 1898), which contains his essay "Agnosticism." Online at books.google.com (accessed 01/15/09).
- 17 Among Freud's many writings on religion, see Sigmund Freud, *The Future of an Illusion* (New York: Anchor Books, 1964 [1928]).
- 18 See Asa Gray, *Darwiniana* (New York: Appleton, 1889) online at books.google.com (accessed Jan. 15 2009).
- 19 Moore's essay "The Christian Doctrine of God" appeared in a famous collection of theological essays, *Lux Mundi*, ed. Charles Gore (London: J. Murray, 1890), p. 99; online at books.google.com (accessed Jan. 15 2009).
- 20 On the history of fundamentalism and creationism, see Ronald Numbers, *The Creationists* (New York: Knopf, 1992).
- 21 See Emil Brunner and Karl Barth, *Natural Theology* (Eugene: Wipf and Stock, 2002 [1946]).
- 22 For Polkinghorne, Barbour, and Peacocke see representative works in the bibliography. On Dobzhansky, see Jitse van der Meer, "Theodosius Dobzhansky," in *Eminent Lives in Twentieth-Century Science and Religion* ed. N. A. Rupke (Frankfurt: Peter Lang, 2007).
- 23 References to authors mentioned in this typology are found in the bibliography of this chapter.

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