Part I
Historical Episodes

1

Early Christian Belief in Creation and the Beliefs Sustaining the Modern Scientific Endeavor

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It is widely recognized that many of the founders of modern Western science were Christians not merely incidentally, but were inspired in creative ways by their Christian faith. Johannes Kepler, Robert Boyle, Isaac Newton, and James Clerk Maxwell are some of the best-known examples. More specifically, the case has often before been made for a connection between biblical thought – particularly the biblical idea of creation – and the rise of modern science. Alfred North Whitehead and R. G. Collingwood were among the pioneers of the argument (see Whitehead 1925; Collingwood 1940). Its more recent exponents include Reijer Hooykaas and Stanley Jaki (see Hooykaas 1972; Jaki 1974). I would like to restate the case for a connection between creation and science with three major alterations to these traditional accounts.

First, I would like to avoid the procedure often used by philosophers and systematic theologians which treats creation as a timeless idea from which implications can be drawn by logical (or theo-logical) inference.[1] Instead I propose to examine the historical implications of belief in creation as that belief has actually been held and acted upon by Christians, and I shall refer here primarily to the writings of the early Church when the fundamental structures of Christian thought – common to all major branches of Christendom – were established. I hope to show, as a result, that the implications of belief in creation are much richer and much more flexible than has usually been supposed.

Second, I would like to avoid any suggestion that science and technology could not have developed, perhaps along very different lines, in non-Western cultures. For one thing, we know that significant advances in science and technology were made by the Chinese, the Hindus, and the Arabs at a time northwestern Europe was still a cultural backwater. The growth of modern Western science would not have been possible without extensive borrowing from all three of these cultures. And what of the future? Is it not possible that Western endeavors in science and technology might fail and that further progress might require the input of alternative world-and-life views from non-Western cultures?

The third alteration I would like to make in the argument is to make explicit the fact that the demonstration of a genetic relationship between theology and science has implications for both disciplines. An affiliation with theology could be intended as a kind of legitimation

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for modern science – and it was so understood by many apologists for the new science of the seventeenth century. But a theological affiliation also entails a set of values which would imply a standard and a direction for modern science if they were suitably updated and articulated. In other words, the separation of fact and value so commonly assumed in modern thought must be challenged by any program that roots modern science in traditional theology.

On the other hand, the claim to be the historic matrix of modern science might suggest a legitimation for Christian theology in the minds of some. In fact, much of the historical research on this topic would seem to have been motivated, at least in part, by an apologetic interest in the context of a culture where science and theology have often been regarded as antagonistic.

But parents always bear some responsibility for their children, even after they have grown up. For better or worse, modern science and technology reflect back on the credibility of the first article of the Christian faith, and there are many in our day for whom the suggestion of any genetic relationship between theology and science would be highly detrimental to the case of theology. In other words Christian laity and clergy bear a certain responsibility – responsibility to recall the creation faith and restate it in such a way that the biblical vision for science and technology will be known and possibly heeded.

Here I shall treat the implications of belief in creation as it relates to the relative autonomy and comprehensibility of the world created by God.[2] I shall briefly review the biblical background for these ideas, give examples of their usage in patristic, medieval, and early modern thought, and discuss their influence and implications for modern science.

The basic idea of creation in Scripture is that the entire universe is subject to a code of law which was established at the beginning of time. This idea has two major implications for our view of the world: (1) nature functions with a high degree of autonomy (meaning literally, "having its own laws"); and (2) the natural world is comprehended by God and therefore comprehensible to human beings created in the divine image.

Frequently we think of creation as having to do with the *origin* of the universe, but more often it is a statement about the *nature and operation* of the cosmos. The origin of the universe (or perhaps the multiverse) depends solely on the wisdom and will of God and hence may lie beyond human understanding, but its subsequent operation is autonomous by virtue of the laws God has given it. It can be understood by humans because of the fact that human reason is itself an image of the same divine reason that governs the world.

By using the phrase "relative autonomy" of nature, I mean the self-sufficiency nature possesses by virtue of the fact that God has granted it laws of operation. Like all laws, the laws of nature may come to be viewed as enslaving and inflexible, but, in their biblical sense, at least, they were viewed as liberating (from chaos) and life-giving. The autonomy of nature was therefore "relative" in the sense of being relational (to God), as well as in the sense of not being self-originate as God is.

The Old Testament and Second-Temple Judaism

As far as we know, the roots of this idea go back before the Old Testament (or Hebrew Bible) to the early stages of Mesopotamian civilization in the fourth and third millennia BCE. The Mesopotamians viewed the universe as a cosmic nation-state in which the wills of the various gods, like the wills of humans, were bound by common law. In a second-millennium revival

of these ideas (the *Enuma Elish* or "Babylonian Genesis"), the Babylonian god Marduk was credited with having ordained laws for the stars (which were identified with the lesser gods). The writers of the Old Testament, particularly those associated with the Israelite monarchy, developed this tradition while stressing the unique sovereignty of Yahweh (Adonai), the God of Israel, and the complete subservience of all nature, both in heaven and on earth, to his command.[3]

Among the texts of the Old Testament contributing to the idea, Genesis 1 and Psalms 19 and 104 are particularly noteworthy. Day and night follow each other automatically once their alternation has been established by God (Gen. 1:5, 8b; Ps. 19:2); the sun rises and sets according to schedule (Gen. 1:16–19; Ps. 19:5–6; 104:19b); and new generations of plants and animals succeed each other without interference through the normal processes of reproduction (Gen. 1:11–12, 21–22, 24–25). Elsewhere in the Old Testament, lawfulness is attributed to the courses of the sun, moon, and stars (Jer. 31:35–36), the ebb and flow of the tides (Job 38:8–11), the alternation of seasons (Gen. 8:22), and even to meteorological phenomena like the wind, rain, and lightning (Job 18:25–27).

In a sense, the work of creation was complete after the work of the "six days."[4] Within the Old Testament understanding of time, however, wherever and whenever the beneficent effects of God's mighty deeds were seen to continue, God's foundational work was also viewed as continuing. Creating once and for all was also continual creation (*creatio continua* or *creatio continuata*; see Hermisson 1978, 50–51). In other words, the order of nature is a dependent or contingent order (Torrance 1981), and, like an executive decree, is subject to regular ratification or amendment by God. God can alter it when doing so would bring greater fulfillment of its ultimate ends. Such alteration would be contingent on the divine will, but would not be arbitrary.

The natural order is therefore not indifferent to human history and its final outcome. It is neither impersonal nor amoral; hence it is not to be set over against the freedom and responsibility humans experience in everyday life (Ps. 19; 93; 104). Any supposed order that might ultimately lead to chaos, anarchy, or injustice would not, in the biblical view, be true order. Hence, the upholding of natural order not only allows, but *requires* its emendation at points where irreversible damage may occur.

During the Second-Temple period (fifth century BCE to the first century CE), the Jews developed the idea of the relative autonomy of nature considerably, partly as the result of their dialogue with Greek natural philosophy. One of the earliest and best-known examples is Yeshua ben Sirah, who wrote the deuterocanonical book known as ben Sirach (or Ecclesiasticus) in the early second century BCE. Ben Sirah gives us a stunning description of the ceaseless regularity of natural rhythms:

> When the Lord created his works from the beginning, and in making them, determined their boundaries, he arranged his works in an eternal order, and their dominion for all generations. They neither hunger nor grow weary, and they do not abandon their tasks. They do not crowd one another, and they never disobey his word. (Sir. 16:26–28)

The stress here on nature's obedience to God's word was intended as a contrast to the foolishness of humans who disregard God's (moral) laws, as the context makes abundantly clear (Sir. 16; 17). The contrast between the obedience of the luminaries and the rebelliousness of humans was made even more explicit in an early segment of 1 Enoch, and it reappeared in the Testament of Naphtali, the Psalms of Solomon, and the Dead Sea Scrolls.[5]

The important point here is that the Hebrew view of nature was neither impersonal nor amoral. As God's creature, nature had laws of its own, hence a degree of autonomy and comprehensibility. And, unlike humans, nature had not violated the laws God set for it; hence it had not taken on the kind of irrationality we often associate with human behavior. Even those aspects of nature that threatened human safety were not lawless in themselves. They served God's purposes and had laws of their own, even if unknown to humans (Job 28:25–27). Hence they were open to human comprehension, at least in principle.

The idea of the comprehensibility of the natural world was reaffirmed in the New Testament, particularly in passages that portrayed Christ as the foundation of the cosmos who united all things in heaven and earth (Matt. 28:18; 1 Cor. 8:6; 15:24–28; Eph. 1:10, 20–23; 4:8–10; Phil. 2:9–11; Col. 1:15–20; Heb. 1:2–3). Christ's work was viewed in this respect as a renewal and perfection of the order in the original creation.

The Autonomy of Nature: Basil of Caesarea to John Buridan

In order to illustrate the idea of the relative autonomy and comprehensibility of the natural world in patristic thought, I turn now to Basil's sermons on the *hexaemeron*, or "work of the six days," as described in Genesis 1. Like most early Christian authors, Basil assumed that the "six days" in question were figures of speech. He followed Philo and Origen in regarding all things as having been created at the first instant of time and remaining in a steady state thereafter.[6]

While Basil is only one of many early Church figures we could examine, he is perhaps the most representative and certainly the most influential. His formal training included the classical Greek arts and sciences as well as monastic spiritual discipline. Consequently, he was well suited to provide a paradigmatic synthesis of Christian and classical learning. Moreover, Basil was a pivotal figure in all of the major areas of early Christian thought and practice. He was a devoted servant of the Church, the leading bishop of the Eastern Church after Athanasius. He was one of the founders of cenobite monasticism, the movement which was to transmit classical and patristic learning to the medieval West. He was the chief architect of post-Nicene (or neo-Nicene) orthodoxy concerning the doctrine of the Trinity. Finally, Basil's hexaemeral sermons were the principal textbook on science and Scripture through the early middle ages and were still one of the two sources recommended by John Calvin, the other being Ambrose, who was himself dependent on Basil (*Institutes of the Christian Religion* I.14.20).

Basil delivered his sermons on the *hexaemeron* on five successive weekdays to a congregation of artisans on their way to and from work. At the time (during the 360s), he was still a presbyter at Caesarea, and his responsibilities included what we would call "Christian education." He was keenly interested in the meaning of Christian faith for secular life in this context.

Perhaps the best example of Basil's views is his comment in the fifth sermon on Genesis 1:11, the text of which reads as follows: "'Then God said, 'Let the earth put forth vegetation, plants yielding seed, and fruit trees of every kind on the earth that bear fruit with the seed in it.' " Basil first noted the wisdom of the basic order of the text: first pasture-land vegetation; then fruit trees. In other words, each spring the grass turns green before the trees bear fruit. This order, once given, he notes, is followed by the earth to this day, and will continue for all time:

> For the voice that was then heard and this command were as a natural and permanent law [*nomos physeōs*] for it; it gave fertility and the power to produce fruit for all ages to come. (*Hexaemeron* V.1; Schaff and Wace 1890–1900, VIII:76a)

Ambrose of Milan wrote a Latin paraphrase of Basil's *Hexaemeron* which used the phrase *lex naturae* ("law of nature") at this point (*Hexaemeron* V.6.16), and this concept became commonplace in Western discourse long before its more specialized use in modern science.

In order to appreciate the force of Basil's argument about the continuing effect of God's command, recall that Aristotle restricted all natural terrestrial processes to linear motion. Fire rose up to the sky, while earth fell down, but both naturally moved in straight (vertical) lines. The cyclical phenomena of nature, on the other hand – Aristotle called them cycles of "generation and corruption" – were not natural: they were forced by the circular motion of the heavens, particularly by the sun.[7] For Basil, however, the cycles of nature were imposed on the earth by the command of God, not by the motion of the sun along the ecliptic. Basil thus eliminated the hierarchical subordination of earth to the heavens and established each process as being "natural" in that it manifested its own God-given law.

In concluding his homily on Genesis 1:11, Basil returned to the theme of the relative autonomy God had granted to nature by his command and, in so doing, gave a classic example of what later became known as the concept of impetus or momentum:

> It is this command which, still at this day, is imposed on the earth. . . . Like [spinning] tops, which after the first impulse, continue their revolutions, turning upon themselves when once fixed in their centre; thus nature, receiving the impulse of this first command, follows without interruption the course of ages, until the consummation of all things. (*Hexaemeron* V.10; Schaff and Wace, 1890–1900, VIII:81b)[8]

Spinning tops were a phenomenon that strained the basic principles of Aristotelian physics and yet were known to every playful child. Belonging to the terrestrial world, they moved in circular fashion like the celestial spheres yet without dependence on the heavens.

The state of spinning was regarded as "unnatural" by Aristotle and required the ad hoc supposition of a thin layer of air whirling around the top to keep it going. For Basil, however, the motion of the spinning top was perfectly "natural," as was the regular cycle of seedtime and harvest (Gen. 8:22) to which he compared it. In either case there was an initial impulse (the twist of fingers or the pull of a string, in one case, the command of God, in the other), the effect of which continued even after the original action had ceased. In modern science, the principle exhibited in the case of the spinning top is called the law of the conservation of momentum (in this case, angular momentum). For Basil, it was not only tops but all of nature, organic as well as inorganic, that moved in regular intervals in accordance with the command of God.

The idea that motion is conserved and that its magnitude depends only on the initial impulse was developed in the sixth century by the Alexandrian John Philoponus as part of his programmatic attack on the physics of Aristotle (Sambursky 1962, 74–76). Through the writings of Philoponus, and also through the Syriac hexaemeral tradition,[9] it was passed on to Arab philosophers of the eleventh and twelfth centuries like Ibn Sina (Avicenna), Ibn Bajjah (Avempace), al-Baghdadi, and al-Bitruji (Alpetragius). The idea was taken up, with significant alterations, by Western scholastics of the thirteenth and fourteenth centuries like Thomas Aquinas, Peter John Olivi, and Francis of Marchia (Nasr 1968–1973).

Partly as a result of the influence of Neoplatonism, Ibn Sina and Ibn Bajjah had reinterpreted the impartation of momentum as a continuously impressed force, thus weakening the

basic idea of the autonomy of nature and ruling out the possibility of conservation of momentum in the absence of a continuous force. In this altered form, the idea of an impressed force continued down to the mid-fourteenth century, when John Buridan revived the idea of a conserved impetus by appealing to the efficacy of God's original act of creation and citing the example of a spinning millwheel (*Questions on the Heavens and the Earth* II.12), just as Basil had done almost a thousand years earlier. Buridan's work was foundational to late medieval and early modern studies that led to the modern concept of momentum (Dales 1973, 111, 116–117).

It was another three centuries before Galileo, Descartes, and Newton were able to formulate the principle of the conservation of momentum in mathematical terms in such a way that it could be used in calculations. The ideas of laws of nature and relative autonomy that lay behind the principle were readily available by the time of Basil, however. Indeed it was deeply embedded in the Jewish–Christian tradition that Basil inherited, as we have seen. Basil merely gave practical examples from everyday experience to illustrate the principle of the relative autonomy of nature as it had been understood at least since the time of Yeshua ben Sirah.

The Comprehensibility of Nature: Gregory of Nazianzus to Johannes Kepler

The lawfulness of nature did not by itself provide any hope that humans could comprehend God's design. For early Christians, however, belief in divine creation also implied that mathematical characteristics like weight, number, and measure were imprinted on the human mind as well as on creation (based on Wis. 11:20). This idea was extremely important, because it implied that the mathematical nature of creation should be visible to anyone with the proper training to see it. One of the clearest expressions of this idea in patristic literature occurs in the orations of Basil's associate, Gregory of Nazianzus (379–380 CE):

> Is it not the Artificer of [all moving things] who implanted reason [*lógon*] in them all, in accordance with which the universe is moved and controlled? . . . Thus reason that is from God that is implanted in all from the beginning, and is the first law in us, and is bound up in all leads us up to God through visible things. (*Orations* 28.16; Schaff and Wace 1890–1900, VII:294b, modified)

According to Gregory, human intelligence is not merely a random product of chance, but deeply tuned to the same logic (*lógos*) that God has implanted in the cosmos.

Gregory did not bring out the implications of this double imprint for scientific endeavor – his main concerns were with churchmanship and theology. However, medieval heirs of the patristic tradition did apply these ideas to their efforts in their crafts (e.g., Theophilus the Presbyter, *c.* 1100) and astronomical studies (Lefèvre d'Étaples, 1503). I shall focus on one particular astronomer, Johannes Kepler (1571–1630), whose work, like that of John Buridan, lies at the basis of modern science.

Like Gregory long before him, Kepler thought of the divine ideas such as those of mathematical geometry as being imprinted on the natural world and also impressed on the human mind as part of the image of God. As he stated in the fourth book of his treatise "On the Harmony of the Universe" (*Harmonices mundi*, 1619):

> Geometry, which before the origin of things was coeternal with the divine mind . . . supplied God with patterns for the creation of the world and passed over to human nature along with the image of God. (Kepler 1997, 304, modified)

As a result of this dual imprinting of mathematical truth, humans could indeed have confidence in their ability – provided they undergo suitable training – to discern the geometries and laws that God had implanted in the natural world.

Kepler was sustained by his deep faith in the providence of God in creating the world and equipping humans with the intelligence to understand it. When questioned about the possibility of solving the mystery of the planetary orbits, he wrote to one of his patrons, Johannes Georg Herwart von Hohenburg (9/10 April 1599):

> Those [laws which govern the material world] are within the grasp of the human mind. God wanted us to recognize them by creating us after his own image so that we could share in his own thoughts . . . and, if piety allows us to say so, our understanding is in this respect of the same kind as the divine, at least as far as we are able to grasp something of it in our mortal life. (Baumgardt 1951, 50)[10]

Kepler's faith in the comprehensibility of the natural world continued to be an influential model for physicists right into in the early twentieth century. In fact, Albert Einstein, in his 1930 lecture on "Religion and Science," cited Kepler as the inspiration for his own efforts in mathematical physics in the early twentieth century:

> What a deep conviction of the rationality of the universe and what a yearning to understand, were it but a feeble reflection of the Mind revealed in this world, Kepler and Newton must have had to enable them to spend years of solitary labour in disentangling the principles of celestial mechanics! . . . Only one who has devoted his life to similar ends can have a vivid realisation of what has inspired these men and given them the strength to remain true to their purpose in spite of countless failures. (Einstein 1954, 39–40)

Even from this brief historical sketch, it can be seen that biblical, theological ideas lay at the heart of the Western scientific enterprise. Those beliefs continue to inspire and sustain scientists the world over, even though in a secularized form.

The Twelfth-Century Reinterpretation: Nature versus God

The lawfulness, relative autonomy, and comprehensibility that early Christians attributed to the processes of nature were clearly an important factor in the rise of early modern science. However, these ideas may also have been responsible for the gradual separation that took place between matters of fact and matters of value in modern Western thought, particularly as they were reinterpreted by twelfth-century natural philosophers. Significant changes took place in the understanding of the relation between God, humanity, and nature in the twelfth century which led to a dichotomy between the sovereignty of God and the autonomy of nature (Stiefel 1977; Dales 1980; Bartlett 2008, 16–17).

There were two sides to the twelfth-century debate. On the one side, naturalists who rightly desired to comprehend the world in its own terms stressed the autonomy of nature and the power of human reason to the point where they lost sight of the dependence of all

natural law on God. On the other side, conservatives who desired to defend the importance of God's role in history attacked the naturalists and stressed the absolute power of God (*potentia Dei absoluta*) and the authority of the Church. The result was a split between naturalists and conservatives within the Church reflected in the emergence of a bifurcation between the autonomy of nature and the power of God in Christian thought.

To illustrate this dichotomy, let us look briefly at the work of Adelard of Bath (early twelfth century). Adelard (not to be confused with Peter Abelard) is often regarded as the first major contributor to Western science (Dales 1973, 37–51).

In order to defend his interest in Arabic natural philosophy against conservatives in his native England, Adelard argued that the present-day work of God was restricted to miracles and contrasted it with the work of nature. In a dialogue with his nephew, he stated:

> I am not slighting God's role. For whatever exists is from him and through him. Nevertheless, that [dependence on God] is not [to be taken] in blanket fashion, without distinction. One should attend to this [distinction] as far as human knowledge can go, but in the case *where human knowledge completely fails*, the matter should be referred to God. (*Natural Questions* 4; Adelard 1998, 97–99, italics added; cf. Dales 1973, 40 for a different translation)

The underlying ideas cited in this passage – the creation of all things by God, the consequent order and rationality of the cosmos, and the ability of human reason to comprehend this order – all stem from the Judeo-Christian belief in creation, dating back at least to the second century BCE. What was new was that Adelard set the natural order and the work of God, rational investigation and Christian faith, over against each other as alternatives: "where human knowledge completely fails, the matter should be referred to God."

The consequence of this polarization was that, for Adelard, God was removed from the natural order in such a way that natural law became inflexible and impersonal:

> But whoever takes away the order of things is a fool. . . . But the Disposer of things is supremely wise. He, therefore, neither wishes to, *nor is able to*, take away the order of things. . . . For this, then to occur to the mind of a philosopher is not at all appropriate. (Adelard 1998, 219, italics added; cf. Stiefel 1977, 351)

The belief that God does not normally alter his established order (*potentia Dei ordinata*) had been an essential part of the historical "creationist tradition" since the Book of Genesis, but for earlier theologians like ben Sirah and Basil, the natural order itself was upheld by God (through his word, will, power).[11] For Adelard, on the other hand, the only properly divine action was his abolition or upsetting of that order (*potentia Dei absoluta*). In this he agreed with conservatives like Peter Damian and William of St. Thierry, who stressed God's absolute power over nature. The difference was that for Adelard any alteration of the natural order was regarded as highly unlikely. The order of nature was so fixed that God was neither willing nor even able, to alter it!

Already in the Middle Ages, therefore, there were problems emerging in Western thought that have plagued us ever since. In order to see how radical the change in outlook was, consider whether, in our own minds today, miracles and natural processes are not two entirely different things – different in reality as well as in words. What I wish to argue is that this division of both words and reality is a social construct that does not occur in other traditional cultures and that, even in Europe, probably does not occur before the eleventh or twelfth

century. Our differentiation between the natural and the supernatural allows scientists like Adelard to pursue secular goals independently of theological criteria, but at a considerable cost. Not only do problems arise for economics and ecology as a result of their isolation from theological grounding, but theology appears rather remote and unrelated to life when its implications for secular practice are ruled out by a definition of terms.

In this chapter, I have argued two theses: (1) that Christian belief in creation has historically had implications that have a bearing on the meaning of modern science and technology; and (2) that these implications have historically had an influence in the development of modern science and technology. It does not follow that people have to be theologically literate in order to be good scientists. However, intellectual honesty requires us to recognize our historical roots and their continuing influence today as much as to recognize our origins in nature with all of the strengths and weaknesses that they bring.

Notes

1 The classic example is M. B. Foster's argument (originally published in 1934) that the idea of creation implies a constitutive role for the divine will and hence a degree of contingency in the structures of creation and an empirical, rather than rationalistic, methodology in science (Foster 1969, 46–49).

2 In a full-length study (Kaiser 1997, 21–83, summarized in Kaiser 1993), I treat four beliefs implicated in the doctrine of creation: the comprehensibility of the world, the unity of nature, its relative autonomy, and the ministry of healing and restoration.

3 For example, Gen. 1:1–25; Job 28:25–26; 38:4–11; Ps. 19:4–6; 104:9; Prov. 8:29; Jer. 5:22; 31:35–36. See Schmid (1984) on the ancient Near Eastern view of the order of creation as the horizon for Old Testament theology.

4 The Greek Septuagint of Gen. 2:2 specifies that God finished his work on the sixth day, but the Hebrew text is ambiguous.

5 1 Enoch 2:1–5:5; Testament of Naphtali 3:2–4; Psalms of Solomon 18:12–14; 1QS 3:15–17 (stressing predestination); 1Q34 (Festival Prayer) frag. 3 2:1–3 (see Gowan 1985, 89, 99–100). Aramaic fragments of 1 Enoch 1–36 (The Book of the Watchers) dating from the late third or early second century BCE have been found at Qumran.

6 For example, Philo, *On the Creation of the World* 13–16, 25, 28, 43, 67–68; *Allegorical Interpretation of Genesis* 1.19–21; *Questions on Exodus* 1.1; Origen, *On First Principles* I.2.2; idem, *Against Celsus* VI.60; Basil, *Hexaemeron* 1.6; Gregory of Nyssa, *Hexaemeron* 72b–77d; Augustine, *Confessions* XII.12.15; *On Genesis Word for Word* IV.18.33; V.3.5–6, 5.12–13; VI.6.11; *City of God* XI.33.

7 See Aristotle, *On Generation and Corruption* 11.10.337a–11.338b; *Meteorology* 11.2.354b.26–28.

8 The concept of continuous spin has Stoic roots; cf. the fragment of Chrysippus in Cicero, *On Fate* XVIII.42–XIX.43, and Virgil's *Aeneid* VII.373.

9 Basil's *Hexaemeron* was translated into Syriac in the fifth century and into Arabic probably by the eighth or ninth century. Syriac *hexaemera* were written by James of Edessa (d. 708) and Moses bar Kepha (d. 903) (see Peters 1968, 116, 132–133). The illustration of a spinning wheel was used by Job of Edessa (d. *c.* 835) in his *Book of Treasures* V.12.

10 As Chancellor of Bavaria, von Hohenburg was able to help Kepler establish connections at the imperial court in Prague. He was also a mathematician and, though a Catholic, had studied under the Lutheran astronomer Michael Mästlin (Baumgardt 1951, 57–59). Kepler shares his ideas about God and creation with Herwart as if the two of them remembered them from their teacher.

11 I borrow the term "creationist tradition" from the seminal article by Richard Dales (1980, 533).

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Further Reading

Dales, Richard C. 1973. *The Scientific Achievement of the Middle Ages*. Philadelphia: University of Pennsylvania Press. A selection of primary sources about medieval scientific endeavor beginning with Adelard of Bath's famous dialogue on *Natural Questions* and prefaced by an introductory essay by Edward Peters.

Grant, Edward. 1996. *The Foundations of Modern Science in the Middle Ages: Their Religious, Institutional, and Intellectual Contexts*. Cambridge: Cambridge University Press. Clearly demonstrates the role of theological beliefs in the revision of Aristotelian science in the late Middle Ages.

Kaiser, Christopher B. 1997. *Creational Theology and the History of Physical Science: The Creationist Tradition from Basil to Bohr*. Leiden: Brill. Surveys the development of creational beliefs and their implications in the development of Western physical science and medicine.

Murray, Robert. 1992. *The Cosmic Covenant: Biblical Themes of Justice, Peace and the Integrity of Creation*. London: Sheed & Ward. Shows how the Old Testament and early Christian idea of covenant included the natural order.