

## CHAPTER 29

# Protestantism and the Sciences

Ted Peters

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Like twins reared separately, Protestant Christianity and modern science were born at the same time into the same family of Western European lineage. They both inherited the same ancestry: a biblical belief in a God who creates a world distinct from divinity and therefore a contingent creation; plus a Hellenistic philosophical belief that both the human mind and the natural world are organized rationally and represented by mathematical structures. Both Protestantism and science were educated by the disciplined thinking of medieval Roman Catholic scholasticism. They both rebelled against hierarchical authority over what the individual heart should believe and over what the individual mind should think. They both took stands against superstition, magic, and human manipulation of alleged supernatural powers.

The overlapping biographies of these twins can be organized into three broad periods: the Copernican, the Kantian, and the contemporary. The first period, the Copernican revolution, has three internal stages: Copernicus himself at stage one in the sixteenth century, with Galileo and Newton marking stages two and three in the seventeenth century. This period concludes with a mechanistic worldview, according to which nature follows a course dictated by laws that never go on a holiday and never need divine intervention or action. The Kantian period, our second, tells how some Protestants developed two languages, one for science and one for faith, untranslatable into one another. The two languages permitted peaceful coexistence between science and theology. Finally, in the contemporary period the Kantian two languages are still widely spoken, but many Protestants are pressing for consonance, for harmony to be gained through dialogue and perhaps even through mutual interaction.

Though the modern period is described by some in terms of a warfare between science and religion, this does not seem to fit the actual history. John Hedley Brooke, an Oxford historian of science, argues, "the image of perennial conflict between science and religion is inappropriate as a guiding principle" (Brooke,

1991: 33). The other extreme, to describe this period as a history of peace and tranquility, would also be misleading. Rather, Protestant history from the Reformation to the present day records a mixture of exploration and threat, advance and withdrawal, enthusiasm and doubt.

### The Copernican Revolution and the Protestant Reformation

Although the Copernican revolution and the Protestant Reformation shared the same century, the sixteenth, they traveled in separate orbits with only occasional intersecting. The first subject of what would become *modern science* was astronomy, and what we now think of as the Copernican revolution took three stages to convince Europe. Nicholas Copernicus (1473–1543) at the University of Cracow, Poland, initiated the first stage. Copernicus determined he needed to reform the worldview he had inherited, namely the Ptolemaic worldview of ancient Greece. The Ptolemaic (*geocentric*) understanding held that the earth is immovable and that the sun and the other planets orbit the earth. Relying upon his own observations (without a telescope) plus his own mathematical calculations, in *De revolutionibus orbium caelestium* (1543) Copernicus advanced the hypothesis that the sun, not the earth, stood at the center of the universe, and the earth – like the other planets – revolves around the sun. This *heliocentric* view of the universe could not be substantiated empirically, so during the sixteenth century it stood as a mere philosophical David against the Goliath of Hellenistic Ptolemaic tradition. Copernicus's argument was not yet compelling.

Turning to the other twin, Protestantism, we observe that Martin Luther (1483–1546) heard tales of Copernicus's new thought but apparently had no serious engagement. One offhand remark appears in 1539 – four years prior to the astronomer's major book – in Luther's *Table Talk* (LW, 54: 358) where he ponders a rumor that Copernicus believes the earth moves rather than the sun and the sky: "This would be as if somebody were riding on a cart or in a ship and imagined that he was standing still while the earth and the trees were moving. . . . This is what that fellow does who wishes to turn the whole of astronomy upside down." Luther added that it was the sun that stood still, not the earth, in the biblical description of Joshua fighting at Jericho (Joshua 10: 12). This remark did not come from Luther's own authored writing but from students who took notes. Spoken in jest, it ought not be interpreted as indicating any general opposition to science.

Central to Luther and to the other Reformers was the role played by Holy Scripture in formulating theological commitments. Although they were literalists, they were neither uncritical nor were they rigid. Luther described the Bible as the "cradle of Christ," thereby ranking scriptural texts according to their relative value for teaching a God of grace and salvation. This hermeneutic indirectly opened scriptural interpretation to new developments in science as they describe God's created order. "The astronomers are the experts from whom it is

most convenient to get what may be discussed about these subjects [sun, moon, and stars]. For me it is enough that in those bodies, which are so elegant and necessary for our life, we recognize both the goodness of God and His power" (LW, 1: 41).

John Calvin (1509–64) opened the door even further by suggesting that the biblical authors could tailor their renderings to fit the mind of the reader. In his *Commentary on Genesis* he reports that Moses adapts his discourse to common usage. When common usage changes, as it does with scientific development, such a hermeneutical insight permits and encourages expanded interpretation. The overriding concern of Luther and Calvin was to see the glory and grace of God in the beauty of creation, so any hesitancy toward science was due to a fear that dispassionate research may render invisible the divine authorship.

Both Luther and Calvin could distinguish between astrology and astronomy, and both rejected astrology as idolatry while celebrating astronomy as science. Luther was both amused and annoyed by the interest in astrology exhibited by his colleague, Philip Melanchthon (1497–1560). The science of astronomy that measures the stars, as valuable as this is, cannot measure the divine creator of the stars. Beyond the aims to which "astronomy, medicine, and all natural science are intended," wrote Calvin, our "mind must rise to a somewhat higher level to look upon his glory" (*Institutes*: I.V.2).

Evidence of this nonadversarial relationship is that near the end of Luther's life, Wittenberg became a podium for Copernicanism. Lutheran Reformer Andreas Osiander (1496–1552) wrote an anonymous preface to the first edition of Copernicus's major work, *De revolutionibus*, for its 1543 publication. This preface includes the infamous line: "it is not necessary that these hypotheses should be true, or even probable; but it is enough if they provide a calculus which fits the observations." Two things are significant to note. First is the acceptance of hypothesis as a component to developing new ideas. Second, that this work has scientific value even if not true. Osiander supported the book's publication, to be sure; yet it appears he feared dogmatic rejection from church authorities. As an outspoken Reformer writing the preface, he may have sought to make it easier for Roman Catholics to adopt by deleting his own name. Just the previous year, 1542, the Inquisition had been reestablished to stamp out Lutheran influence, so by his feeble attempt at anonymity Osiander might have sought to avoid contaminating Copernicus's science with a Lutheran association. Historians debate whether Copernicus himself was aware or approving of the notorious preface.

In summary, Copernican thinking within its own century awaited further scientific confirmation before it could attain the status of irrefutable truth that it presently enjoys in modern society. The Reformers, though dimly aware and moderately interested, were preoccupied with other theological agendas, especially scriptural interpretation and the struggle with Roman Catholicism. For both Protestants and Catholics, the Reformation and Counter-Reformation became the primary lens through which any new developments could be viewed. Catholics were poised to see new developments in science as a variant on Protest-

ant deviancy from church authority: whereas Protestants, somewhat more poised to welcome new developments, had their eyes directed toward holy writ with only furtive glances toward the starry heavens.

### *Galilean Copernicanism*

The century following the history-shaking events of the Reformation witnessed a period of Protestant consolidation and the establishing of foundations. Aristotelian metaphysics was retrieved, and scholasticism returned to the Reformation church bodies. Within this approach theological claims became propositional. The Reformation's *sola scriptura* metamorphosed into a new emphasis on verbal inspiration and biblical inerrancy. The Bible became the source of revealed information articulated in propositional form. Even though Luther and Calvin had never questioned the Bible's divine status, seventeenth-century Protestants developed a vigorous defense of biblical authority, claiming its dictation by the Holy Spirit. By implication, not only does the Bible cradle Christ and the message of salvation, it also becomes the divinely appointed authority on matters of astronomy and the other sciences. Even though Copernican astronomy had found a home in Protestant universities, the clouds of a coming storm were beginning to form. The new science would rebel against both Ptolemy's physics and Aristotle's metaphysics; and for those who interpreted Scripture through the logic of Aristotle in conjunction with the cosmology of Ptolemy, a conflict could not be avoided.

The cultural storm approached as the Copernican revolution inserted a distance between God and the world, making it more difficult to perceive the presence of the Creator within the creation. Despite the advances in mathematical support for heliocentrism as offered by the German astronomer Johannes Kepler (1571–1630), the second stage actually begins with the Italian mathematician Galileo Galilei (1546–1642). Galileo adapted the telescope to astronomy (and in doing so discovered moons orbiting Jupiter among other fascinating things) and more importantly provided the observational evidence on behalf of Copernican heliocentrism. Galileo revived otherwise dormant attention to Copernicus with the result that Copernicus's book (*De revolutionibus*) was finally put on the index of banned books by the Catholic Church in 1616. This was followed in 1632 by an order from Pope Urban VII through the Inquisition to compel Galileo to recant, and the Italian scientist remained under house arrest until his death, the year Newton was born.

Kepler and Galileo buttressed the mathematical evidence for heliocentrism and both affirmed that God organizes the creation mathematically and that the human mind is capable of understanding divine reason. Both rejected Aristotle's notion of final causality – that is, both considered science to be the study of efficient causation in nature and not the study of final ends or purposes. Both altered the Aristotelian concept of change; no longer did change refer to transition from potentiality to actuality but rather the rearrangement of

particles in time and space. Both of these Copernicans sought to reconcile Scripture with science.

However, a slight difference became historically decisive. Kepler, following Plato and rejecting Aristotle, had a mystical temperament and emphasized how God's mathematical thoughts daily structure the natural world. Galileo's temperament was more rationalistic, emphasizing how mathematics functions in a lawlike way as a mechanism for nature. For Galileo, the scientist could describe nature without reference to the divine. Natural laws provide exhaustive explanations. Though Galileo was a devout Roman Catholic believer, he set the stage for a description of nature devoid of providential action.

Galileo supported Copernican heliocentrism with telescopic observations in his major work of 1632, *Dialogo sopra i Due Massimi Sistemi del Mondo*. For him, the glorious natural world (and our world) was created by God. However, and crucially, God is the first cause only; thereafter the laws of nature describe the cause and effect relations. Although Galileo was a theist, in relegating God to first cause and removing God from active intervention, the seeds were sewn for the rise of deism.

For *sola scriptura* Protestants, as well as the Vatican hierarchy, Galileo posed a challenge with his declaration of independence on behalf of the scientific interpretation of nature. In a letter to Castelli in 1613, Galileo wrote:

The Holy Bible and the phenomena of nature proceed alike from the divine Word, the former as the dictate of the Holy Spirit and the latter as the observant executrix of God's commands . . . Nothing physical which sense-experience sets before our eyes, or which necessary demonstrations prove to us, ought to be called in question (much less condemned) upon the testimony of biblical passages. (Dillenberger, 1960: 88)

With Galileo, the "Book of Nature" suddenly appeared on the same level as the "Book of Scripture." Nature gained an independent status to which other truth must conform.

### *De-centering Earth*

It is frequently said that the Copernican revolution shocked European Christianity by de-centering the planet Earth and thereby de-centering the focal status of the human being within nature. There is little or no evidence to support the claim that change in cosmic geography shocked either Protestants or Roman Catholics. Far more serious than heliocentrism was the emerging empirical epistemology that would rely upon independent experimental knowledge and reject biblical authority; and still more important yet was the emerging ontology of a natural world operating mechanistically without divine participation or intervention.

Somewhat disconcerting to the religious psyche, however, was a battle internal to theology regarding many worlds. A question raised centuries prior to

Copernicus was this: did God make only one world or many? Some, arguing from an Aristotelian commitment to oneness as perfection, argued for a single world. Others looked to the stars and wondered if each might support a living world similar to Earth. Although the science of Copernicus and Galileo did not deal directly with extraterrestrial life, its impetus to deviate from Aristotle seemed to support the many worlds alternative. Toward the end of the seventeenth century books appeared in France and England espousing the "many worlds" view. They argued that the vastness of the universe dwarfs planet Earth in size and the possible existence of extraterrestrial civilizations blunts the human sense of self-importance. Yet they also retained the earlier sense of human centrality in their contention that human minds are responsible for the contemplation of this possibility and the celebration of the human mind makes it all bearable.

Despite the drama over cosmic centrality, the theological debates were themselves oriented around the contest between biblical and extrabiblical knowledge. No mention of extraterrestrial life appears in the Bible, so some Protestant extremists sought to deny the possibility. Opposing parties used speculation on other worlds as leverage for establishing the independence of scientific research in developing new knowledge. This contributed to advances in natural theology as it advocated knowledge testifying to God apart from scriptural authority. The net impact doctrinally was that creation – because the scope of our understanding of creation could now be expanded by science beyond what the Bible has bequeathed us – took center stage and sent strict biblically revealed redemption to the wings. The domain of nature became divorced from its Christological center.

### *Newtonian mechanism*

The theater of activity moves in the latter half of the seventeenth century from the Continent to England and to the metaphor of the clock. The father of chemistry, Oxford scientist Robert Boyle (1627–91), sought to demonstrate divine design in the natural realm. Science is a religious task, Boyle argued, disclosing the admirable workmanship that God displays in the universe. Boyle likened the natural world to a clock (the cathedral clock in Strasbourg is the specific clock on Boyle's mind) with a finely engineered mechanism. The clock metaphor emphasized the orderly course of the world, an autonomous machine, with which God would occasionally tinker when performing a miracle. Miracles would not, however, call into question the normal dependable order discernible to the scientist as the laws of nature.

The revolutionary forces set in motion by Copernicus attained full victory in the work of Cambridge mathematician and physicist Sir Isaac Newton (1642–1727). Author of scientific works such as *Philosophia Naturalis Principia Mathematica* (1687), *Optics* (1704), and *Arithmetica Universalis* (1707), Newton is remembered and applauded for unifying the heavens with earth in a single mathematical concept of nature united by the laws of mechanics and the law of gravity. By invoking the idea that all bodies everywhere operate with mutual

gravitation, he ascertained that the forces that keep the planets in their orbits must be reciprocally the squares of their distances from their centers. Newton applied what was known about terrestrial mechanics to the heavenly bodies and thereby erased any previously presumed gulf of difference. Derivation of such knowledge is experimental, mechanical, and mathematical.

Although likening the natural world to a well-designed clock, Newton emphasized that it needs God as the clock maker – that is, as the first cause. Further, the world clock also needs God for frequent adjustment and repair. Newton was again a theist, believing in an active God whose *concursum* with nature performed necessary tasks such as determining the actual paths of planets in their orbits. Historians of science view this as a mistake on Newton's part, as later research would provide a scientific explanation for actions he had thought to be divine. When asked by Napoleon (in an alleged conversation) about God's intervention into planetary orbits Pierre Simon, Marquis de Laplace answered, "I have no need of that hypothesis." What subsequent scientific history would carry beyond Newton is the image of nature as a universal and mathematizable mechanism, dependable and discernible, with no need for divine intervention. "Given the mechanical world and his religious faith, Newton had creatively related the two," judges John Dillenberger, "But Newton's successors saw that the two did not necessarily imply each other" (Dillenberger, 1960: 125).

In terms of the number of pages, Newton wrote more on theology than on science. Much of his theological work remains unpublished. Yet, even in his published theological treatises, Newton asserted that space in the natural world is the divine sensorium; God is present to the world while allowing the world to operate according to natural law. "The true God is a living, intelligent, and powerful Being," he writes in *Principia Mathematica*: "In him are all things contained and moved; yet neither affects the other: God suffers nothing from the motion of bodies; bodies find no resistance from the omnipresence of God. It is allowed by all that the Supreme God exists necessarily; and by the same necessity he exists always and everywhere" (Dillenberger, 1960: 123). Rather than ask how Protestants react to such science, it is better to think that this is Protestantism as science. Alexander Pope put it this way in his *Epitaph on Newton*:

Nature and Nature's laws were hid in night;  
God said, Let Newton be! and all was Light.

Protestants share with Roman Catholics and Orthodox Christians a number of theological commitments that have fertilized the growth of natural science in the modern world. First, the monotheistic commitment implies a unity and universality to principles ordering the world. Second, the doctrine of Creation, understood as a contingent divine act – God is free and did not need to make the world the way it is let alone make the world at all – implies that we cannot deduce the nature of the world from abstract principles; rather, we can understand this world only by observation. Third, nature is positively affirmed not only because it is a witness to the marvel and wonder of its divine creator but also

because it is beloved by God and therefore we human beings must treasure nature. Fourth, by affirming that secular vocations are as divine as religious vocations, Luther and Calvin indirectly inspired later Puritans and others to actively pursue scientific study as a sanctified this-worldly enterprise (Barbour, 1966: 46-9).

What was missing or inadequate in astronomy and cosmology and physics, from the Protestant point of view, was the moral dimension of human existence. Methodist champion John Wesley (1703-91) could write two treatises on the practical value of modern science, one on medicine and one on electricity, plus *A Survey of the Wisdom of God in the Creation; or a Compendium of Natural Philosophy* (1777). On the one hand, Wesley saw signs of a divine designer in the design of nature. On the other hand, Wesley voiced impatience with science when it seemed to divert attention from what is really important to human life and welfare. What really is important is to see that God created us with a moral capacity to love one another.

### *Miracles*

The eighteenth century witnessed a battle over the theological significance of miracles. Seventeenth-century science had increased confidence in the exhaustive order of cause and effect in the natural world, and the essence of miracle came to be understood as a divine intervention that temporarily disrupted the order. In a miracle God inserts a divine cause into the otherwise autonomous nexus of secondary causes. The first cause that created the order of nature *ex nihilo* in the first place returns in a miracle to disrupt it for a providential end.

John Locke (1632-1704), the English philosopher who authored *Essay Concerning Human Understanding* (1690) and other political works influential on the development of American democracy, was a contemporary of Newton. In *The Reasonableness of Christianity as Delivered in the Scriptures* (1695) and *A Discourse on Miracles* (1704), Locke analyzed miracles and marshaled biblical accounts into a rational defense that Jesus is the messiah. Eyewitness testimony, in particular, to Jesus's miracle-working power was subjected to review and found reliable. Miracles, in short, testify to the credibility of Christian faith.

In his *A Short and Easy Method with the Deists* (1698), Charles Leslie (1650-1722) offered three rules to establish the credibility of witnesses to miracles: first, the event must be subject to outward senses such as seeing and hearing; second, a miracle must be public if it is to be considered verifiable; and third, the miracle must result in new customs or practices to demonstrate its social impact. Later Protestants added a fourth rule: the miracle must lead to a willingness on the part of Christian believers to suffer persecution for the faith. These remain in usage even today.

Theologians of this era believed miracles were rare. Some Protestants were willing to limit the miracle-working era to the biblical period, whereas Roman



Catholics extended it to contemporary times through the miracle-working powers of the saints. Of significance here is that Protestants presumed that testimonies of miracles contributed to the rational credibility of Christianity; and by limiting miracles to rare events that disrupt the natural order, they could rely upon that order as well for testimony to God's creative design.

A philosophical revolution prosecuted by David Hume (1711–76) reversed the meaning of what it meant to be rational. To be rational, from Hume forward, is to affirm that the order of nature remains exhaustively intact and further to deny, by definition, miracles. In his "Essay on Miracles" within the larger work, *Philosophical Essays Concerning Human Understanding* (1751), Hume delimits the concept of experience to experience of what is lawful in nature: "It is experience only, which gives authority to testimony; and it is the same experience, which assures us of the laws of nature . . . We may establish it as a maxim, that no human testimony can have such force as to prove a miracle, and make it a just foundation for any such system of religion" (Hume, 1962: 132–3). In other words, we use experience to establish the laws of nature – how could we then use experience to establish the violation of those laws? Due to this tie between experience and the ubiquity of natural law, we must eliminate miracles as something rationally knowable. Without miracles, post-Hume theologians were left with only the world's original design as testimony to the divine responsibility toward nature.

### From Kant to the Two Languages

There are two kinds of reason, not one, said German philosopher Immanuel Kant (1724–1804), namely reason applying to the starry heavens above and reason applying to the moral law within. What we know as the causal law in nature (every natural event has a natural cause) is not constrained by the objective world, he says in *Kritik der reinen Vernunft* (*The Critique of Pure Reason*, 1781); rather, human consciousness is so constituted that it must interpret empirical observations in terms of cause and effect. Human reasoning, in short, results from the synthesis of experience with the external world plus *a priori* structures such as space and time that come from the human mind. Because cause and effect reasoning is limited to our understanding of the external *physical* (phenomenal) world, Kant concludes that we cannot have knowledge of the *same type* for three *theological* (and therefore noumenal) ideas: God, freedom, and immortality. Decisive to note is that Kant splits human knowing. Disciples of Kant could no longer speak of noumenal realities such as God on the same plane with phenomenal realities as observed by scientific research.

Even though divine matters could no longer be known as we know physical objects, Kant could justify speaking of God, freedom, and immortality by turning to the moral law within human awareness. The stern universal (if rational) voice of conscience, he argued, bespeaks a transcendent source. The sense of duty

implies that we are free (else fated and not able to fulfill conscience) and that immortality is promised (else why bother?). In his *Religion innerhalb der Grenzen der blossen Vernunft* (*Religion Within the Limits of Reason Alone*) (1793), Kant stressed that shouldering moral responsibility is an end in itself, even if it needed the noumenal for its initial foundation. Kant relied upon the moral sense within, not the testimony of miracles from without.

Kant marks a fork in the rivers, one flowing toward Liberal Protestantism and the other toward Conservative Protestantism. The liberal stream took a turn to human subjectivity with Friedrich Schleiermacher (1768–1834) and Albrecht Ritschl (1822–89) leading to the nineteenth-century cultivation of a morally conscious Christianity bent on transforming society into the kingdom of God. The roles of faith and reason were reversed. Whereas, for Locke, reason provided the basis for faith, liberal Protestant faith gave rise to its own reasoning. Instead of miracles producing faith, faith produced miracles as a form of interpretation of otherwise natural physical events. The religious language of liberal Protestants shied away from speaking of the objective world studied by science and instead turned to the subjective sphere of consciousness, faith, and values. What we know as the distinction between right and wrong, good and evil, faith and nonfaith, became a subjective overlay superimposed on an otherwise valueless nature studied by a value-free science.

Conservative Protestants were left to hold on to a divine design objectively manifested in the natural realm and discoverable by science. Nonetheless, conservatives also feared that the direction being taken by modern science buttressed by Kantian philosophy would lead to atheism. "They were remarkably right," says Dillenberger. "But their own course of action was more shrouded in defensive and rear-guard ways of thinking than in any creative advance through the problems" (Dillenberger, 1960: 186).

#### *The language of fact versus the language of meaning*

The Kantian divide between two types of reason marks the next stage in this history, not only for Protestantism but also virtually for all of Western culture. Many commentators liken the divide to speaking two separate languages, with science speaking the "language of fact" and religion speaking the "language of meaning." Science deals with objective reality, whereas religion deals with subjective interpretations of reality. Science is concerned with the physical, whereas religion is concerned with the spiritual. Science asks questions about penultimate reality, whereas religion asks about ultimate reality. The most prominent scientists, such as Albert Einstein, have held to the two-language view: science speaks of objective facts whereas religion speaks of subjective values, and society needs both.

Even belligerent advocates of atheism (based upon scientific materialism or secular humanism) hold to the two-language scheme. This includes Marxists and Maoists. Science and religion speak separate languages, contend

spokespersons such as mathematician Bertrand Russell, astronomer Carl Sagan, and biologist Richard Dawkins, and though science speaks truthfully about reality, religious language speaks only of imaginary fictions, of pseudo-knowledge. To be authentic and democratic, society should live exclusively according to the language of science and according to humanistic values based upon the materialist worldview.

Twentieth-century neo-orthodox Protestant theologians such as Karl Barth, Paul Tillich, Rudolf Bultmann, Reinhold Niebuhr, and Langdon Gilkey have vociferously defended the two-language view. Gilkey spoke for the era while taking the stand in a 1981 courtroom in Little Rock, Arkansas, as expert witness against the teaching of creation as a scientific subject in the public schools. He testified that science asks "how?" while religion asks "why?" Science deals with objective or public knowing of *proximate* origins, whereas religion and its theological articulation deals with existential or personal knowing of *ultimate* origins (Gilkey, 1985: 49–52, 108–13). What Gilkey advocates is that a healthy society speaks both languages.

It is important to note that the two-language view emerges as a modern cultural phenomenon, fully embraced by the liberal Protestant tradition and its progeny, the neo-orthodox and related schools of thought. Conservative Protestants have also absorbed the two-language view from culture and render it limited support, but conservative theologians are still more likely to think of theology as speaking about objective reality. Hence, conservatives are more likely to see scientific and theological languages as commensurate (Murphy, 1996: 58).

It is always a mistake to presume that liberal Protestantism is proscience and conservative Protestantism is antiscience. The distinction lies rather in whether or not one can speak of God, moral freedom, and immortality along with miracles in objective terms, in the same kind of language that science speaks.

### *Evolution versus fundamentalism, creationism, and intelligent design*

With the publication of the *Origin of the Species* in 1859, the match was lit for a fiery controversy that has been burning down to the present. To explain variation and change in species, Charles Darwin (1809–82) enunciated the key principle of evolution: "natural selection" or "survival of the fittest." Natural selection explains *post hoc* the evolutionary success of those species now in existence compared to those species that have become extinct. When the wide variety of individual differences within a species becomes a factor in adapting to changing environmental circumstances, and when some adaptations are selected for and others selected against, large-scale Malthusian selection occurs with the surviving remainder determining the heritable traits of a new species. The last half of the twentieth century added the concept of genetic mutation to explain heredity with greater precision, resulting in the neo-Darwinian synthe-

sis of natural selection with genetic mutation. The DNA that survives is considered a competitive success, the victor in nature's relentless and impersonal struggle to determine who will be more fit.

Darwinism has received mixed reviews among Protestants. Fundamentalists and evangelicals, for whom science and religion still speak the same language, are quite likely to see conflict. Liberal Protestants following the Kantian tradition of two languages see no conflict; they are more likely to either ignore evolutionary theory or in some rare cases incorporate evolution into Christian anthropology.

Evolution appeared to be a challenge to fundamentalists for whom authority, if not inerrancy, of Scripture is paramount. Bishop Samuel Wilberforce (1805–73) of Oxford is remembered for saying that Darwin was guilty of limiting God's glory in creation and that "the principle of natural selection is absolutely incompatible with the word of God" (White, 1896: I, 70). At the John T. Scopes "monkey trial" in Dayton, Tennessee, July 10–21, 1925, William Jennings Bryan (1860–1925) defended the authority of the Genesis account of creation against biological Darwinism, and defended Christian values and democracy against social Darwinism. Much less absolutely, American fundamentalist Reuben A. Torrey (1856–1928) conceded that a person could "believe thoroughly in the absolute infallibility of the Bible and still be an evolutionist of a certain type" (Numbers, 1992: 39).

Fundamentalists are not alone in providing a Protestant response to Darwinism. Scientific creationists and advocates of "intelligent design" oppose Darwinian theory; other Protestants have embraced Darwinian theory and even see themselves as evolutionary theists. Whereas fundamentalism appeals to the authority and even inerrancy of the Bible, scientific creationism and intelligent design appeal to scientific arguments against the common descent of humanity from prehuman life forms and for restricting natural explanations to natural factors. "Young Earth Creationists" at the Institute for Creation Research in El Cajon, California, for example, hold that the earth was created pretty much as we find it less than 10,000 years ago, and that at the moment of creation God fixed the species. Creationists can accept microevolution within a species, but they reject macroevolution from one species to another.

Intelligent design advocates are less concerned about the age of the earth and more concerned about explaining how one species surpasses another in macroevolution. They emphasize that emergent life forms are irreducibly complex – that is, complex life forms could not result merely from incremental change through natural selection. What is required for new evolutionary developments, they say, is "intelligent design" by a transcendent intelligent designer. The struggle between Darwinism and intelligent design is the struggle between a strictly natural explanation and a theological explanation, and both are claimed to be scientific. Fundamentalists, creationists, and intelligent design proponents all agree that naturalistic ethics based upon Darwinian principles such as survival of the fittest corrupt social morals by approving brute selfishness, *laissez faire* capitalism, and "might makes right" nationalism.

Other contemporary Protestants of the hypothetical consonance mind (discussed below) work to incorporate the anthropology of evolutionary theory into their theology. Arthur Peacocke adds *creatio continua* to *creatio ex nihilo* in his doctrine of creation, and argues that God has established a dialectic between law and chance by which the world operates. Evolution is the history resulting from God's gifts of law and chance. "God is the Immanent Creator creating in and through the processes of the natural order" (Peacocke, 1993: 104).

### The Contemporary Question of Consonance

Speaking two languages has become less than intellectually satisfying for many contemporary Protestants and their Roman Catholic colleagues. If there is only one God and one world, then there must be only one truth. Science at its best and theology at its best seek only one thing, the honest truth about reality. Furthermore, both science and theology are realistic – that is, both presume the existence of a reality to which their propositions refer. To be sure, neither advocates a *naïve realism*, wherein what you see is what you get; but both operate with variants of *critical realism*, according to which some things cannot be known directly but can be pursued indirectly. Neither God nor electrons can be known directly, yet critical realism asserts that they are "there." Even though some criticize critical realism for its alleged foundationalism (Murphy), others believe "critical realism offers considerable potential as a theoretical bridge between the two disciplines" (McGrath, 1998: 164). With such things in mind, many scholars are looking beyond warfare and even beyond the two-language model to dialogue. "The imagery of 'dialogue' is thus vastly to be preferred to the unhelpful (and frankly rather outdated) image of 'warfare'" (McGrath, 1998: 28).

In the final quarter of the twentieth century the Notre Dame University historian of science Ernan McMullin began asking if we might be ready for exploring greater consonance between scientific and theological claims about the world. What has developed among many Protestant theologians is a methodological agenda of *hypothetical consonance*. It is hypothetical, as it seeks to test the waters of both science and faith, to see if they are the right temperature for some degree of mixing.

The term "consonance" in the strong sense means accord or harmony. Full accord or harmony between scientific and theological claims does not yet exist; they still sing different melodies. Yet consonance in a weak sense appears to be progressive and fruitful. In the weak sense consonance is put forth hypothetically, identifying common domains of "question-asking." Recent discoveries and theoretical advances in fields such as quantum physics, Big Bang cosmology, and thermodynamics, for example, have raised questions within science of transcendence, about a divine ground to the physical universe. The God-question rises up out of scientific reasoning itself (Davies, 1983: ix). Many theologians

are readying themselves for dialogue, for conversation with scientists on the hypothesis that in the future further consonance may be uncovered (Peters, 1998: 18–19).

Robert John Russell (b. 1946), an ordained minister in the United Church of Christ who holds a doctorate in physics, founded the Center for Theology and the Natural Sciences at the Graduate Theological Union in 1981. Russell has proposed that whenever we discover consonance between a theological and a scientific claim, we will also find an element of dissonance closely related. For example, the finite age of the universe according to Big Bang cosmology (the theory that the entire universe began with a bang some 15 billion years ago) is consonant with the theological claim that creation is temporally finite. Yet the open Big Bang model pictures the universe as infinite in size, making it dissonant with the theological assumption that creation is spatially finite. Russell has further proposed that the presence of dissonance and its relation to consonance should drive the discussion further in creative ways; in this case, by expanding the concept of finitude scientifically and theologically.

This agenda reflects the central tenet of Russell's program: to promote the creative mutual interaction of science and theology. He advocates a "two way interaction between scientific and theological research programs" (Russell, Clayton, Wegter-McNelly, and Polkinhorne, 2001: ii), meaning that when research is taken up by theology it takes science into consideration; and it means that at some point we should expect theology to suggest fruitful areas of research for science to pursue. Nancey Murphy, who teaches Christian Philosophy at Fuller Theological Seminary in Pasadena, California, measures both science and theology on the basis of whether or not they foster progressive research programs – that is, do they yield fruitful new knowledge or expanded understanding? (Murphy, 1990: 85–7).

At the beginning of the third millennium, we find a number of leaders in the growing dialogue between science and faith to be hybrids, individuals with advanced accomplishments in both Christian theology and natural science. John Polkinghorne of Cambridge University is an ordained Anglican priest with a widely respected reputation as a researcher in physics. Recently retired Oxford University professor Arthur R. Peacocke, also an Anglican priest, is a trained biologist. Peacocke has organized the Society for Ordained Scientists. Celia E. Deane-Drummond has degrees in both genetics and theology as credentials for her position as Professor in Theology and the Biological Sciences at Chester College of Higher Education. Alister E. McGrath, Professor of Historical Theology at the University of Oxford, holds a doctorate in molecular biology. Physicist and theologian Ian G. Barbour, now emeritus Professor at Carleton College in Minnesota, is widely known for classifying patterns of interaction between science and religion and for proposing two-way traffic on a bridge of Whiteheadian metaphysics. Philip Hefner, a systematic theologian and former director of the Zygon Center for Science and Religion in Chicago, though not a hybrid, has pioneered an extensive integration of Christian anthropology with biological and cultural evolution.

At least two theologians in the dialogue would like to see theology considered as scientific. Wolfhart Pannenberg, emeritus Professor of Systematic Theology at Munich, contends that theological statements are constructed as hypotheses. Because they cannot be confirmed directly by examination of the subject matter to which they refer, namely God, theological assertions must be confirmed only indirectly according to their ability to illuminate reality. This renders theological commitments provisional, subject to further confirmation. The ultimate confirmation of our beliefs about God, then, will come eschatologically when we, as St Paul says, see God face to face.

Thomas Forsyth Torrance, who taught Systematic Theology at the University of Edinburgh from 1952 until 1979, argues that theology is scientific (actually meta-scientific) because it is objective due to its subject "God." Just as scientists must remain humble before the truths of nature as they are revealed through experimentation, and be willing to change their mind, so also must theologians render themselves humble and obedient before the revelation of God. Like Karl Barth (his teacher), Torrance begins with God's self-revelation to us; and this constitutes God's objectivity. Human subjectivity does not manufacture belief in God; rather, it responds to God as God comes to us in revelation. "Scientific theology is active engagement in that cognitive relation to God in obedience to the demands of His reality and self-giving" (Torrance, 1969: v).

Turning to the evangelicals, the American Scientific Affiliation (ASA) was founded in 1941 to serve practicing scientists in the evangelical Christian community. Its membership consists of people with degrees in one or another natural science, and it seeks to wrestle with the intellectual problems posed by the dialogue between science and faith. These members pledge "as stewards of God's creation, to use science and technology for the good of humanity and the whole world" (Hearn, 1997: 21).

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