CHAPTER 2

The Encounter between Christianity and Science

Although our developing discussion focuses on Christology and genetics, it inevitably connects with two larger bodies of information: all major Christian doctrines and the whole array of life sciences. Classical Christology is central in the entire web of orthodox Christian doctrine, while evolutionary genetics is now fundamental to all the sciences that study life. At relevant points, then, essential orthodox Christian doctrines and key findings of the biological sciences will come into play. Furthermore, the interaction of Christology and genetics we seek depends on how we understand the broader Christianity–science relationship. Of course, various ways of looking at the Christianity–science relationship have developed over the centuries since the birth of modern science.

In this chapter, we contextualize our project by surveying the different interpretations of the religion–science relationship, which have in part been in response to major events in the history of science. Since Christianity was prominent in culture at the rise of modern science, much of our survey pertains to it specifically. We begin with a brief sketch of how modern science developed and how it changed society's view of the world. Then we survey the main interpretations of the religion–science relationship – *conflict*, *independence*, *dialogue*, and *integration*. This approach allows us to refer as we go to recurring themes and to accent the significance of our eventual conclusions.

The Scientific Revolution Challenges Religious Views

Science in antiquity covered everything from the earliest advances in agricultural technology in Mesopotamia to the development of key concepts in mathematics in ancient India. In ancient Greece, however, the intellectual seeds were planted to turn the almost universal human

wonderment at the night sky into a precise science: astronomy. Doing natural philosophy in the fourth century BC, Aristotle projected the structure of the universe as having Earth at the center around which the sun, moon, planets, and fixed stars revolve. In the second century AD, Ptolemy of Alexandria mapped the heavens, with the earth as center, supported by his calculations that helped make predictions of planetary positions. Ptolemy's more scientifically expressed geocentric theory correlated with both the common perception that the sun moves relative to the earth and resonated with the theological teaching of the medieval Christian church that humanity was the center of divine attention.

In the mid-sixteenth century, however, the Polish astronomer Nicolaus Copernicus, who served as a canon for the church, proposed that the sun, not the earth, was at the center of our solar system, triggering dramatic reaction. Protestant Reformer Martin Luther spoke derisively:

> There is talk of a new astrologer who wants to prove that the earth moves and goes around instead of the sky, the sun, the moon, just as if somebody were moving in a carriage or ship might hold that he was sitting still and at rest while the earth and the trees walked and moved. But that is how things are nowadays. . . . The fool wants to turn the whole art of astronomy upside-down. However, as Holy Scripture tells us, so did Joshua bid the sun to stand still and not the earth.[1]

Relying on a literal reading of Joshua 10:1–15 to support the prevailing geocentric view and asking no critical questions about the ancient biblical author's state of knowledge, Luther dismissed the new astronomy.

In 1543, Copernicus published *On the Revolutions of the Heavenly Spheres*. The Catholic Church reacted in a more measured way but eventually placed Copernicus's book on a censored list and prohibited its theory from being taught. However, the views of this respected Christian believer were revisited in the early seventeenth century amid a wave of Protestant opposition to them, leading the Catholic Church to ban them as contrary to the Bible. The new Copernican astronomy set the stage for what is called "the Galileo Affair" – which became symbolic of the birth of modern science out of ancient science.

In 1610, Galileo Galilei, an astronomer and mathematician born in Pisa, published *Starry Messenger* supporting the heliocentric theory of Copernicus. His arguments involved careful calculations based on his

[1] Martin Luther, *Table Talks*, collected by Jonathan Aurifaber, first published 1566. Luther's response to Copernicus's pamphlet *Commentariolus* of 1514.

observations accomplished with the newly invented telescope. However, in 1616, the Roman Inquisition declared heliocentrism "heretical":

> It has … come to the knowledge of the said Congregation that the Pythagorean doctrine – which is false and altogether opposed to the Holy Scripture – of the motion of the Earth, and the immobility of the Sun, which is also taught by Nicolaus Copernicus in The Revolutions of the Heavenly Spheres … is now being spread abroad and accepted by many.[2]

Galileo continued to offer the theory as an item for "discussion" without emphasizing its scientific truth until he was condemned at a second trial in 1633. The interested reader may wish to pursue the many personal, political, cultural, and religious nuances of the Galileo Affair, but these lie beyond our present scope.

Yet what we have here, right at the beginning of the Scientific Revolution at the dawn of modernity, are three particularly contentious issues that profoundly affect the relationship between science and Christianity. First, the method of biblical interpretation is crucial. In the Galileo Affair, the important biblical theological claim – that humanity is the focus of divine concern – was thought to be entirely compatible with the prevailing scientific claim – that the earth must be the center of our solar system. However, there is good precedent for not linking theological and scientific claims – such as tying the theological teaching about humanity's key place in God's purposes to factual statements about the position of the earth. For instance, in his commentary on Genesis, St. Augustine in the fifth century counseled that some scriptures should be interpreted spiritually, and perhaps figuratively, rather than literally, when literal interpretation ran counter to well-known facts – which he listed as the positions and orbits of the stars, the eclipses of the sun and moon, and so forth. He warned believers not to be "reckless and incompetent expounders of Holy Scripture" who confuse the public image of Christianity by associating it with "their obviously untrue statements."[3] Thus, Augustine, in effect, recommended that valid interpretations of biblical texts must respect extra-biblical knowledge established by "reason and experience."

Second, at this very early point in the birth of modern science, a version of the realism–anti-realism debate, as defined in Chapter 1, became

[2] *Opere*, XIX, 323. Quoted in Jerome Langford, *Galileo, Science and the Church* (New York: Desclee Company, 1966), 97–98.

[3] St. Augustine, *The Literal Meaning of Genesis*, 1.19.39, John Taylor, trans. (Westminster, MD: Newman Press, 1982).

crucial. Historians of science know that the Church was willing to tolerate Galileo's views as a "hypothesis" but not as a claim that it depicted the true behavior of the sun and planets. Interestingly, when Andreas Osiander (1498–1552) wrote the preface to Copernicus's *Revolutions*, he presented the heliocentric theory in anti-realist terms, saying that no one could "attain to the true causes" involved. This *instrumentalist* view of science implied that Copernicus was simply offering a convenient calculational schema for planetary motion, among many alternative calculational schema. Trying to defuse the disapproval of heliocentrism, Osiander conceded that astronomy does not purport to describe the real world, thus providing space for the Church to make its pronouncements about the structure of the heavens. However, Copernicus, like Galileo after him, assumed an implicit realism about science, holding that the new astronomy had discovered the best explanation of the phenomena and thus could be accepted as indeed telling us "the way things are" regarding the heavens.[4] As realist science advanced – led by astronomy – theology had to modify the scope of the reality about which it could make factual pronouncements. We will have more to say about this later.

Third, the transition from ancient to modern science turned on the method of science, which became a watershed in the history of human inquiry. Instead of working from a priori assumptions about how the world "must" work, the new method of science became the practice of posing hypotheses to test how the world works by observational data. Ancient geocentric astronomy was influenced by the Aristotelian conviction that all heavenly bodies moved in perfect circles (or epicycles) in orbit around the earth. Medieval astronomy embraced Ptolemaic astronomy and gave it theological support. Clever calculations were even employed to align the geocentric theory with some problematic planetary motion. But modern science shifted epistemic procedures for acquiring knowledge of the physical world toward the empirical and inductive, breaking the grip of top-down metaphysical preferences and theological perspectives. Over time, theological reflection was able to see the new scientific method as a way of knowing God's world.

Although the Galileo Affair is often seen as a symbol that science and religion have a difficult relationship and are often at odds, the above narrative suggests a more complex situation, which necessitates that we work harder to properly understand the nature and roles of these two

[4] Copernicus, *On the Revolutions of the Heavenly Spheres* (Buffalo: Prometheus, 1995; orig. 1543).

important human enterprises. The initial plausibility of the discussion before us, then, depends on arriving at more adequate meta-scientific and meta-theological assumptions. For now, let us trace the ramifications of the new science for what had been the medieval understanding of the world.

The Machine Model Replaces the Organic Model

The medieval worldview saw all reality as a unified whole, existing and moved by love, from the planets and stars to terrestrial earth and humans living upon it. Love's exalted status, having roots in Plato and the Neoplatonists and culminating in Dante's *Divine Comedy*, was seen by the medievals as emanating from God and pervading the cosmos, imbuing it with meaning and purpose. As literature scholar Peter Shakel says, medieval thinkers took the universe to be, in a sense, alive, "dancing, ceremonial, a festival" of life and love grounded in God.[5]

The rise of the new science seemed to portend a different sort of world than previously envisaged. The new astronomy was not simply constituted by theories about the motions of physical objects in space, as confirmed empirically by Copernicus and Galileo. Instead, by disturbing the dominant view of reality – that is, of God and his created order – the Copernican Revolution seemed to undermine the meaning and purpose of everything. No wonder the resources of the Church were marshalled to support the prevailing understanding against the perceived threat.

A helpful way of characterizing what was ultimately happening in the Scientific Revolution is that a tumultuous transition in fundamental metaphors was occurring – the medieval "organic metaphor" was gradually being replaced by the modern "machine metaphor."[6] In other words, thinking and speaking of the universe as having meaning and everything in it as having its own purpose was shifting to a conception of the universe as consisting in material objects following lawlike patterns. Interestingly, Copernicus, Galileo, Kepler, and other early modern scientists were Christian believers and saw their work as an outgrowth of their faith because they were discovering the structure of creation. Over time, however, the scientific method they were pioneering came to stand on its own, requiring no explicit theological context, no reference to purpose, no

[5] Peter Schakel, *Imagination and the Arts in C. S. Lewis* (Columbia: University of Missouri Press, 2002), 114.

[6] Thomas Kuhn, "Metaphor in Science" in *Metaphor and Thought*, A. Ortony, ed. (Cambridge: Cambridge University Press, 1979), 409–419.

identification of what an object is for. Thus, the focus of scientific inquiry shifted from questions of purpose to questions of the mechanical behavior of matter, radically changing the foundational metaphor of the natural world.

For Aristotle and scientists following his approach to science, the complete explanation of any object required identification of its four causes – material, formal, efficient, and final.[7] The material cause of a thing is the material out of which it is made; the formal cause of anything is the very idea or essence that makes the object the kind of thing it is; the efficient cause is that which produced the object; and the final cause is its end or purpose. Consider the sonnet, which is composed of words (material) arranged in a certain structure (formal) by the poet (efficient) for the sake of, say, celebrating the beauty of nature (final). Or take the bunk bed composed of wood, screws, and mattresses (material) in a certain arrangement (formal) – not a mere pile – by the increasingly flummoxed father (efficient) for the sake of providing a place to sleep for his daughters (final). Ancient science, as reflected in the medieval view of the universe, sought the final cause of any object – and thus employed teleological explanation, which refers to an object's end or purpose (*telos*). And that end or purpose related to how the Christian God had ordered the world.

Although medieval science was Aristotelian in seeking teleological explanations, the new science sought only mechanical explanations. As science came to focus exclusively on efficient causes – on what produces some object or what makes it function – teleology was banished from nature and the organic model replaced. Francis Bacon, pioneer scientist in early modernity, aphoristically quipped that final causes in science were like the Vestal Virgins of ancient Rome – decorative but useless.[8]

Thus, the Scientific Revolution – that great transformation of our understanding of the natural world that began with Copernicus at the beginning of the sixteenth century and ended with Isaac Newton at the end of the seventeenth century – replaced the organic model of the world with the mechanical model. Christian thinking eventually adjusted to this change by seeing the laws and regularities of the universe as God's design for physical nature, which gradually became viewed as a divinely organized machine, and later as a self-sufficient machine without God or teleology. Newtonian physics provided a comprehensive framework for the "machine" or "clockwork" universe. In *The Mechanization of the World Picture*, E. J. Dijksterhuis, famous historian of the Scientific Revolution, writes that the

[7] *Physics* II 3 and *Metaphysics* V 2.
[8] Francis Bacon, *The Advancement of Learning* (1605), Book III, viii.

mechanical world picture led to seeing God as a "retired engineer" and then to God's complete elimination.[9] After that, no properly scientific explanation needed reference to God or purpose.

Although the physical sciences were readily subsumed under the mechanical model, biology as the science of life did not conform so readily. Descartes argued in the middle of the seventeenth century that living organisms are actually machines belonging to the world of matter, explicable by efficient causes, with no ends or purposes discernible by us. He held that we must, then, learn about living organisms as we do about all material things: by drawing conclusions from their observable effects.[10] Yet not all scientific thinkers were convinced that efficient causation could replace final causation in biological explanations.

Opposing the Cartesians, chemist Robert Boyle, for example, argued that the intricately structured eye is an example of something that has the immediate purpose of allowing an animal to see and may indeed have a higher purpose as well.[11] For Boyle, a machine universe, operating by strict laws with no intentionality or purpose, would never produce the eye – God had to be involved. By the end of the eighteenth century, there was still wide agreement that teleology was essential to biology, following the basic argument promoted by Boyle. This occasioned philosopher Immanuel Kant to despair that biology could ever be mechanized, saying, "there will never be a Newton of the blade of grass."[12] To Kant's dismay, biologists had no viable ideas about how living things could change over generations.

However, with the coming of Darwin in the mid-nineteenth century, biology joined the Newtonian Revolution as organisms were shown to be products of a long, slow process of adaptive change. In his 1859 book, *On the Origin of Species*, Darwin argued that species arose from common ancestors as natural selection acted on heritable variation. Although other researchers were coming to recognize elements of evolution – such as common ancestry and development of new species – Darwin's discovery of natural selection identified the actual mechanism of adaptive change, its

[9] E. J. Dijksterhuis, *The Mechanization of the World Picture* (Oxford: Oxford University Press, 1961), 491.

[10] Rene Descartes, *The Principles of Philosophy* in *The Philosophical Works of Descartes*, E. Haldane and G. Ross, eds. and trans. (New York: Dover Publications, 1955; orig. 1644), 169.

[11] Robert Boyle, *A Free Enquiry into the Vulgarly Received Notion of Nature*, E. Davis and M. Hunter, trans. (Cambridge: Cambridge University Press, 1996; orig. 1688), 397.

[12] Immanuel Kant, *Critique of Judgement*, J. H. Bernard, trans. (New York: Hafner, 1951), 270.

efficient cause, thus transforming biology by bringing it under the machine model with the rest of the sciences.[13] In 1863, Ernst Haeckel celebrated Darwin as the "Newton of the blade of grass," signaling that the mechanization of the sciences, longed for by Kant, was now complete.[14]

The triumph of the mechanical model of the sciences has continuing and profound intellectual and cultural impact, including impact on our present discussion of Christology and biology. By the early twentieth century, the mechanical model had been incorporated into what we may call "scientific naturalism" as the prevailing philosophical outlook. Essentially, scientific naturalism was a commitment to the world of the natural sciences as the fundamental reality and to the methods of those sciences as exclusive avenues of knowledge, coupled with the denial that, as philosopher Alvin Plantinga puts it, God or anything like God exists. Philosopher Roy Wood Sellars spoke for many in remarking that "we are all naturalists now."[15]

For present interests, let us distinguish between *methodological naturalism* and *metaphysical naturalism*, sometimes called philosophical naturalism. Methodological naturalism seeks to explain natural phenomena in terms of natural causes while bracketing reference to supernatural entities or purposes. Adoption of methodological naturalism is widely regarded as an essential feature of science, a feature that demarcates science from nonscience. Methodological naturalism in the practice of science, then, is worldview neutral, equally consistent with its practitioners having religious or nonreligious commitments. Metaphysical naturalism, however, is a philosophical worldview, asserting that physical nature alone is real and has causal primacy in everything that happens. This worldview entails that there is no God or divine realm, which, in turn, generates important implications for concepts of humanity, morality, religion, and other important issues that we will encounter later in the book. The alliance of metaphysical naturalism and methodological naturalism forms, according to a common perspective, a total worldview that displaces a theistic or Christian worldview.

Yet metaphysical naturalism and methodological naturalism are not necessarily connected. Although metaphysical naturalists claim that

[13] For an excellent explanation of how Darwinian evolution completed the machine model of physical reality studies by science, see Michael Ruse, *Charles Darwin: No Rebel, Great Revolutionary* (Cambridge University Press, forthcoming).

[14] Ernst Haeckel, "Über die Entwicklungstheorie Darwins" *Amtlicher Bericht der Versammlung Deutscher Naturforscher und Aerzte* 38 (1863): 17–30.

[15] Roy Wood Sellars, *Evolutionary Naturalism* (New York: Russell and Russell, 1922), i.

science (which operates by methodological naturalism) both completes and supports an atheistic or anti-religious outlook, it can be readily argued that methodological naturalism originated in the Christian idea that God gave rational creatures powers to engage an orderly, discoverable empirical creation. Therefore, one may reasonably hold philosophical beliefs about the Christian God as creator of a purposeful universe while also maintaining the view that methodological naturalism is a reliable way to inquire into that created universe. As our discussion develops, we will monitor the philosophical naturalists' attempt to co-opt methodological naturalism.

The above survey provides a preview of the myriad misunderstandings and disagreements that can arise between biology and theology due to the foundational shift from the organic to the machine model of the natural world. Now, our discussion turns to an examination of how the relationship between religion and science has been interpreted since the Scientific Revolution.

What Is the Relation between Theology and Science?

Our study of the intersection of Christology and biology will play out very differently depending on how we conceive of the overall theology–science relationship. In his book *Religion and Science*, Ian Barbour, a theologian and physicist, identifies four ways of looking at the relationship between religion and science that we use to clarify our approach to this project. Barbour labels the four models: *independence*, *conflict*, *dialogue*, and *integration*. The models are differentiated according to three important features of both religion and science – their *objects*, *methods*, and *aims*. That is, both areas have objects of investigation, methods for knowing, and explanatory aims that can be identified and compared. Before proceeding, we note that the terms "religion" and "science" each cover a wide range of phenomena, which leads to numerous ways of thinking about their relationship – such as cultural compatibility or incompatibility, and the like. However, our use of the term "religion" refers essentially to the *intellectual content* of a religion, its claims about what is true – and we are especially interested in the intellectual content of orthodox Christianity. Although Christians may make various religious claims that do not have official theological status, we engage the truth claims that constitute official Christian doctrines formulated at the Great Ecumenical Councils and summarized in the Great Creeds. Since science also has its own *intellectual content* – as reflected in its truth claims – we can put the respective truth claims of science and religion in perspective as we investigate their relationship. Obviously, if theology, say, addresses some of the same objects

that science investigates, making truth claims about them, such pronouncements can affect their relationship.

We accept the basic intent of Barbour's four models and refer to them throughout the book, but here we need to elucidate them with some analytical precision that advances our unfolding discussion of Christology and biology. The analytical precision we seek pertains to the propositions that may be affirmed by either theology or science. The reader may find it helpful for us to explain this by asking and then answering a series of questions specifically about how the truth claims of theology and science might relate. But our ultimate interest will be in how Christological claims and biological claims might relate.

First, begin with the following question about the relations between the truth claims of religion and science:

> *Question 1*: Are the implications of religion and the implications of science such that they could, in principle, both imply a truth-value for the same atomic (non-logically complex) proposition?

That is, for some atomic proposition P – say, "God created the world in six, consecutive 24-hour days" – could both religion and science imply a truth-value for that proposition? We use the technical language here of an atomic proposition because there are some complex propositions that both science and religion would imply a truth-value for. Consider "or" statements composed of truths from theology and from science. "God exists or atoms exist." Both science and theology agree that that claim is true. To rule out such sneaky answers to *Question 1*, we narrow our focus to simple, not logically complex, propositions.

It does not matter at this point whether they agree or disagree in their assessment of that proposition. All that matters is that, at least in principle, they could both have something to say about the same object. Before we answer *Question 1*, we note that the question as stated is very broad, as is the whole religion–science discussion in our culture. Obviously, religion taken as a whole *could* include some empirically testable claims within the domain of science. For instance, some religious believers explicitly take their religion to include such claims as "God created the world in six, consecutive 24-hour days" or "Helios draws the Sun across the sky each day with his mighty chariot." So, the broad understanding of religion seems to yield an immediate "yes" to *Question 1* above. However, as we proceed, we eventually narrow our study to a particular set of religious claims, those beliefs expressed by Chalcedonian Christology, which we explicate in Chapter 3. Clearly,

focusing on other sets of religious beliefs, say, those of different religions, might yield different answers to our *Question 1*, but it should be no surprise that one religion would have a different relation to science than does another religion when their respective truth claims are the focus.

Return, then, to our *Question 1*, but narrowed to exclusively Christian beliefs, and especially the beliefs included in Chalcedonian Christology. In this restricted case, if the answer to the question is "No" – which means that there is not even one proposition upon which Christian beliefs and the deliverances of science could both, even in principle, imply a truth-value – then their relationship is depicted by the *Independence model*, or what is sometimes called Compartmentalization. The findings of science do not imply anything one way or another concerning the Christian doctrines in question, and vice versa.

If the answer to *Question 1* is "Yes" – that is, there is at least one proposition upon which Christian beliefs and the deliverances of science could both, in principle, imply a truth-value – then we have some more questions to answer. For instance, we must answer this:

Question 2: Given a "Yes" to *Question 1*, such that the deliverances of science and Christian doctrine can in principle speak to the same topic, have we found and assessed some implications where they both determine a specific truth-value to a particular atomic proposition?

In other words, if we know that science and Christianity can both speak to the truth or falsity of at least some statements, have we found some such statements? And have we figured out whether they agree or disagree?

If the answer to *Question 2* is "No" – that is, we have not yet both found such statements and assessed whether they agree or disagree – then we may favor a *Dialogue* model under which further discussion is desirable. We will wish to keep the discussion going and see whether there are conflicts or concords in the future.

If the answer to *Question 2* is "Yes" – that is, we have found such statements and assessed whether they agree or disagree – then we are prepared to answer one last question to determine which model describes the relationship:

Question 3: Given that such statements – ones where science and Christian doctrine address the same topic – have been found and assessed, are the scientific claims and Christian doctrines consistent in their implications?

That is, supposing that science and Christian doctrine both have something to say about some proposition, do they endorse the same or different truth-values for that proposition?

If the answer to *Question* 3 is "No" – science and Christian doctrine *are not consistent* in their implications, then the *Conflict* model applies. For any two sets of views, if one implies that some proposition is true and the other implies that the very same proposition is not true, then it follows that the two sets of initial views cannot be true together. Philosophically, for example, if Christianity implies that there is a God and metaphysical naturalism implies that there is not a God, then Christianity and metaphysical naturalism cannot *both* be true. This illustrates the definition of logical inconsistency: inconsistent propositions cannot all be true at the same time, in the same respect.

Finally, if the answer to *Question* 3 is "Yes" – meaning that science and Christian doctrine *are consistent* and not inconsistent in their implications – then we have the preliminary conditions for what Barbour calls the *Integration* model, or what some have called *Concord*. Furthermore, a robust form of integration would involve more than mere consistency; it would involve a kind of coherence or affinity between beliefs and even some overarching conceptual framework in which those beliefs make best total sense. This framework of course would take us in the direction of a comprehensive worldview. To summarize our step-by-step reasoning to this point, we offer the following flowchart in Figure 1.

Employing the four models of the religion–science relationship, defined in this analytic way, will help our treatment of Christology and biology focus more precisely on the logical relations between their propositions. Other very different projects might study social attitudes toward religion and science, or the major events involving them, or even the varying opinions of their respective practitioners – matters that touch on this project but are not its core concern.

Along these lines, dare we raise the prospect of integration between Christology and biology, let alone robust integration? Could our exploration of Christology and biology support the thought that orthodox Christianity and mainline science as bodies of truth claims might be integrated in a comprehensive worldview framework? As we proceed, we try to transcend the bifurcation of independence, remove apparent inconsistencies of supposed conflict, propose important items for rich and unexpected dialogue, and discern the shape of possible integration at the worldview level. Clearly, if any one of the models of the religion–science

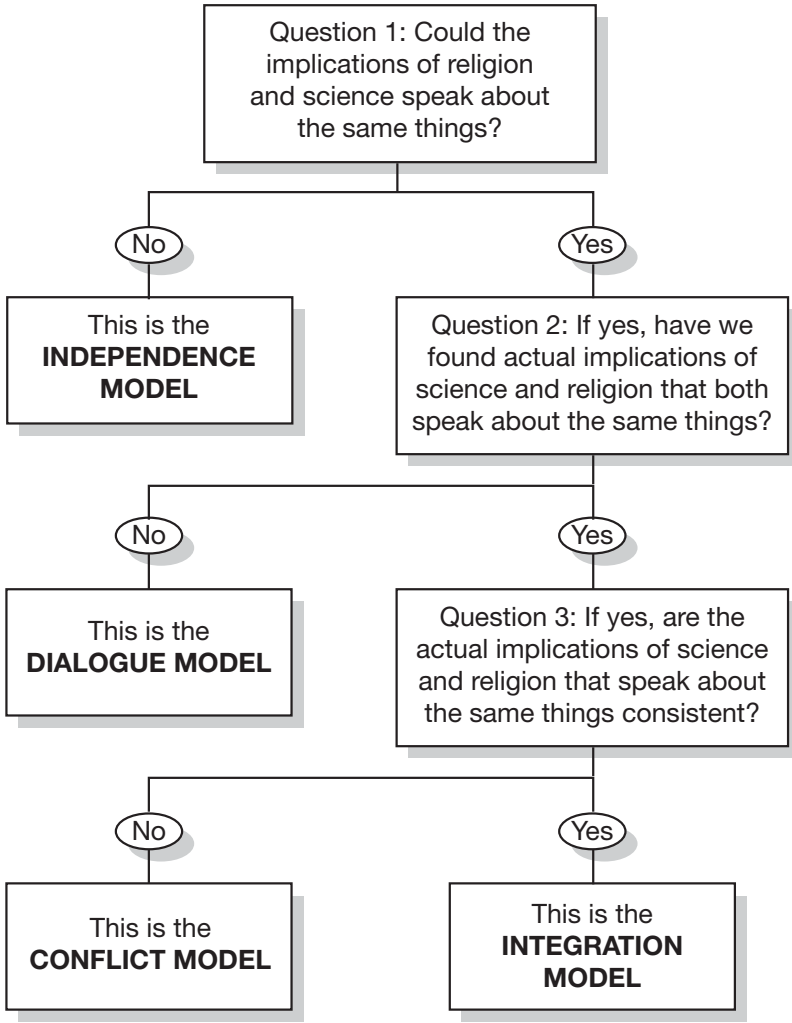

FIGURE 1 Decision chart to determine model of science–religion relationship.

relationship besides *Integration* is accurate, then a major aim of this book is thwarted. In the remaining sections of this chapter, we briefly survey how the four models have been exemplified historically, particularly in regard to Christianity and science. We begin below with the *Conflict* model for two reasons: first, because it is the dominant cultural image of the religion–science relationship; second, because, if it is accurate, none

of the other models really matter, and the project of this book is completely ill-founded.

Do Science and Religion Conflict?

In the late nineteenth century, the conflict thesis was promoted by two influential books: J. W. Draper's *History of the Conflict between Religion and Science* and A. D. White's *A History of the Warfare of Science with Theology in Christendom*.[16] Debates about the selectivity of their evidence aside, the conflict theme they support became very influential. Although the history of conflict traces back to the Scientific Revolution in Europe, we will particularly pay attention to how conflict has intensified in the United States in the past couple centuries. Contemporary advocates of the conflict model fall into two broad camps – anti-religious and religious – and much of their disagreement stems from their conflation of the objects, methods, and aims of religion and science. The anti-religious orientation embraces philosophical naturalism, atheism, and science as a total worldview package while the religious orientation embraces the literal interpretation of the Bible, including its ostensible factual claims regarding the history, structure, and operation of the natural world. Unfortunately, such groups are very outspoken, receiving most of the news coverage and crowding out more moderate voices. Although the cultural conflict is obvious, we are looking for clarity about whether there is technically any logical inconsistency between key theological propositions and established scientific propositions.

Conflict arises on the science side culturally because the anti-religious science camp styles itself as promoting science to push back repressive religion. The Galileo Affair and the Scopes Monkey Trial lead the list of famous clashes between religion and science, although the historical record of these symbolic events contains nuances that are usually glossed over. Barbour identifies various representatives of the conflict view under the label *scientific materialism*. This view combines the metaphysical position that matter is the only reality with the epistemological position that the scientific method is the exclusive procedure for knowing reality. As our discussion proceeds, we typically use the term "naturalism" to

[16] John W. Draper, *History of the Conflict between Science and Religion* (New York: Appleton, 1874). See also Andrew Dickson White, *A History of the Warfare of Science and Theology*, 2 vols. (New York: Appleton, 1896).

denote the metaphysical position that nature alone is real, but we note that many naturalists take a materialist position on the essential makeup of nature. Obviously, since most religions affirm a nonmaterial supernatural reality and make claims that are not amenable to the scientific method, those in the non-religious conflict camp must reject religions as false, irrational, and anti-science.

In the first half of the twentieth century, *logical positivism* allied itself with the scientific materialist outlook. The philosopher A. J. Ayer promoted logical positivism, insisting that no statements are cognitively meaningful unless they are verifiable or falsifiable by the kind of empirical experience known to science. By contrast, Ayer claimed that nonempirical statements are cognitively meaningless, such that "all utterances about the nature of God are nonsensical."[17] Generally speaking, these early twentieth-century discussions took physics as the paradigmatic science, but in recent decades scientific naturalists have made much use of evolutionary biology in their opposition to religion.

One prominent thinker who employed evolutionary biology against religion was Harvard sociobiologist E. O. Wilson, who acknowledged that religion was an effective survival mechanism in the past but urges that it must now be eliminated to assist human progress. Indeed, he advocated that religion must be replaced by a philosophy of "scientific materialism."[18] Other well-known voices who enlist biological information in support of scientific materialism – or what we could call *scientism* – include Francis Crick and Daniel Dennett. Yet Oxford biologist Richard Dawkins is surely the most famous advocate of such views, commenting that "Darwin made it possible to be an intellectually fulfilled atheist" by providing the previously unknown cause of organic complexity that can be incorporated into the overall naturalist philosophical framework. For Dawkins, Darwinian evolution completes the mechanical picture of the sciences for the naturalist or materialist perspective, thus falsifying religious claims that organic complexity is perfectly divinely designed. In a TED talk, Dawkins summed up his view of the irreconcilable opposition between science and religion:

> Not only is science corrosive to religion; religion is corrosive to science. It teaches people to be satisfied with trivial, supernatural non-explanations and blinds them to the wonderful real explanations that we have within

[17] A. J. Ayer, *Language, Truth, and Logic* (New York: Dover, 2012), 115.
[18] E. O. Wilson, *On Human Nature* (Cambridge, MA: Harvard University Press, 1978), chaps. 8 and 9.

> our grasp. It teaches them to accept authority, revelation, and faith instead of always insisting on evidence.[19]

Although Dawkins does not say it this way, he takes religion and science to imply opposite truth-values to many of the same propositions – about the age of the earth, the adaptive diversity of life, and so forth. In this mortal combat understanding of science and religion, science corrects and displaces religion with an alternative explanation of how the physical world works, particularly the living world. We observe that, the more the most publicly prominent versions of religion say the opposite of established science, the more the conflict image of their relation is reinforced.

Unfortunately, conflict also arises culturally from the religious side. The prime example here is Protestant fundamentalism, which views the Bible as God's inerrant revelation, which in turn requires a literalistic interpretation – including literalism about empirical claims that pertain to the operations of the natural world. Given this religious mentality, it is hardly surprising that Darwin's theory of biological evolution was threatening to this outlook. In *The Creationists*, historian of science Ron Numbers explains that the fundamentalist agenda in the United States became crystallized around the turn of the twentieth century and persists little modified even today – making it predictable that biological evolution will remain a big target in pulpits, religious media, and fundamentalist religious education.[20] After all, evolution entails a very ancient earth and adaptive species change over time whereas the Bible, when literalistically interpreted, records a seven-day creation and fixed forms in the living world. So, for propositions asserting the age of the earth, or the causes of speciation, or whatever – science and fundamentalist Christianity imply conflicting truth-values. Especially contentious is the scientific inclusion of human beings as advanced primates in the evolutionary process, which seemingly contradicts the special miraculous creation of Adam and Eve endorsed by fundamentalism. Predictably, fundamentalists identify evolution with naturalism and atheism, which are inimical to a biblical viewpoint and thus, they claim, inappropriate to teach in public schools.

Since the Scopes Monkey Trial of 1925 held in Dayton, Tennessee, failed to prevent evolution from being taught in biology classes,

[19] Richard Dawkins, "Militant Atheism" TED Talk, www.ted.com/talks/richard_dawkins_militant_atheism/transcript?language=en. See also *The Blind Watchmaker* (New York: Norton, 1986), 6.

[20] Ronald Numbers, *The Creationists: From Scientific Creationism to Intelligent Design*, Expanded Edition (Cambridge, MA: Harvard University Press, 2006).

fundamentalists began demanding equal educational time to have their view of "creationism" explained alongside evolution. Although fundamentalist creationists argue that equal time is justified because creationism is "scientific" and can be supported by the research of their partisan scientists, their contention to authentic science has been continually rebuffed in the court cases of recent decades. *McLean v. Arkansas Board of Education* in 1982 and *Edwards v. Aguillard* in 1987 in Louisiana were high-profile cases in which fundamentalist creationism lost again. While unsuccessful in the courts, creationists continue to exert measurable influence on society via organizations such as the Institute for Creation Research and Answers in Genesis, which demean Darwin and attack evolutionary biology as they promote what they call "biblical science."[21]

As the religious side of the conflict model evolved (pardon the pun), Intelligent Design (ID) theory came on the scene to wage battle against evolutionary biology. In 1996, *Darwin's Black Box* by biochemist Michael Behe claimed that there are irreducibly complex organic structures that cannot be explained by gradual Darwinian evolution, thus helping inspire the ID movement. As Behe contends, these particular organic structures must come into existence instantaneously as a single integrated system, such that "the removal of any one of the parts causes the system to effectively cease functioning."[22] William Dembski, a mathematician and theologian with conservative Protestant roots, gave fuller voice to this line of thinking. In 1999, Dembski's book *Intelligent Design* argued that it is highly improbable that certain complex organic forms arose from blind natural selection acting on random variations.[23] Proposed examples of such irreducibly complex organic forms included the bacterial flagellum and the eye. The basic point is that the low probability that these forms occurred naturally by chance generates the high probability that they were designed by a nonnatural intelligent agent. Considering his case to be weighty, Dembski declares that "to reinstate design within science is to liberate science, freeing it from arbitrary restrictions" – which translates to discarding "methodological naturalism" to accept teleological explanation for biological forms.[24]

[21] George Marsden cited in Langdon Gilkey, *Creationism on Trial* (Charlottesville: University of Virginia Press, 1998; orig. 1985; 1998:), 89.
[22] Michael Behe, *Darwin's Black Box* (New York: Free Press, 2001; orig. 1996), 39.
[23] William Dembski, *Intelligent Design* (Downers Grove: InterVarsity Press, 1999).
[24] Dembski, *Design*, ch. 5.

Criticisms of ID emanated from both religious and nonreligious thinkers, who agreed on several of its problematic features. One major criticism from both sides is that ID is not science because it provides no fruitful research program by which we can construct experiments to confirm or disconfirm the theory. Whereas ID appeals to a nonnatural explanation for its selected biologically complex forms, mainline science looks only for natural explanations. At the conclusion of the 2005 *Kitzmiller v. Dover Area School District in Pennsylvania* case, Judge John Jones ruled that ID is not science. When the 2005 ruling was challenged in federal court, it was upheld, and the judge declared ID a type of creationism rather than genuine science. Another criticism, offered by biologists such as Kenneth Miller and Francisco Ayala, is that alleged instances of irreducible organic complexity, which ID insists are not explicable by evolution, really are explicable by evolutionary mechanisms, and they are written about in many dozens of scientific publications every year.[25] Indeed, in a blockbuster piece in the *Proceedings of the National Academy of Sciences*, John Avise showed how the recently available genomic data provides conclusive confirmation of the evolutionary explanation of the origin of all biodiversity while simultaneously revealing characteristics wholly incompatible with major ID claims.[26] It seems that the ID proposition asserting that natural selection cannot explain complexity in some organic form X is contradicted by science more times that we can count.

An important distinction to note about the high-profile conflict between religion and science is that it is shaped by "fundamentalist" mentalities on both sides – by Protestant literalists and scientific naturalists. Both sides holding the conflict view can exude rather militant, exclusivist instincts, which seems to suggest that they take the objects, methods, and aims of science and religion to be so similar in so many cases that their unending competition is guaranteed. Whether it is the religiously generated propositions that the earth is 6,000–10,000 years old or that evolution is insufficient to explain the biodiversity we see on earth today, conflict between fundamentalist Christianity and scientific knowledge on these matters is unavoidable. Yet, for all this, the dramatic science–religion warfare in culture tells us virtually nothing regarding our central question: Do orthodox Christianity and mainline science imply contradictory

[25] Francisco Ayala, *The Big Questions: Evolution* (London: Quercus, 2012); Kenneth Miller, *Finding Darwin's God* (New York: Harper, 2007).

[26] John Avise, "Footprints of Nonsentient Design Inside the Human Genome" *Proceedings of the National Academy of Sciences* 107, no. 2 (2010): 8969–8976.

truth-values for any proposition? Of course, the more specific question we will later ask is whether Chalcedonian Christology and modern genetics imply contradictory truth-values for any proposition.

Are Science and Religion Independent?

In contrast to the conflict model, we get the independence model of science and religion when their aims, objects, and methods are construed as completely different. This move would entail that there is not one atomic (non-complex) proposition common to both science and religion for which they both imply a truth-value. In the twentieth century, for instance, Protestant neo-orthodoxy and existentialism held to strict independence. Famous neo-orthodox theologian Karl Barth emphasized that theological knowledge must be based on God's self-revelation to us and not on human reason, which is debilitated by sin. Thus, for him, Christianity is essentially about inward subjective encounter with God and not about objective natural knowledge of the external world.[27] Similarly, even religious forms of existentialism endorsed independence by saying that religion deals with the realm of personal commitment while science deals with the realm of impersonal objects.

Support for independence can be found on both sides, the religious and the scientific. On the religious side, many non-fundamentalist Christians accept the Bible's message regarding having faith in God but see science as neither threatening nor supporting their core religious beliefs. At the 1981 *McLean v Arkansas Board of Education* trial – billed by the media as Scopes II – theologian Landon Gilkey expressed this view. The points of Gilkey's expert testimony are readily summarized: science deals with objective data whereas religion deals with meaning and value; science asks "how" questions whereas religion asks "why" questions; science relies on reason and experimental confirmation whereas religion relies on scripture, tradition, and personal experience; science uses quantitatively precise empirical language whereas religion uses symbolic or analogical language regarding its nonempirical transcendent object.[28] In his later reflections on that 1981 trial, published as *Creationism on Trial*, Gilkey states,

[27] Thomas Torrance, "The Ground and Grammar of Theology" in *The Christian Theology Reader*, Alister McGrath, ed. (Oxford; Cambridge, MA: Blackwell, 1995), 85–88.

[28] Transcript of Gilkey's testimony, www.antievolution.org/projects/mclean/new_site/pf_trans/mva_tt_p_gilkey.html.

"These different forms of inquiry are distinct, each with its own logic, methods, and modes of validation."[29]

On the science side, at the trial, Stephen Jay Gould, Harvard paleontologist and biologist, also expressed an independence view. For Gould, just as the magisterium of the Catholic Church claims teaching authority on theological matters, science should claim authority to make pronouncements in the empirical domain – its own distinct magisterium, so to speak. These two areas of human activity are completely different and should be treated as "nonoverlapping magisteria" (codified by Gould as NOMA) that can never be unified.[30] In *Rocks of Ages*, he wrote,

> Science tries to document the factual character of the natural world, and to develop theories that coordinate and explain these facts. Religion, on the other hand, operates in the equally important, but utterly different, realm of human purposes, meanings, and values.[31]

On Gould's account, science deals with the objective and religion with the subjective, such that they cannot address the same matters. Since they are independent, any apparent conflict between science and religion is based on a misunderstanding of differences in the nature of the two enterprises.

Now, if religion and science are incommensurable, then there is no conflict and the way is open, as Gould said, for "respectful non-interference" and even for dialogue. Of course, the way is also open for either side to ignore the other or be hostile to the other side for reasons besides conflict. Taking Gouldian independence a bit further, philosopher of science Michael Ruse advocates "accommodationism," which avoids conflict with religion as long as religion does not try to answer questions that fall under the mechanical model of science.[32] But for religion to make factual claims contrary to established science – say, asserting a global flood – would be to transgress the boundaries of its proper domain. Yet the independence approach eliminates conflict between religion and science since their very nature prevents them from generating different truth-values for the same proposition.

[29] Langdon Gilkey, *Creationism on Trial: Evolution and God at Little Rock* (Charlottesville: University of Virginia Press, 1998), 217.

[30] Stephen Jay Gould, "Nonoverlapping Magisteria" *Natural History* 106 (March 1997): 16–22.

[31] Stephen Jay Gould, *Rocks of Ages: Science and Religion in the Fullness of Life* (New York: Ballantine Books, 1999), loc 90. Kindle edition.

[32] Michael Ruse, "Why I Am an Accommodationist and Proud of It" *Zygon* 50, no. 2 (2015): 361–375.

Now, when it appears that religion and science are addressing the same proposition, the independence approach emphasizes that the referents (the world and its constituents) in the proposition shift meaning. So, the world and its constituents in the context of God as their ultimate source have different meanings than when the world and its constituents are treated in the context of rigorous empirical investigation. Some thinkers use the labels "compatibility" or "harmony" for the lack of conflict between religion and science while others reserve these terms for a more positive relationship. Clearly, there will be important nuances of difference regarding what would count as compatibility or harmony. As we go, we revisit the question of what could be meant by harmony between orthodox Christianity and mainline science if there is indeed no conflict between them – a question that, of course, applies equally to our more specific focus on classical Christology and modern evolutionary biology.

Is Dialogue between Science and Religion Possible?

During the 1990s, when conflict and independence were the dominant positions on the religion–science relationship, the idea gained traction that they should at least engage in dialogue. Even if the objects, aims, and methods of each discipline are in conflict or should be entirely separate, dialogue and discussion could help clarify issues and aid understanding. We remember that, in the mid-twentieth century, British scientist and novelist C. P. Snow had warned against the divorce between the "two cultures," the sciences and the humanities, which would create an expanding divide in our knowledge and be a challenge for scholars on each side to bridge. To incentivize dialogue, and to move beyond conflict and compartmentalization, the John Templeton Foundation and other organizations began supporting conferences and research projects that put theologians and scientists in interaction. Since then, key public and private agencies have come to explicitly recognize contact between science and religion at some level. In the United States, the National Academies of Sciences, Engineering, and Medicine recognizes the inevitable intersection of science and religion in a diverse culture.[33] In the United Kingdom, the International Society for Science and Religion positions itself in this broad context, declaring confidence that "fruitful dialogue" is possible

[33] See National Academies of Sciences, Engineering, and Medicine, "Science and Religion," www.nationalacademies.org/evolution/science-and-religion

across religious traditions.[34] We applaud such efforts to get the two different cultures to engage, and engagement is the minimum goal we seek.

Dialogue between science and religion has taken various shapes depending on the sciences and the religions involved and the topics proposed for discussion. Among the many topics treated in academic conferences and research projects in the science–religion dialogue, those topics pertaining to the respective objects, aims, and methods are particularly relevant here. For instance, philosopher of science Nancey Murphy has addressed the methodological parallels between science and religion, drawing parallels between the intellectual procedures of science and theology: becoming committed to a non-negotiable core theory about the reality in question and then offering auxiliary theories explaining how new and challenging data can be accommodated. An instructive example may be found in the first half of the twentieth century, when cosmological physicists who believed that the universe had no temporal beginning or end protected the prevailing Steady State Theory against the discovery of an expanding universe by positing the continual appearance of new hydrogen atoms to maintain constant average density in the universe. Similarly, theologians committed to a supremely good God try to explain the troublesome data of evil by offering a theodicy. Another avenue for dialogue concerns the apparent overlap in the objects explained by both science and religion. One example of this would be seeking common insights between the Hindu concept of Brahman and quantum field theory, say, because both viewpoints assert that the temporal material universe emanated from a timeless immaterial source.[35]

The present investigation amounts to a far-reaching dialogue, which, at a minimum, recognizes similarities in scientific and theological methods. Going beyond conflict and independence approaches, we particularly investigate any overlap in the objects that Christianity and science each address. In relevant cases, we see Christianity and science as addressing the same objects but with different explanatory aims that provide two different but very important kinds of knowledge. Our further hope is to explore how these two kinds of knowledge shed light on two aspects of a unified reality. Thus, dialogue over possible parallels and points of contact can reveal

[34] See International Society for Science and Religion, "About ISSR," www.issr.org.uk/about-issr/. See also the Pew Research Study "On the Intersection of Science and Religion," www.pewresearch.org/religion/2020/08/26/on-the-intersection-of-science-and-religion/

[35] S. R. Nene, "Relevance of Kanada's Vaisesika and Upanishadic Brahman to Modern Physics" *Annals of the Bhandarkar Oriental Research Institute* 86 (2005):135–137.

deeper affinities and interconnections – which in turn beckon us beyond the dialogue model to the possibility of integration.

Can There Be Integration of Science and Religion?

Our strategy is to recognize the distinctions between science and theology, examine consistency or inconsistency between their implications, structure an important dialogue between them, and seek to integrate them into an overall worldview framework. Our integrative approach gives specific attention to the intersection of Christology and biology, which will, if successful, implicate the whole of orthodox Christianity and the whole of science in a comprehensive worldview. To get a sense of this kind of project, consider a few past frameworks for attempting integration. As the fountainhead of traditional natural theology, Thomas Aquinas starts with observed facts to draw theistic conclusions. His cosmological argument moves from the contingency of the universe to God; his teleological argument from order in the world to God.[36] Similarly, consider Christian philosopher Richard Swinburne's updated natural theology, in which he maintains that such phenomena as the emergence of conscious beings and religious experience make theism "more probable than not" – an approach that resembles confirmation theory in philosophy of science.[37] Also, for several decades, scientists have been intrigued by the Anthropic Principle in cosmology, which recognizes that life would have been impossible if some of the physical constants of the universe had even slightly different values. Freeman Dyson, a mathematical physicist, stated that "the architecture of the universe is consistent with the hypothesis that mind plays an essential role in its functioning."[38] Referring to the apparent "fine-tuning" of the universe, theoretical physicist Paul Davies made a similar claim in *The Mind of God: The Scientific Basis for a Rational World*.[39] Nonetheless, constructing quasi-theological arguments starting with some impressive aspects of nature and concluding to a transcendent mind or intelligence does not yield a comprehensive worldview.

In the early twentieth century, Alfred North Whitehead sought a comprehensive worldview framework for science and religion shaped by his

[36] Aquinas, *Summa Theologica*, I q.2 a.3.
[37] Richard Swinburne, *The Existence of God* (Oxford: Clarendon Press, 1979), 291.
[38] Freeman Dyson, *Disturbing the Universe* (New York: Harper & Row. 1979), 250–251.
[39] Paul Davies, *The Mind of God: The Scientific Basis for a Rational World* (New York: Simon & Schuster, 1992).

process metaphysics. In his 1929 book *Process and Reality*, Whitehead posited that reality is not composed of enduring substances, such as Newtonian objects, but of dynamic interconnected events, characterized by continual change and inherent chance. Inspired by exciting developments in relativity physics and quantum mechanics, this metaphysical vision is meant to account for all important areas of human life and knowledge. Charles Hartshorne and other intellectual followers of Whitehead explicitly developed process theology in the direction of a nonstandard theistic view called process theism – essentially, the idea that God and all reality are in a process of change. Yet critics of process theology have identified serious inadequacies – including the depersonalization of God to an abstract principle driving things toward greater complexity, the reduction of free will to indeterminacy, and the conceptualization of incarnation as the impressive actualization of human potential in Jesus rather than the actual union of divine and human natures in one person.[40] So, while process thought offers its own kind of worldview integration, it explicitly abandons a realist view of Christian orthodoxy, and thus offers no help for our quest.

Our realist quest for integration follows the classical ideal of seeking a comprehensive worldview based on the idea that a multifarious reality is still ultimately a unified whole, consistent among its parts, which may nevertheless be known by different means. Although we must ask and answer important questions of logical consistency (or inconsistency) between theology and science, we are not seeking merely consistent conjunction of theological and scientific propositions as though constructing a worldview is like putting assorted beads on a string. Instead, we are seeking a comprehensive conceptual framework that incorporates science and its findings, orthodox Christianity, and all other important phenomena into a coherent worldview. Centering our project on the relationship of Christology and biology is ambitious indeed, since virtually no precedent for it exists.

Obviously, unless Christian theology and contemporary science contain the inherent potential for integration, there can be little hope to integrate Christology and biology. What we are interested in is how a realist construal of both theology and science shape their integration under a unified worldview. Such integration requires, on the one hand, that theology come to grips with the best scientific knowledge and, on the other hand, that

[40] See Ronald Nash, ed., *Process Theology: A Critical Appraisal* (Grand Rapids, MI: Baker, 1987).

science be given larger context and meaning by theology. Thus, on a realist view of Christology, core doctrinal commitments cannot be surrendered in light of biological information; rather, biological information is important in helping probe the parameters of those commitments, particularly regarding what it means to be fully human biologically. Then, on a realist interpretation of science, biological truths must be considered in articulating theological doctrine in relevant intellectually informed terms.

Since the Christian tradition contains extensive reflection on the nature and status of science, both historically and today, there is strong precedent for this conceptualization of our project. On a realist interpretation of theology and science, we think that the potential concord between Christology and biology will become obvious. Moreover, our realist approach to both science and theology generally – and to Christology and biology specifically – raises the stakes of our current enterprise, such that the unfolding discussion here should be both fruitful and important.

Our description of the different models of the religion–science relationship – their logical structure and historical influence – now becomes background for the following chapters. Going forward, we will face numerous issues at the intersection of orthodox Christianity and mainline science where questions of independence, conflict, or concord will be raised. Resolution of these questions will depend largely on the *content* of each field – that is, on the propositions that they assert. What exactly does Christian doctrine assert – particularly about the Incarnation? What exactly does science assert – particularly about biology and genetics? Since the doctrine of the Incarnation is inseparably woven into Christian theology, and since evolutionary biology is deeply embedded in the whole body of scientific knowledge, our discussion will inevitably encounter issues regarding the relation of Christianity and science. But to begin with precise focus on Christology and biology, we devote Chapters 3 and 4, respectively, to explaining the essential teachings of these two areas. We then build the ensuing discussion on that basis.