1 Science, Biology, and Religion

A discussion of the relationship between biology and religion is a subset of the larger conversation about the relationship between science and religion. At the turn of the seventeenth century, the new astronomy catalyzed the Scientific Revolution, which raised questions about whether the Roman Catholic Church or practicing scientists were properly entitled to make claims about the structure and operation of the heavens. As modernity unfolded, the Newtonian Revolution consolidated its position: the purview of the natural sciences – from astronomy to physics to chemistry – was to make claims about the structure and operation of the physical world that were grounded in empirical research and not religious dogma. In the middle of the nineteenth century, the science of biology, mostly in the form of natural history and practiced by Darwin and others, caused new tensions with religion. Biology has remained at the center of much controversy with religion – and now, given their influence in contemporary life, what we may call the emerging "biosciences" present new challenges to which religion must continually respond.

The intersection between biology and religion requires careful analysis because the historical engagement between these two important human activities has been complex and because these activities remain deeply enmeshed in cultural and political power structures. However, our philosophical approach offers a way forward. Philosophy helps us identify ontological and epistemological commitments, clarify alternative positions, define terminology, analyze connections across areas of knowledge and human experience, and evaluate arguments on important issues. To begin our exploration of the issues, we clarify the nature of religion and the nature of science, respectively, and then survey the major typologies or models reflecting the different ways their relationship has been conceived. This philosophical work is a prelude to clarifying the particular nature of biology as a science so that we may fruitfully study its interactions with religion. The foundational and integrative role of philosophy plays out as we interact with a variety of positions on the topics under study. Our dialogical format thus provides a context and sets the stage for the reader to navigate through the pertinent issues.

Religion in Human Life

Arriving at a precise definition of religion is notoriously difficult, and yet attempts at definition abound. C. P. Tiele writes that "[r]eligion is, in truth, that pure and reverential disposition or frame of mind which we call piety." "Religion," claims James Martineau, "is the belief in an ever living God, that is, in a Divine Mind and Will ruling the Universe and holding moral relations with mankind." F. H. Bradley states that "[r]eligion is rather the attempt to express the complete reality of goodness through every aspect of our being." Each of these definitions keys on some characteristic associated with religion: Tiele accents the attitude of piety; Bradley links religion with goodness; and Martineau features belief in ethical monotheism. Other definitions touch upon traits such as ritualistic acts, prayer and communication with gods, and so on.[1]

Wisdom counsels us, however, not to define religion by elevating any single feature to the status of universal definition because such treatments admit of counterexample. Tiele's definition is incomplete because shamanistic religions, for example, do not involve feelings of genuine piety so much as they promote prudential or utilitarian acts of obeisance. Likewise, Martineau's definition fails to cover ancient polytheistic religions (such as those of ancient Egypt and Greece) that do not recognize a single divine moral ruler of the universe. Frankly, these and other readily available counterexamples show that defining religion too generically distorts the rich, complicated particularities of each religion. Even attempts to specify the most general aspects of religion, say, by connecting religion with the idea of worship or with the need for the divine or the supernatural, are too narrow. The notion of a supernatural realm does not even occur, for

[1] W. P. Alston, "Religion," in P. Edwards (ed.), *Encyclopedia of Philosophy*, 8 vols. (New York: Macmillan, 1967), vol. VII, 140.

example, in the nontheistic schools of Buddhism, which seek Nirvana, and it functions in very different ways, say, in Taoism and Hinduism. The great differences among religions make it extremely difficult to find a common denominator or to talk about "religion" in the abstract.

Instead of offering a universal definition that is subject to counterexample, religion scholar Ninian Smart suggests that we start by identifying the common dimensions of all religions; he designates seven.[2] First, the "doctrinal dimension" involves the accepted beliefs – perhaps few and unsystematic or perhaps many and highly organized – about ultimate reality or the divine and its relation to humanity. Each religion, second, also has a "mythological dimension" that conveys its particular understanding of the religious ultimate to faithful adherents in terms of symbolic speech and stories. Third, certain moral actions and general life orientations are associated with what it means to embrace and follow a given religion: this aspect is the "ethical dimension." Fourth, the "ritual dimension" pertains to the prescribed behaviors, both public and private, that are thought to reflect worship of the divine or properly relating to the ultimate. Fifth, the "experiential dimension" of religion, both personal and collective, reflects what it is like to act and live as a religious believer. The experience can range from a quiet sense of the presence of a god in daily life to the highly mystical consciousness of union with ultimate reality. Sixth, the "social dimension" is how a religion organizes all sorts of interpersonal relationships. Last and seventh, the "material dimension" of a religion pertains to how the gods or god or ultimate religious reality is reflected in the physical world. The material dimension can be simply how the divine is conceived in relation to the world (say, as the ancient Greek god Poseidon is associated with the ocean) or how a religious community designs art and architecture to create an atmosphere of worship (say, in the great Christian cathedrals of Europe).

Now, after recognizing the difficulty of identifying one trait that defines religion and after appreciating the value of characterizing religion by its key dimensions, we, nevertheless, venture a working definition for the purposes of our developing discussion. Let us say that "religion" is *a human phenomenon that is constituted by a set of beliefs, actions, and experiences, both personal and collective, organized around the concept of an ultimate reality that inspires or requires*

[2] N. Smart, *Dimensions of the Sacred* (Los Angeles: University of California Press, 1999).

https://doi.org/10.1017/9781139381765.003 Published online by Cambridge University Press

a certain response like devotion, worship, or focused life orientation.[3] This reality may be understood as a unity or a plurality, personal or nonpersonal, divine or not, differing from religion to religion. Yet, it seems that every cultural phenomenon that we call a religion fits this definition. The prescribed actions vary from ritualistic patterns of behavior to general ethical living; the desired emotions vary from feelings of piety and humility to a sense of optimism about life and the universe.

For the most part, our study of the relation of science and religion revolves around the recognition that all religions have *beliefs* – that is, a doctrinal dimension, as Smart would label it – whether the beliefs are rather simple or sophisticated. Our inquiry into the relationship between science and religion generally, or into the relationship between biology and religion more specifically, takes religious beliefs seriously. In philosophy, we typically say that a belief is propositional, that it is expressible in terms of an assertion that can be true or false, probable or improbable, and the like. Specifically, *religious* beliefs relate in one way or another to what a religion teaches about reality, including knowledge, morality, humanity, and a number of other key features of life and the world. In a certain sense, then, every religion rests on a set of beliefs that function conceptually as its worldview core, but this core also undergirds and gives sense to specifically religious observance as well as daily living.

Science as a human activity also generates beliefs – which are, again, claims about the world and human life, assertions that can be understood and discussed and can be true or false; therefore, a crucial area of inquiry into the relation of science and religion obviously pertains to the respective beliefs they hold, their grounds and implications. Of course, at another level, science also offers theories or explanations of religion as a human phenomenon – psychological, social, and biological explanations of religion that have some measure of theoretical and empirical support.

As we develop our exploration of the relation of science, and particularly biology, to religion, we will often transition from discussing religion in general to discussing theism in particular because of its important role in Western culture. Theism asserts that there is an omnipotent, omniscient, perfectly good being that created, sustains, and interacts with the world and

[3] M. L. Peterson et al., *Reason and Religious Belief: An Introduction to the Philosophy of Religion*, 5th ed. (New York: Oxford University Press, 2013), 7.

all it contains. Although theism is not a living religion, it is the common conceptual core of the three great Abrahamic religions: Judaism, Christianity, and Islam. Historically, in the West, theistic ideas have interacted in a variety of ways with science and thus require specific attention in our treatment of religion and the biosciences.

Science in Human Life

Science is one of the most impressive knowledge-gathering projects in human history, providing an astounding amount of information about the world and promising much more. Like religion, science is an important human activity, shaping so much of our world and exerting enormous influence. To begin our discussion of science, we face the same question of definition that we did with religion. What is the definition of science? How shall we characterize it as a human activity in its own right? Let us begin our discussion at a very basic level, observing science both as a way of seeking knowledge and as a body of accumulated knowledge.

The method of science is at the heart of its success in gaining insight into the workings of the physical world. However, the scientific method is not a single procedure but a number of practices in which scientists engage, from observing and experimenting to creative hypothesizing and constructing models. The key is the intentional rigor of scientists in tying hypotheses to empirical experience through experimentation. Hypotheses are used to make predictions, which are then tested. Those hypotheses that are experimentally supported are provisionally retained and used to form additional predictions. Over time, a hypothesis might become so well supported that it becomes viewed as a theory; in the scientific sense, a theory is a broad explanatory framework that makes sense of a large swath of experimental data and has not yet been falsified or overturned. Theories may be modified in light of new evidence or even, in principle, discarded if shown to be inadequate. Thus, a theory is a conceptual tool accepted by scientists as enjoying a high measure of corroboration, and some theories are even felt to be so well supported that new evidence is unlikely to substantially modify them. Science is an important expression of the human drive to understand the physical universe – how it is structured and how it works – and it remains the most productive method to that end that humans have thus far conceived.

We typically say in science that we have an understanding of a given phenomenon when we have a well-supported theory. The explanatory work of science is, in turn, anchored in its ability to identify causes of the phenomena under study. To do its work, science must assume that there are causes – that is, physically necessary connections between events – and that these causal connections can be codified as scientific laws. Scientific explanation, then, brings empirical phenomena under known laws and explains them by means of theories. Although this basic characterization of science might seem uncontroversial now, it was born out of historical controversy. Ancient science, inspired largely by Aristotle, was a priori and nonexperimental in character because it sought understanding of the behavior of any given physical phenomenon by means of pure insight into its essential nature. However, at the beginning of the seventeenth century, this way of doing science was rejected, effectively giving birth to modern science. Now, the scientist first formulates a hypothesis about what causes a particular object to operate in certain ways and then tests that hypothesis empirically through observation and experiment.

Of course, even in early modernity, there were misinterpretations of the new scientific procedure. Francis Bacon gave rise to the famous misunderstanding that science begins by collecting data, from which it draws conclusions through inductive reasoning, a view that, unfortunately, is still taught in high school science books and believed in general culture. This narrow inductivist view of the scientific method makes it seem like one does science just by putting on a white coat on a Monday morning and walking into the lab and gathering data. Instead, the scientist begins with questions about a phenomenon and then formulates a hypothesis about why it is the way it is or functions as it does. Only then is the experiment designed and data collected for evaluation.

In a book covering the biosciences, it is fitting to quote Charles Darwin's rejection of the Baconian view of science. In a well-known passage in his correspondence, Darwin precisely identified the error of narrow inductivism:

> How profoundly ignorant [Bacon] must be of the very soul of observation! About thirty years ago there was much talk that geologists ought only to observe and not theorize; and I well remember some one saying that at this rate a man might as well go into a gravel-pit and count the pebbles and

https://doi.org/10.1017/9781139381765.003 Published online by Cambridge University Press

> describe the colors. How odd it is that anyone should not see that all observation must be for or against some view if it is to be of any service![4]

The Baconian definition simply fails to see that the scientific method does not begin with data but with problems and puzzles about the behavior of physical phenomena that we do not fully understand. Nothing is recognized as data in science unless it is related first to a hypothesis, which, if empirically supported, advances our understanding. Thus, it is the careful construction of testable hypotheses and, subsequently, the highly structured attempts to test those hypotheses that form the essence of science.

Note that the underlying ontological assumption of science mentioned earlier – that there is a physical world structured by causal regularities that can be codified as laws – is now obviously coupled with the key epistemological assumption of science: that human beings have the capacity to access these regularities. The human capacity to explain the physical world according to causal laws finds sophisticated expression in the scientific method. In the philosophy of science, this characterization of the ontological and epistemological assumptions describes a realist view of science. Philosophical realism broadly holds that there is a real world independent of our minds and that we have the cognitive ability to access it, recognizing, nonetheless, that our knowledge of the world is revisable and not perfect and that knowledge is mediated through our own cognitive structures and our social situation. However, the dual confidence remains that there is a regular world and that our knowledge of it is objective. In fact, the growth of scientific knowledge in early modernity gave rise to the belief, rooted in Aristotle, that the world is a physical system, characterized by a total, coherent set of laws, and that our knowledge of it can progressively increase.

Although the unfolding discussion of this book interacts largely with a realist view of science, it is helpful to note before proceeding that various nonrealist or antirealist views of science have been proposed in the history of the philosophy of science. Instrumentalism, for example, holds that a successful scientific theory does not reveal anything about the structure, properties, or processes of nature itself but instead provides a summary of the behavior of a natural phenomenon and a valuable predictive tool for its future behavior. Thus, for instrumentalists, the question of whether a

[4] Darwin to H. Fawcett, September 18, 1861, Letter no. 3257, Darwin Correspondence Project, www.darwinproject.ac.uk/letter/DCP-LETT-3257.xml.

scientific law is actually true about some aspect of physical nature is sidestepped in favor of using the law as a predictor. Instrumentalism in particle physics, for example, avoids the question of whether a particle is a discrete entity with individual existence or is rather the excitation mode of a certain region of a field. Instead, it focuses on the usefulness of the theoretical term "particle" to predict outcomes. We note that the practice of science – pertaining to how we can get along doing science – is different from the fundamental philosophical question of how effective practice is best explained in ontological and epistemological terms.

Probably the most famous version of scientific antirealism was advanced by Thomas Kuhn in *The Structure of Scientific Revolutions*. In this 1962 book, Kuhn describes the working of science as a communal activity of researchers who operate according to the prevailing "paradigm" – a shared understanding of the physical world and the yet-unsolved problems about it they investigate. Essentially, paradigms are conceptual frameworks, shared by a community of inquirers, that contain the solved problems and project the unsolved problems of the science in question, providing implicit directions and limits to theorizing and research.[5] At one point, Kuhn explains that paradigm thinking is somewhat like metaphorical thinking, calling attention to the fact that scientific thought and language are deeply metaphorical and that scientific knowledge is, in the end, socially constructed, thus sparking criticism that his theory does not adequately account for objectivity in science. Kuhn's work may be seen as part of the movement in epistemology holding that knowledge is "socially constructed" and is not a pure, pristine representation of objective reality.

Although our developing discussion assumes a generally realist view of science, it is helpful to note the idea that, in any period of time, science interacts with its culture to give rise to what we may call the scientific picture of the world. Philosopher of biology Michael Ruse states that this picture is in a real sense a metaphor – a word or figure of speech applied to the world that is not literally applicable. "We look at the world, or parts of it," Ruse states, "through the lens of something with which we are familiar, spurring us to ask questions and (with luck) to find answers."[6] He adds that

[5] T. Kuhn, *The Structure of Scientific Revolutions*, 2nd edn. (Chicago: University of Chicago Press, 1970).

[6] M. L. Peterson and M. Ruse, *Science, Evolution, and Religion: A Debate about Atheism and Theism* (New York: Oxford University Press, 2016), 29.

the particular sciences are "drenched" in their own metaphors – force, work, attraction, genetic code, natural selection, plate tectonics, Oedipus complex, and more. Work in cognitive linguistics reveals that metaphorical thinking in science is a reflection of the broader practice of metaphorical thinking in ordinary life as we seek to organize our experience.[7]

One way of characterizing the historic tension that occurred between science and religion is to say that the most dominant metaphors – the root metaphors – of science changed from ancient Aristotelian science, which viewed nature as an organism, to modern science, which views nature as a machine. From the time of the Greeks, nature was seen as a self-contained organism and studied in organic terms. However, classical Christianity taught that nature was not a self-contained whole but a divine artifact, a creature made by a supreme being and endowed with laws and harmonies. By successive steps, over many centuries, the Christian understanding of nature led to the idea that nature was "a divinely organized machine in which was transacted the unique drama of Fall and Redemption."[8] Ironically, since God was spirit, he was eventually seen as removed from the universe, which was completely material. At a very fundamental level, the mode of scientific explanation had to change to fit the shift in metaphor. If a self-contained nature is imbued with purpose, then purposive or teleological explanations for the behavior of natural objects were appropriate – indicating *why* something does what it does. However, if nature is machine-like, then mechanical explanations were appropriate – indicating *how* some material thing works the way it does.

The Scientific Revolution – that great transformation of our understanding of the natural world that began with Copernicus in the middle of the sixteenth century and ended with Isaac Newton at the end of the seventeenth century – changed our metaphors about nature and our ways of explaining it. In the Galileo affair, which was the symbolic birth of modern science, the tension between religion and science was partly over a conflict in metaphors. On the one hand, the Catholic Church insisted that the geocentric theory of Ptolemy provided the true picture of the cosmos, a position supported by the Church's teleological view that humans are the center of God's concern.

[7] G. Lackoff and M. Johnson, *Metaphors We Live By* (Chicago: University of Chicago Press, 1980).

[8] A. R. Hall, *The Scientific Revolution 1500–1800* (London: Longmans, Green, 1954), xvi–xvii.

When Galileo strongly supported the heliocentric theory of Copernicus, his view came into direct conflict with the Church. Although Galileo, a faithful believer, was essentially applying the Christian idea that the divinely created material cosmos could be studied empirically and explained mechanically, the Church insisted that its particular teleological explanation determined what mechanical explanation was acceptable, a posture that was eventually shown to be indefensible. As the Enlightenment progressed in Europe, then, the burgeoning sciences prospered as they relinquished teleological explanation and developed a mechanistic model of explanation, with new empirical theories, some of which were so well supported that they became scientific laws.

By the end of the eighteenth century, all of the sciences were mechanistic except biology, the science of the living world. Immanuel Kant thought it impossible that there could be a mechanistic explanation of organisms because they seem purposively constructed: "We can boldly say that it would be absurd for humans even to make such an attempt or to hope that there may yet arise a Newton who could make comprehensible even the generation of a blade of grass according to natural laws that no intention has ordered; rather, we must absolutely deny this insight to human beings."[9] Later in the nineteenth century, however, the work of Charles Darwin would revolutionize biology with the recognition that all organisms are the end products of a long, slow process of adaptive change. In *On the Origin of Species*, published in 1859, Darwin argued that species arose from common ancestors as natural selection acted on heritable variation. Thus, Darwin's work showed that there was a lawlike mechanism that accounted for organic structure and function, an insight that revolutionized biology and brought that science under the machine model with the rest of the sciences. After Darwin, there was scientifically no apparent need for teleological explanation in science, but not all religious people agreed, a point we trace in several discussions later in the book.

Conflict or Compartmentalization?

Our previous discussion of the respective natures of science and religion now serves as prelude to further exploration of how to think about their

[9] I. Kant, *The Critique of Judgment* (New York: Hafner Publishing Company, 1951), 270.

relationship. Ian Barbour has identified four major conceptions – which he calls "models" – of the science–religion relation: conflict, independence, dialogue, and integration.[10] Referring to the natural sciences to define these models, let us consider each one in turn.

Perhaps the most dominant image of the science–religion relationship in contemporary culture is one of irresolvable conflict. The conflict or "warfare" model has deep roots, as old as the Galileo affair and as contemporary as the creation/evolution controversies in America. Other tensions between science and religion abound, from relativity theory in physics – which challenges religious perspectives on God's relation to the world due to changing concepts of space, time, and causality – to artificial intelligence research – which calls into question the unique status of human beings as we find that computers can perform increasingly complex reasoning calculations and even "learn" new things.

Early in the twentieth century, two dramatically opposed schools of thought greatly solidified the cultural idea of inherent conflict: scientific materialism and biblical literalism. Scientific materialism was very much shaped by logical positivism, which held that all intellectually serious beliefs must be verifiable or falsifiable by empirical experience, giving rise to the epistemological view that the method of science is the only reliable procedure for obtaining knowledge. Religious beliefs, then, cannot be knowledge because they seem private and parochial. This epistemological view dovetails with the metaphysical view that the physical world that science studies is the sum total of reality. Thus, there is no supernatural reality – involving God, soul, or afterlife – to which religion can meaningfully relate. Although the term "scientific materialism" is no longer used, its basic epistemological and metaphysical assumptions underlie many current approaches to the science–religion relationship. A group of thinkers who are often labeled the "New Atheists" have become famous for defending this same basic viewpoint in contemporary culture. Richard Dawkins, Daniel Dennett, Sam Harris, and Christopher Hitchens are particularly prominent representatives of the view that science discredits religion and supports philosophical naturalism and materialism.

[10] I. G. Barbour, *Religion and Science: Historical and Contemporary Issues* (New York: HarperOne, 1997), 77–105.

Biblical literalism, at the other end of the spectrum, is a distinctively American phenomenon within Christianity that began around the turn of the twentieth century. During the late nineteenth and early twentieth centuries, "Protestant fundamentalism" – or simply "fundamentalism" – began as a reaction to several movements in intellectual culture: the rise of Darwinian biology, Freudian psychology, and German "higher criticism" of the Bible.[11] Tenaciously insisting on a literal interpretation of the Bible, fundamentalists taught that the book of Genesis indicates that God created the universe in six literal twenty-four-hour days and instantaneously created humanity at the end of the sixth day. Coupled with the calculation based on biblical texts that Earth is about 6,000 to 10,000 years old, this fundamentalist outlook clashed dramatically with the scientific claims that the planet formed about 4.5 billion years ago, that life developed within the first billion years, and that *Homo sapiens* appeared only after untold millions of years of evolutionary development.

From the perspective of 2,000 years of Christian thought, which contains a variety of views on the relation of scripture and science, biblical literalism can be seen to be an anomaly. St. Augustine, for example, famously maintained that when some particular passage of the Bible appears to conflict with established facts or scientific information, that passage should probably be reinterpreted, perhaps figuratively.[12] Other Christian medieval thinkers acknowledged that the Bible includes a rich diversity of literary genres, reveals truth at many levels, and was never meant to be a scientific document. Interestingly, in 1983 Pope John Paul II articulated a stance quite different from the one the Roman Catholic Church took toward the Galileo controversy when he asserted that we now have "a more accurate appreciation of the methods proper to the different orders of knowledge," thus clearly giving place to both religious and scientific knowledge.[13] Nevertheless, the conflict model was dominant through the twentieth century and is still dominant at the beginning of the twenty-first century. This has been particularly true in America, where science has often been understood in strict empiricist terms and Christian belief has often been

[11] R. E. Olson, *The Story of Christian Theology* (Downers Grove: IVP Academic, 1999), 554–569.
[12] Augustine, *The Literal Meaning of Genesis*, 1.19.
[13] John Paul II, "Address on the occasion of the 350th anniversary of Galileo's publication," *L'Osservatore Romano*, English weekly edn. (May 30, 1983), 7. See his encyclical *Fides et Ratio* (1998). Available online at www.vatican.va.

aggressively projected in fundamentalist terms. The conflict in various forms still lingers, as we will see in several chapters to follow.

However, some more recent thinkers have been interested in a position more moderate than one of outright conflict, proposing ways of thinking about science and religion that make them completely independent activities that cannot in principle be at odds. The “independence model” asserts that each field has its own distinctive function in human life, making for separation or compartmentalization. Various perspectives on the religious side have supported the view that science and religion are independent. Religious existentialism, originating with Søren Kierkegaard in the nineteenth century, insists that the heart of religion is the risky choice to live authentically in pursuing religious values as the basis of meaning in one’s life. Also, Protestant neoorthodoxy in the twentieth century specifically emphasized the primacy of “special revelation” – God’s self-disclosure in scripture – as the sole source of religious knowledge.[14] Karl Barth, the most famous representative of neoorthodoxy, argued that religious knowledge is self-authenticating, carrying its own validation. To him, religious knowledge was not dependent on natural theology, which sometimes utilizes knowledge from science. Continuing the existentialist theme, noted Jewish theologian Martin Buber stressed that the individual’s relation to God is an “I-Thou” relationship, deeply personal and subjective. In contrast, science studies nonpersonal objects through relationships he characterized instead as “I-It.”[15]

The independence model has its advocates on the science side as well. Scientist Stephen Jay Gould used the Roman Catholic idea of a “magisterium,” which is a domain of teaching authority, to support the model. For Gould, science and religion are “nonoverlapping magisteria” – entirely separate domains over which each discipline has teaching its respective authority. He advances this idea as a principle that he dubs by the acronym NOMA – nonoverlapping magisteria – and explains as follows:

> The net of science covers the empirical realm: what is the universe made of (fact) and why does it work this way (theory). The net of religion extends over questions of moral meaning and value. These two magesteria do not overlap,

[14] Olson, *Story of Christian Theology*, 570–589.
[15] M. Buber, *I and Thou*, trans. W. Kaufmann (New York: Charles Scribner’s Sons, 1970).

> nor do they encompass all inquiry (consider, for starters, the magisterium of art and the meaning of beauty).[16]

In eliminating conflict between science and religion, the independence model conceived by Gould claims the realm of fact for science, which he considered objective, but cedes the realm of value and meaning to religion, which he considered subjective. Gould concluded that the independence model has a double effect. It prevents religion from dictating to science and prohibits science from claiming higher moral or intellectual insight than religion, all of which may inspire mutual humility and provide the basis for a larger vision of reality.

Is Dialogue Possible?

The dialogue model seeks to go beyond conflict or compartmentalization and foster mutual understanding between science and religion by seeking common ground. Since the 1990s, conscious pursuit of this model has greatly enhanced contact between science and religion. In recent decades, the pursuit of this model has borne fruit. The John Templeton Foundation has been particularly involved in funding conferences and scholarly research projects, both of which have resulted in a number of books and articles on the topic. Let us consider two avenues proposed by Ian Barbour along which science and religion might have meaningful dialogue: boundary questions and methodological parallels.

Boundary questions delve into how science points beyond itself. Philosophers of science point out that science rests on certain *presuppositions*, assumed beliefs that shape its whole enterprise. One key boundary question asks where the presuppositions required for the foundations of science come from, since science cannot establish them by its own methods. These presuppositions are essential to provide a sketch of the fundamental characteristics of the natural world that science investigates and of the capacities of human beings as scientists to investigate and know about it. For example, science must assume, but cannot by its own methods validate, the belief that nature is physical, real, and accessible to rational investigation. Furthermore, in order to do its work, science must also assume that human beings have the rational

[16] S. J. Gould, “Two Separate Domains,” in M. L. Peterson et al., *Philosophy of Religion: Selected Readings*, 5th edn. (New York: Oxford University Press, 2014), 541.

https://doi.org/10.1017/9781139381765.003 Published online by Cambridge University Press

capacity to investigate nature and learn about its inherent lawlike operations. It does no good to say that science investigates our human powers of inquiry, because those powers must already be trusted in order to begin that investigation.

These beliefs that are foundational for science are drawn from a vastly different philosophical worldview. The belief that nature is real and rational may seem unremarkable, but it was not assumed by ancient Greek science, which had to be supplanted for modern science to be born. For the Greeks, the material world was both less real than the world of ideas and also inherently disordered, which is why Greek science specified a priori how things necessarily must behave rather than engaging in disciplined inductive empirical investigation. Modern science arose in the context of yet another philosophy of nature, one rooted in the Judeo-Christian doctrine of creation. E. L. Mascall argues that the worldview serving as the intellectual backdrop for the pioneers of early modern science was radically different from the intellectual backdrop of Greek science:

> A world which is created by the Christian God will be both contingent and orderly. It will embody regularities and patterns, since its Maker is rational, but the particular regularities and patterns which it will embody cannot be predicted a priori, since he is free; they can be discovered only by examination. The world, as Christian theism conceives it, is thus an ideal field for the application of scientific method, with its twin techniques of observation and experiment.[17]

In the same vein, Mascall argues for another assumption drawn from the classical Judeo-Christian doctrine of creation: that the human rational ability to know physical nature enables robust empirical inquiry.

Another boundary issue arises when science reaches the limit of its abilities to explain an important phenomenon. "Big Bang" science is a perfect example, because, in pushing back to the earliest event in the cosmos, astronomers and theoretical physicists ask questions about the prior conditions that precipitated that initial cataclysmic event. Physicist Stephen Hawking, using M-theory, has explained that the initial singularity from which the universe expanded indicates that the operation of quantum gravity got everything going and, by implication, makes creative activity by God

[17] E. L. Mascall, *Christian Theology and Natural Science* (New York: Ronald Press, 1956), 132.

unnecessary.[18] Since considering ultimate beginnings takes us as far back in time as science can extend its explanatory reach in terms of known laws, philosophers say that science has reached a limit or boundary and thus open a path for dialogue between theology and science.

At this level of inquiry, profound questions arise that are not clearly just scientific – such as, why is there a law such as gravity, which Hawking thinks created everything else? Or, better, why is there something rather than nothing; why the law of gravity? How does reference to the abstract law explain the existence of a concrete universe? Theologian and physicist John Polkinghorne indicates that these kinds of questions are at the limits of science, for they open the door for metaphysics and theology to say something about God as the creative ground of the existence and lawful order of the universe.[19] Of course, some nonreligious thinkers counter by proposing that the ordered cosmos arose by pure chance rather than by divine activity. One move they make on the side of pure chance is to argue that there is an infinity of possible universes out of which one universe will be actual, such that it is by chance that our specific universe exists, albeit a very fortunate occurrence that brought about our lawlike and ordered universe.[20] The debate in effect comes down to whether the ultimate, rock-bottom explanation for the existence of this universe is mechanistic or teleological. Unless we claim for science the supremacy and exclusiveness of reductionist empiricism and materialism, boundary questions invite fruitful science–religion dialogue.

We turn now from the topic of boundary questions to a discussion of methodological parallels between religion and science. Two productive topics for exploring methodological parallels pertain to the role of paradigms and to the nature of "research programmes." Barbour believes that the idea of a paradigm provides insight into the ways in which both science and religion operate. On the science side, some philosophers of science, such as Norwood Russell Hanson and Stephen Toulmin, have argued that science is not pristine, objective, and free of bias, as popular stereotypes suggest. They

[18] S. Hawking and L. Mlodinow, *The Grand Design* (New York: Bantam Books, 2010), 180–181.

[19] J. Polkinghorne, *Science and Theology: An Introduction* (Minneapolis: Fortress Press, 1998), 79–81.

[20] V. Stegner, *God and the Multi-verse: Humanity's Expanding View of the Cosmos* (Buffalo, NY: Prometheus Press, 2014).

note a dimension of "personal involvement" in science, which makes it subjective in a sense – or, better, intersubjective and communal. No philosopher of science, however, has had more impact on these discussions than Thomas Kuhn, who argued that theory selection depends on the prevailing paradigm of the scientific community, which is historically conditioned and value-laden in various ways. He describes a paradigm as functioning in two basic ways:

> On the one hand, [the term "paradigm"] stands for the entire constellation of beliefs, values, techniques, and so on shared by the members of a given community. On the other, it denotes one sort of element in that constellation, the concrete puzzle-solutions which, employed as models or examples, can replace explicit rules as a basis for the solution of the remaining puzzles of normal science.[21]

"Normal science" simply means the efforts of the scientific community to solve the research problems they face according to the prevailing paradigm.

The paradigm contains examples of puzzles already solved and helps decide what could count as an adequate solution to other puzzles. An established paradigm is resistant to simple falsification by a few negative instances and can often be preserved by arguing that these instances are anomalies or by articulating ad hoc hypotheses. Theology may be seen as operating by a widely accepted paradigm that is then used to address questions and problems that arise within its scope, such as the problem of evil.

Kuhn's idea of a "scientific revolution" is also highly suggestive of parallels with religion. Normal science, which is typically conservative and controlled by tradition, enters crisis when the long-accepted paradigm encounters increasing difficulty solving some important puzzles. At some point, the scientific community becomes dissatisfied and is attracted to an alternative paradigm because of its ability to account for existing data while handling new data in a more helpful way. When such conditions are present, according to Kuhn, science undergoes a major "paradigm shift," which is a "scientific revolution." The shifts prompted by Copernicus and Mendel would be examples of scientific revolutions. Similarly, when the accepted theological paradigm – the dominant way of looking at the world and explaining and responding to important life situations – comes under

[21] Kuhn, "Postscript – 1969," in *Scientific Revolutions*, 2nd ed., 175.

pressure, and a new paradigm seems promising to a significant number of influential thinkers in the religious community, a "theological revolution" is almost inevitably brewing. One could interpret, say, the Protestant Reformation in breaking from Roman Catholicism or the modern reformulation of traditional Christian doctrines by feminist theologians in this light. We could also see the emergence of Mahayana Buddhism from Theravada Buddhism, for example, as a major paradigm shift.

All of this highlights the social and communal nature of paradigms in conditioning what we call knowledge. Although debates continue about the exact degree of subjectivity in science, Kuhn's provocative analysis has inspired some to suggest that religious traditions can also be viewed as communities sharing a common paradigm. For religious communities, relevant data would be religious experience, historical events, sacred texts, and so forth – all interpreted and given significance within the paradigm. Challenges to religious belief, like challenges to a scientific theory, can be deflected by calling them anomalies or by proposing ad hoc hypotheses. Thus, the tendency of religious believers to maintain their beliefs even in light of seemingly contrary evidence is not drastically different from the behavior of scientists working under their own shared paradigm.

For those who think that a paradigm interpretation is an extreme view of the nature of theories in both science and religion, philosopher of science Nancey Murphy suggests that it is better to interpret each field as operating according to a research program that guides inquiry.[22] She draws her idea from the work of philosopher of science Imre Lakatos, who argued that a scientific community engages in ongoing projects that in one way or another preserve an accepted core theory that is supported by auxiliary theories. Thus, in light of difficult data, it is the auxiliary theories that may be modified or rejected in order to keep the difficult data from overturning the core theory. For Lakatos, viewing science – or various areas of science – as following a research program explains the tendency of scientists to cling to their main theory in light of seemingly adverse data, while at the same time accounting for their ability to make appropriate theoretical adjustments. For example, when the behavior of the perihelion of Mercury was found anomalous with respect to Newtonian mechanics, that did not in itself precipitate

[22] N. Murphy, *Theology in the Age of Scientific Reasoning* (Ithaca NY: Cornell University Press, 1990).

the collective abandonment of classical physics but rather stimulated auxiliary theories about the phenomenon.[23] Of course, in this case, Einsteinian physics eventually superseded Newtonian physics.

Similarly, Murphy argues that theology as an intellectual discipline proceeds by extending the scope of its core theory and defending it against difficult data with auxiliary hypotheses when necessary. The core of the Christian theological research program would contain the theologian's judgment about how to sum up the essential minimum content of the faith community – perhaps revolving around the loving and holy nature of God and God's revelation in Jesus. The next step would be to develop auxiliary hypotheses to be explained by the core and whose future modification could help protect the core. The last step, if theology is to be genuinely parallel to science, is for the theologian to seek data that help confirm the core theory and the auxiliary hypotheses related to God's goodness. For example, the positive data would include a range of religious experiences (such as a sense of providence, joy, and communal support). However, potentially negative data might be the evil and suffering in the world, which can be taken as evidence that there is no good God. Instead of surrendering the core theory, which is the theological foundation, theodicies about why God allows evil can be formulated to protect the core theory (such as theories about character building or strengthening faith). In the end, whereas a Kuhnian approach takes both science and religion in a subjective direction, Murphy sees both science and religion as having an objective quality – developing theories that have to be accountable to both all of the data and intersubjective testing by the community of inquirers.

Attempts at Integration

Although a dialogue model looks more promising than conflict or compartmentalization, some thinkers press further toward a more organic relationship between science and religion. The integration model is grounded in the intellectual ideal that human beings should seek a comprehensive and unified understanding of reality. After all, if reality is rationally coherent, and if truth is self-consistent, then surely science and theology must somehow be

[23] I. Lakatos, *The Methodology of Scientific Research Programmes, Philosophical Papers*, 2 vols. (Cambridge: Cambridge University Press, 1978), vol. I, 8–101.

https://doi.org/10.1017/9781139381765.003 Published online by Cambridge University Press

harmonious. However, there are different versions of integration between the content of science and the content of theology, as identified by Barbour: natural theology, theology of nature, and systematic synthesis. In effect, each involves a different approach to how the content of science and the content of theology can be combined.

Traditional natural theology reasons from the existence of the cosmos itself or from some particular feature of the cosmos – such as its general order or human moral awareness – to the existence of God. Rather than rely on sacred revelation or church authority, natural theologians construct arguments based on human reasoning from some observable fact. Perhaps the most popular piece of natural theology is the teleological argument, which historically took several forms, and which will become relevant to later discussions in this book. Historically, Isaac Newton, Robert Boyle, and other early scientists extolled the evidences of design in nature, while William Paley in the same vein articulated a famous rendition of the argument from design. Of course, the great skeptical philosopher David Hume effectively critiqued the design argument in the eighteenth century, and Charles Darwin's work in the nineteenth century put further pressure on the design argument. Chapter 3 thoroughly addresses this important controversy, which continues to draw much interest today.

A different kind of integration of science and religion is represented in what we may call a theology of nature. Unlike those doing natural theology, those engaged in forming a theology of nature do not start from science and then construct an argument for a divine being. Instead, a theology of nature uses the content of science to tutor, reformulate, and reinterpret traditional theological doctrines rather than to argue for the existence of God. Within the Christian intellectual community, for example, the doctrines of creation, providence, and human nature are affected in fascinating and important ways by the most influential scientific theories. As biochemist and theologian Arthur Peacocke states, for example, the traditional picture of nature as static and hierarchical has been replaced by a picture of nature as dynamic and developmental. For Peacocke, the new scientific picture presents an opportunity for an informed theology to assert that "the natural causal creative nexus of events is itself God's creative action."[24] Many see

[24] A. Peacocke, *Intimations of Reality* (Notre Dame, IN: University of Notre Dame Press, 1984), 63.

https://doi.org/10.1017/9781139381765.003 Published online by Cambridge University Press

Peacocke's approach as opening the door for a closer relationship between religion and the most current science than seems possible in natural theology because it interprets the objects of science (entities and processes in the physical world, even characterized in a general way) as mediating God's presence and activity in the world.

A third version of integration is systematic synthesis, which tries to incorporate key theological themes and basic scientific insights into a total worldview. After all, the classical understanding of "uni-verse" is that all things are part of "one truth" – or, better, that all truths, in principle, fit together harmoniously, even if we do not always see how they fit in practice.

Nonetheless, a worldview provides a comprehensive framework that serves to fit all truths together in relationship. A well-known example of seeking a scientifically informed worldview in this way is the work of Alfred North Whitehead, who tried to create a total conceptuality that would harmonize religion, education, the arts, and human experience. Whitehead's "process philosophy" replaced the fixed, deterministic processes of Newtonian science with the concepts of change, randomness, and uncertainty characteristic of contemporary science – thus projecting the ideas that nature is open, relational, ecological, and interdependent. God, for Whitehead and his intellectual followers, is not the personal being of traditional religion but rather is a cosmic principle that seeks ideal aims for the universe and then optimally synthesizes the actual outcomes of all events in the history of the universe.[25]

Biology among the Sciences

After our preliminary survey of the nature of religion, the nature of science, and the kinds of philosophical questions that arise regarding their relationship, it is now appropriate to locate more precisely the scientific fields playing into the discussion that occupies this book. First, although we must inevitably speak of the sciences generally in making various broad points, our developing discussion centers on the science of biology specifically. It is typical to classify biology within the general discipline of science by

[25] A. N. Whitehead, *Process and Reality*, corrected ed. (New York: Free Press, 1985).

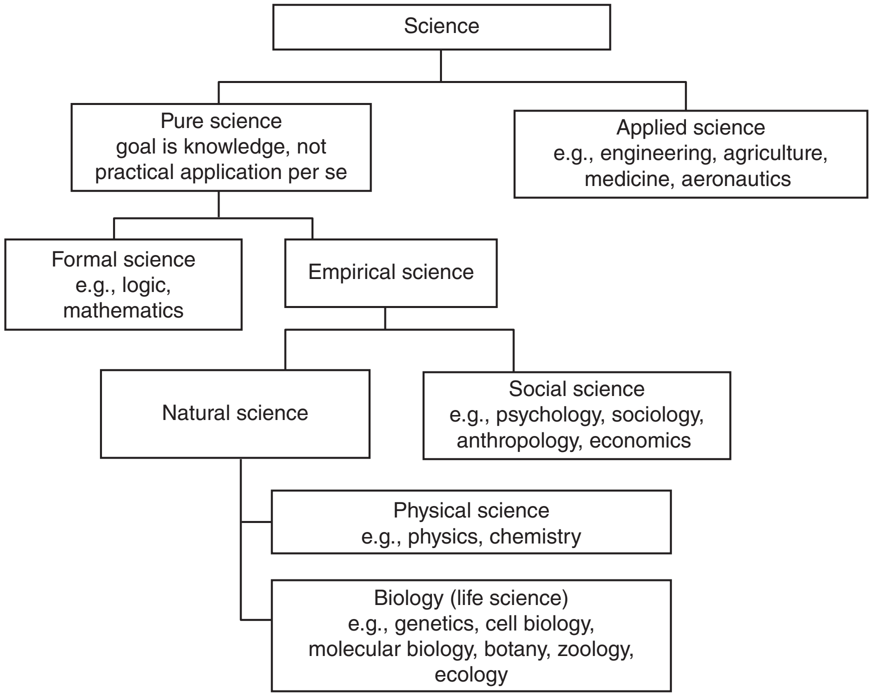

Figure 1.1 Areas of Science

envisioning it as a natural, empirical science. Since the term "biology" comes from two ancient Greek words – *bios* (life) and *logos* (words, organized thoughts, knowledge) – biology is a science of the living world. While there are other ways to classify the sciences, the present conception of biology can be defined and situated according to Figure 1.1.

On the one hand, all of the previously mentioned issues pertaining to the relationship between science and religion recur in our discussion of the relationship between biology specifically and religion. On the other hand, the field of biology raises some new and difficult issues related to religion that do not arise in regard to the sciences of the nonliving world.

There is no greater historical example of one who saw the interplay between biology and philosophy, and the implications for theology, than Charles Darwin himself, the great field biologist and scientific naturalist who thought very philosophically about his own discipline – acting like a philosopher of biology, as we would say today. Moreover, he characterizes his 1859 *Origin of Species* as "one long argument" for evolution by "natural selection."[26] He also offers in that monumental work a philosophical analysis of what counts as adequate biological explanation and a blueprint for the systematization of the biosphere. Darwin's contemporaries even referred to him as a philosopher – a philosopher, of course, who ended up providing the very foundation for biological science today. It is no wonder that an influential article by biologist Theodosius Dobzhansky was entitled "Nothing in Biology Makes Sense Except in the Light of Evolution."[27]

Although our classification of the science of biology is rather traditional, the biology within that taxonomy long ago became firmly anchored in evolutionary theory and findings, and thus developed into what we may call the "new biology," which has flourished in recent decades. Although Ludwig Boltzmann once insightfully remarked that the nineteenth century would be the century of Darwin in science, under Darwin's influence the biological sciences also experienced burgeoning growth in the second half of the twentieth century. How we perceive the living world and human life itself has thereby been greatly altered.[28]

In 1953, a major facet of the "modern synthesis" was revealed, a culmination of decades of combining neo-Darwinian biology with physics and chemistry. Work by James Watson and Francis Crick showing that DNA molecules have a three-dimensional chemical structure – suitable both for the faithful transmission of hereditary information and for the (heritable) variation necessary for Darwinian natural selection – was a major accomplishment in relating work by Mendel and Darwin.[29] Indeed, in the early 1900s, there had been concern that the newly rediscovered work of Mendel, with its emphasis on faithful transmission of hereditary information, might be incompatible with Darwinian natural selection, which required variation to arise. The discovery of the structure of DNA resulted from work that progressively showed the compatibility of Mendelism and Darwinism.[30]

[26] C. Darwin, *On the Origin of Species* (London: Murray, 1859), 459.
[27] T. Dobzhansky, "Nothing in Biology Makes Sense Except in the Light of Evolution," *The American Biology Teacher*, 35, no. 3 (1973), 125–129.
[28] L. Boltzmann, "The Second Law of Thermodynamics," in B. McGuinness (ed.), *Theoretical Physics and Philosophical Problems: Selected Writings* (Heidelberg: Springer, 1974), 15.
[29] J. D. Watson and F. H. C. Crick, "Molecular Structure of Nucleic Acids: A Structure for Deoxyribose Nucleic Acid," *Nature*, 171 (1953), 737–738.
[30] A. Stoltzfus and K. Caleb, "Mendelian-Mutationism: The Forgotten Evolutionary Synthesis," *Journal of the History of Biology*, 47 (2014), 501–546.

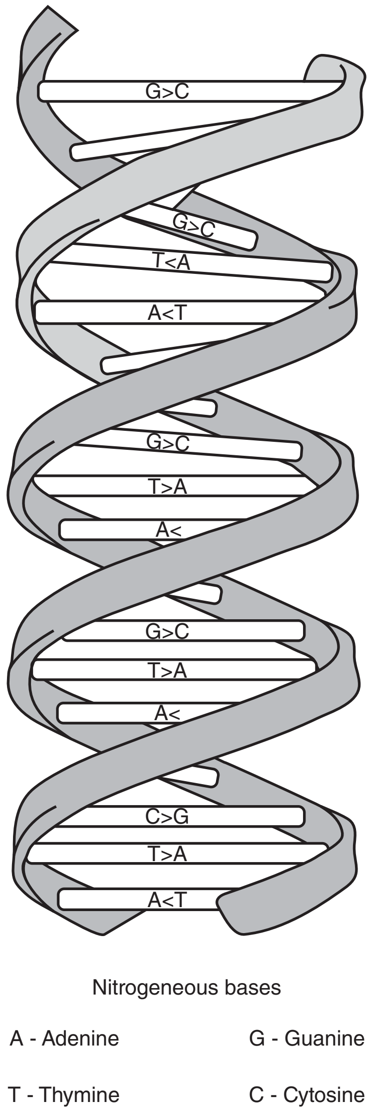

Figure 1.2 DNA Molecule

Now there is hardly a more famous symbol of the new biology than the famous double helix (Figure 1.2).

After the discovery of the structure of this amazing molecule, the resulting explosion of molecular biology was swift and powerful, transforming biology. When it comes to relating the new biology – its theories, findings, and potential implications – to religion, we are still engaging in a distinctively philosophical task that proceeds by raising fundamental

https://doi.org/10.1017/9781139381765.003 Published online by Cambridge University Press

questions, insisting on conceptual clarity, and rationally evaluating alternative views. Philosophy of biology, as a subdiscipline within the overall philosophy of science, is clearly involved, but philosophy is also interested in relationships between disciplines such as biology and theology. Metaphysics (which asks what reality is like and what sorts of things exist) and epistemology (which asks how we can know about the things that exist) are major philosophical interests in this interdisciplinary study as we sort out the kinds of realities and modes of knowledge of biology and theology. Other areas of philosophy, such as philosophy of mind and value theory, are also relevant to some issues. But we are now ready to embark on our journey and inquire more deeply into the complex relationship between biology and religion.

https://doi.org/10.1017/9781139381765.003 Published online by Cambridge University Press