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Article

The Nuts and Bolts of Creation

George L. Murphy

The Christian doctrine of creation is discussed in connection with scientific knowledge of the universe, primary attention being given to God's ongoing activity in the world. We consider first the reason for Christian belief in such activity and the Trinitarian character of the Creator, using Irenaeus's picture of Word and Spirit as two "hands" through which God works. The traditional view that God cooperates with creatures in their actions is presented, with consideration of the idea of a "causal joint." This divine work is kenotic, with God always present and active, but limiting action to the capacities of creatures.

Having described God's creative work in our local space-time neighborhood, we follow the example of science and extrapolate our theological understanding out in space and back in time to see what God has been doing since the beginning of cosmic expansion. While this does not describe creatio ex nihilo, *it does enable us to understand the origins of entities such as the earth and living things that are included in the traditional "six days of creation." The origin of the universe "from nothing" is then considered, and we conclude with reflections on God's freedom to act in creation.*[1]

In 1980, this journal published my paper "A Positive Approach to Creation."[2] This focused on belief in God's origination of the universe and its relationships with scientific cosmology, and briefly discussed God's ongoing activity in the world. Its positive feature was a focus on contributions that the doctrine of creation could make to the science-theology dialogue rather than a reconciliation of science with traditional views.

As the present title suggests, the emphasis of that earlier paper is reversed here, with God's ongoing creative activity receiving the greatest attention. It will, however, explore connections between that ongoing activity and cosmic origins. Reference to "nuts and bolts" does not mean treatment of God's work as a matter of mechanics, something we will touch on in connection with the question of a causal joint. But I will say something specific about what God does locally, in individual phenomena, as well as globally.

The Hebrew bara`, translated "created" in Genesis 1:1, has only God as its subject in the Old Testament but does not always imply strict *creatio ex nihilo* and is not limited to the origin of the universe.[3] In the Christian theological tradition, God's ongoing work in the world has been discussed in connection with the first articles of the creeds that deal with God as Creator. Divine action can be called continuing creation without suggesting that the world is constantly remade from nothing.

God's ongoing creative activity is often referred to as "providence." The word has its origin in a phrase of Genesis 22:14, traditionally translated as "the LORD will provide."[4] As in that story of God

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providing a sacrifice to take the place of Isaac, attention to a doctrine of providence often concentrates on God's care for human beings. Examples are existentialist theologies, in which belief in creation is understood to simply mean faith that God is *my* Creator.[5] But scripture speaks of God's care for wild creatures quite apart from humanity (e.g., Job 39–41), and to speak of God as my creator I must be able to say that God acts in the world both to provide me with food and to empower a supernova billions of years ago to make the carbon atoms in my body. God's activity has cosmic scope.

We will begin with a fundamental question: What is the justification for speaking about divine action? We also need to ask, "Who is this 'God' who acts?" Until recently, the one who does so, in many discussions, could have been the deity of philosophical theism rather than the God revealed in Jesus Christ. Attention to a Trinitarian understanding of creation both globally, in the overall picture of God's work, and locally, in individual events, helps to clarify not only *who* acts, but *how* God acts in the world.

Why Should We Say That God Acts?

Since the work of Newton, the successes of science have led many people to think that discussion about divine action is superfluous. Science has not yet explained things such as dark matter and the origin of life. But there is no reason or principle for thinking that any phenomena in the natural world cannot be explained in terms of natural processes obeying rational laws. In a phrase popularized by Bonhoeffer, it seems possible to understand the world "though God were not given."[6]

But there is an old principle of Christian thought, *lex orandi, lex credendi* – "the law of praying is the law of believing." The way we pray, and more generally, what we do in worship, should inform what we believe. For example, the practice from an early period of baptizing people in the name of the Father, and of the Son, and of the Holy Spirit, as in Matthew 28:19, helped to lead Christians to understand that the one God is triune.

Jesus taught a pattern for prayer that includes the petition "Give us this day our daily bread." We ask God to give us food and other necessities of life and acknowledge that God does provide for us. The Lord's Prayer is hardly unique in that regard. For example, Israel's "historical credo" (Deut. 26:5–9) is set in the context of a liturgy of thanks for God's provision of first fruits (vv. 1–11), Psalm 145:15–16 is often adapted as a table prayer today, and 1 Timothy 4:5 specifies that food is to be "received with thanksgiving."

If the law of praying is the law of believing, then we are to believe that God is involved in providing our food and other needs. But Jesus and his hearers knew that our supply of bread depends on the growth of grain and requires seeds, good soil, good weather, and human labor. It does not appear out of nowhere but is "bread which earth has given and human hands have made."[7] A faith-seeking understanding must think about God's activity in conjunction with natural processes.

Similar things can be said about prayers for healing, which should not be understood as alternatives to medical care. God may heal as God chooses, but, in most cases, it will be through drugs, surgery, radiation, and other means applied by skilled humans. In biblical times, olive oil was used as a medicine (Isa. 1:6, Luke 10:34), and today, in the anointing of the sick (Mark 6:13, James 5:14–15), it can be seen as a symbol of all medical treatments through which we ask God to heal.

That God acts in the world is a statement of faith, not the result of scientific observations. But it is also not an arbitrary assertion. It is an expression of trust in the God revealed in Jesus Christ, the crucified one.[8] Though it will not always be explicit here, this article is part of a long-term project of pursuing an understanding of the scientific picture of the world in the context of a theology of the cross.[9]

Who Is the God Who Acts?

Ideas about how God acts in the world have a long history.[10] The influential views of Aquinas were developed by early Lutheran and Reformed theologians.[11] While all of them believed in God as the Holy Trinity, none of the discussions of providence in the sources I have cited refers explicitly to the activities of Father, Son, and Holy Spirit in this providential work. The first volume of Barbour's *Gifford Lectures* and its later revision, together discussed ten different views of divine action with little reference to the Trinitarian character of God's work in creation.[12]

Failure to allow the doctrine of the Trinity to inform other aspects of theology was, for a long time, widespread in the western church, and can be seen as a result of emphasis on the divine unity at the expense of God's triune character. Fortunately, that situation has changed over the past century.[13] Many of those concerned with theology-science issues, as well as systematic theologians with broader interests, have given attention to specifically Trinitarian features of God's work on ongoing creation. A few of these may be noted, and specific references will be given in appropriate places.[14]

"By the word of the LORD the heavens were made; and all their host by the breath of his mouth" (Ps. 33:6). This pairing of God's "word" and "breath" is an example of the parallelism common in Hebrew poetry, one that comes naturally in this case because our speech is accompanied by our breath. In the Old Testament, God's word and spirit are not pictured as persons of a triune God, a concept to which early Christians were brought by God's revelation in Christ. But, in the context of all of scripture, it is natural to see this verse as a pairing of the activity of the divine Word and Spirit, the second and third persons of the Trinity, in God's creative work.

It does not stand alone in that regard. In the first creation account of Genesis, God speaks the world into being, successive acts of creation being preceded by the spirit of God sweeping over the face of the waters (Gen. 1:2, following NRSV margin). God's creating word is often accompanied by spirit, as when Ezekiel prophesies "'Hear the word of the LORD'" to the dry bones, and the wind/spirit/breath comes upon them to give them life (Ezek. 37:1–14). (Hebrew *ruach* can be translated as "wind," "breath," or "spirit." Sometimes it is misleading to focus on only one of these English words.)

Discussions of God's activity directed toward the world have often "appropriated" the work of creation to God the Father, redemption to the Son, and sanctification to the Holy Spirit.[15] This provides a convenient way to organize important theological topics, but appropriation should not be imagined as a naive "division of labor."

In the late second century, Irenaeus, the first great theologian of the post-apostolic church, suggested a vivid image of the Trinitarian work of creation. He pictured the Word and Holy Spirit as the two "hands" by which God creates the world and acts within it.[16] They work together but in distinctive ways that we will consider in the next section. This is seen, for example, in the Nicene Creed, which says that the Holy Spirit "has spoken through the prophets," and in Cranmer's *Eucharistic Prayer* in which God is asked to "vouchsafe to bless and sanctify, with thy Word and Holy Spirit, these thy gifts and creatures of bread and wine."[17]

Irenaeus's image or analogy is not a literal description of the Trinity, but it is quite helpful in discussing divine action and its relationships with scientific descriptions of phenomena. For other purposes, some other analogy may be more helpful. Dorothy Sayers's comparison of the creative work of the Trinity with the work of a literary artist is an example.[18]

The Work of Word and Spirit

Our first step is to consider the role of the Word, the *Logos*, in John's prologue, where we are told that "all things" were made by the Word who was "in the beginning" (John 1:1–3). The resonance of the gospel's opening verses with the beginning of the first creation account in Genesis strongly suggests that John's "Word" has its roots in the way the Word of God is pictured in the Old Testament.[19] God's creative speech in Genesis 1 is important, as is the word of the LORD that came to the prophets—"Is not my word like fire, says the LORD, and like a hammer that breaks a rock in pieces?" (Jer. 23:29). Goethe's Faust, who wanted to change the beginning of John's gospel to "In the beginning was the deed," missed this active sense of the word. God's word is deed, doing what it says (Isa. 55:10–11).

The author of the fourth Gospel may also have been aware of the *logos* concept in Greek philosophy, and perhaps its use to interpret the Jewish tradition by Philo.[20] Greek *logos* had a wide range of meanings, from counting and reckoning through "word" to human reason. For the Stoics, *logos* could have a sense of the ordered nature of the universe, and thus be equated with God. Whether these ideas influenced the evangelist, early Christians soon saw connections between the creativity of the Johannine *Logos* and the rationality of Hellenistic philosophy.[21] The universe is logical because it is the work of the divine *Logos*. The regularities science discerns can be connected with the creative role of the *Logos*.

In the past, it was often assumed that before the conception of Jesus the pre-incarnate or "unfleshed" Word (*logos asarkos*) was the agent of creation through whom all things were made. But, in the past century, a number of theologians, following Barth, have argued—correctly, I believe—that the incarnation was not simply God's "Plan B" to solve a problem that arose with human sin. God intended it before creation. Nevertheless, Jesus did not exist as a physical entity in the universe until about 2,000 years ago, and it is difficult to see what might be meant by speaking of the activity of that entity prior to his birth.

Between the beginning of the universe and Jesus's birth, Jenson suggests that we should speak of "the narrative pattern of being going to be born of Mary."[22] The Word who was active in creation before his coming in the flesh, was also the Word who was on the way to suffering under Pontius Pilate, dying on the cross, and rising on the third day. As Bonhoeffer said, "The world exists from the beginning in the sign of the resurrection of Christ from the dead."[23]

The laws, or patterns, of nature are themselves God's creation, the work of the divine Reason, the Son of God who became human as Jesus of Nazareth. We may think first of mathematically expressed laws of basic physical processes, but we cannot be certain that all the patterns of living things and the interactions of intelligent creatures can be reduced to physics. Whether such reduction is possible, the Word brings about "the distinctiveness of each creaturely form as opposed to others and to God the Creator."[24] Pannenberg's phrase "creaturely form" should not be understood in a static sense. The rational patterns of the world include patterns of temporal change.

The *Logos* is not merely the pattern of this world but the personal source of patterns of all possible worlds. God could have created different universes with different rational laws, so that we can speak, with Torrance, of a doctrine of the contingent rationality of the universe.[25] That explains why observation as well as rational thought is essential for the possibility of scientific understanding of the world. The contingency of mathematical patterns for worlds was shown by the discoveries of consistent non-Euclidean geometries in the nineteenth century, something that eventually led to Einstein's use of Riemannian geometry in his successful theory of gravitation, general relativity.

In recent years, there has also been renewed interest in the role of the Holy Spirit in the creative work of the Trinity and its significance for science-theology dialogue.[26] Johnson speaks of birthing and restoring life, healing what is broken, moving people to proclaim and do God's will, and creating community as works with which the Spirit is especially associated.[27] Psalm 104, a hymn of praise to the Creator, tells of the variety of the living things that inhabit the world, and then says (vv. 29–30),

> When you hide your face, they are dismayed;
> when you take away their breath (*rucham*)
> they die and return to their dust.
> When you send forth your spirit (*ruchakha*), they are created;
> and you renew the face of the ground.

We are reminded of Genesis 2:7, in which God "breathed … the breath of life" into the first human. The Spirit, the Nicene Creed says, is "the Lord and giver of life"—all life.[28]

The Spirit is often associated with unpredictable behavior. When the Spirit comes upon people such as Samson or the apostles at Pentecost, they behave in wild and unexpected ways (Judges 14:6, 19; 15:14; Acts 2:1–21). In his conversation with Nicodemus, Jesus compares the Spirit's work with the unpredictability of the wind. That may remind modern readers of the butterfly effect of chaos theory, that the flapping of an insect's wings in Asia today could change the weather in New York two weeks from now. The Holy Spirit is involved with novelty and spontaneity, with phenomena that our experience of the past has not led us to expect.[29] Thus, "the powers of the Spirit" can be said to be "the powers of the new creation."[30]

In the heyday of the mechanical worldview, strict determinism was often thought to rule out freedom for divine action, while today the probabilistic character of quantum theory and aspects of biological evolution are sometimes claimed to prohibit purposeful divine action. In reality, spontaneity and regularity, "chance and necessity," are both essential features of natural phenomena.[31] Individual quantum events cannot be predicted, but their statistical distribution is governed by the deterministic Schrödinger equation. Genetic variations that

contribute to evolution are random but they are embodied in DNA, which obeys the rules of quantum chemistry.

Polkinghorne summarizes this Trinitarian work with reference to Irenaeus's image of the divine hands. "The Father is the fundamental ground of creation's being, while the Word is the source of creation's deep order and the Spirit is ceaselessly at work within the contingencies of open history."[32] Again, we need to emphasize that the order given by the Word is dynamic. Word and Spirit work together in the unfolding of creation's history, the spontaneity granted by the Spirit making possible the emergence of that which is genuinely new.

God's Word and Spirit work together. Chance and necessity, lawlike behaviors and spontaneity, go together as the mutual creative activity of the two hands of God. We cannot, however, derive physics or biology from the doctrine of the Trinity. Here we are considering what we know about the world in the context of Christian faith.

Divine and Creaturely Energies[33]

How should we speak theologically about God or creatures acting? Early Christian theologians made use of the Greek philosophical term *energeia*, "operation," the activity appropriate to any nature. The English word "energy," derived from *energeia*, is used in both the physical sciences and theology, but, in the latter discipline, it cannot be expressed with a formula such as $E = mc^2$. Our word "operation," from Latin *operari*, "to work," is more to the point there. In elementary physics, energy is defined as the capacity to do work. In quantum theory, the Hamiltonian operator of a system (its energy expressed in terms of canonical coordinates and momenta), acting on the state of the system, gives the rate of change of the state with time, and thus can be said to be responsible for the temporal evolution of a physical system.

The Fourth Ecumenical Council (Chalcedon, AD 451) attempted to settle christological debates by declaring that in Christ there were two natures, divine and human, united in one person of the divine Son. This did not resolve all differences, and it was proposed that while there are two natures in Christ, there is only one operation (and will). The Sixth Ecumenical Council (III Constantinople, AD 680–681) rejected that position and said that both natures in Christ, human and divine, have their appropriate operations. "For each form (μορφὴ) does in communion with the other what pertains properly to it, the Word, namely, doing that which pertains to the Word, and the flesh that which pertains to the flesh."[34] The relevance of this will become clear in the next section.

Divine action can be discussed as relating, in some way, divine energy and the energies of creatures.[35] But this cannot be seen as God simply pouring energy, in the physical sense, into the world, for that would violate a well-established conservation law.

We can refer simply to "God" acting in the world because there is a single divine operation. The classic statement of this is "The external works of the Trinity are undivided." But a qualification needs to be added to that—"preserving, of course, the properties of each person."[36] The need for such a qualification is clear from the way different things are ascribed to different persons in scripture and the way we have delineated their roles. They work together but some activities display the character of one person more than others. (This is the point of the idea of appropriation.)

Jesus says that he does the will of the Father who sent him (John 4:34; 5:30; 6:38–39), and we can speak of the Father willing the creative work.[37] Word and Spirit contribute lawlike pattern and spontaneity in varying degrees in each act, the former most prominently in phenomena described well by classical physics and the latter most prominently in living things. This should be borne in mind in the following sections.

How Does God Act?

How are we then to speak of God acting in a world that is described quite well in terms of entities and processes conforming to patterns that we call laws of nature? Our purpose here is not to review all ten of the theologies of divine action discussed by Barbour,[38] but to use three of them (Existentialist, Neo-Thomist, and Kenotic) that seem, with modifications, most helpful. We have already expanded upon the role of faith that is central to the first idea, that belief in creation means trusting in God as our Creator.

Some authors have sought a "causal joint where God's action joins nature's actions."[39] At first glance

this may seem reasonable. There is a standard procedure for studying the interaction of two physical systems, such as an electromagnetic field and charged particles. We know the Hamiltonians for fields and particles separately. We then look for an interaction Hamiltonian, involving variables for both systems, to describe the causal joint between them. The total Hamiltonian, the sum of the parts for field, particles, and interaction, then describes how the field and particles affect one another.[40]

But divine action is not that of an entity within the world, and what God does in the world is not just one more cause along with the causes with which physics deals. Though there is, as we have noted, a theological concept of energy, there is no "Hamiltonian for God," and we cannot write an interaction Hamiltonian for the way God influences creatures. The idea of a God-creature causal joint thus seems questionable.[41]

The claim that God does not act as an entity within the world has been challenged by Sollereder, who gives the incarnation as a counterexample.[42] But this is not convincing. First, the divine Word was not "an entity within the world" for the first 13.8 Gyr of the world's existence and did not act as such an entity. Secondly, we noted the decision of the Sixth Ecumenical Council that the incarnate Word has not one but two natural operations. In Jesus, the Second Person of the Trinity did act as an entity within the world, his human operation accomplishing human things. But it was the divine operation that continued to sustain creation. It is the sustenance of creation that is at issue here.

I suggest that instead of searching for a causal joint, we will be better occupied with a traditional picture of divine action which is frankly analogical, that of cooperation. God works with creatures as humans work with tools. An analogy is not an exact description of a thing, and there is not a one-to-one mapping of features between them. That there is a causal joint between a human and a wrench does not require that we be able to find such a joint between God and a creature.

All models of divine action use analogy to some extent, and this should not be seen as an embarrassment. It expresses the fact that the Creator is not a creature, as any theology must acknowledge. As Jesus Ben Sirach said some 2,100 years ago, "Where can we find the strength to praise [God]? For he is greater than all his works" (Sirach 43:28).

The term "cooperation" seems preferable to another that is often used in this connection, "concurrence." The etymology of the latter word implies "running together," while the meaning of the former, "working together," indicates that creatures as well as the creator are actually doing something. Cooperation can illustrate a neo-Thomist theology in which God is the first cause (with the qualification noted above) operating through secondary causes.[43] But we need not commit ourselves to Aquinas's metaphysics.

It is important to note that the analogy of cooperation is teachable. Theology ought to be useful for preaching to, and teaching of, ordinary people. The picture of God working with created things requires no complex philosophical explanation. It can be illustrated with familiar pictures, such as a person using a computer or a carpenter sawing a board (an appropriate image for Christians). The tools do not do the jobs by themselves, but neither do the humans' hands. They cooperate.

This also emphasizes that God is at work at every stage of a network of events, and does not just "intervene" at some point or points. There is not one special place in that network where divine input occurs. God is active along with all the activities of created things. In providing daily bread, God works with nuclei fusing in the core of the sun, radiation transporting energy to the earth, molecules involved in photosynthesis, farmers and their equipment, millers, and so on.

This picture is not a deistic one in which God created in the beginning but does not act in the world today. Nor does divine action precede the actions of creatures. God does not preoperate but cooperates.[44] Things in the world owe their existence to God, but God grants them their own integrity and a relative autonomy. Creatures are not extensions of, or emanations from, God.[45]

Things in the world with which God cooperates are those that God has brought into being, as we will discuss later. Traditional doctrines of providence also spoke about God's preservation of creatures. That cannot mean keeping static entities in existence, for nothing in creation is static. In quantum field theory, a "bare" particle is an unobservable abstraction,

and real particles from which matter is built up are "dressed" because of their interactions. Thus God's cooperation with them in their interactions is essential for preservation of them as they actually are.[46] The traditional doctrine also dealt with the divine governance of creation, which is directed ultimately to God's eschatological goal. Our final section will be germane to that topic.

A distinction between "causation" and "agency" should be borne in mind. We can say that the impact of an asteroid was a cause of the extinction of the dinosaurs, but the asteroid was not an agent that brought this about. Agency is exercised by personal entities. Thus the personal (or tri-personal) God was the agent of the universe's creation.

The distinction is especially significant when we come to talk about the way in which God acts with human beings. It is relatively easy to think of what God does with electrons, DNA molecules, or stars in analogy with our use of tools such as screwdrivers or smart phones, and humans too can be pictured as God's instruments, as in the prayer attributed to St. Francis that begins, "Lord, make us instruments of your peace."[47] But God acting with a human should be pictured as the cooperation of two personal agents, like a ruler with a subject or one friend with another, not like a mechanic using some inanimate tool. Helpful analogies suggested by Settle for double agency, such as horse and rider or ballroom dancers, may be seen as examples of concurrence, two agents moving together. But the agents also cooperate, in that they work together even though they are not in physical contact.[48]

And because we possess some free will in worldly affairs and are sinners, we tend in varying degrees to be faulty instruments, refusing to cooperate with God. Recognition of this reality helps in understanding some issues of theodicy. If we wonder why God did not stop the holocaust sooner, the failure of the people of the world to resist and to attempt strongly enough to end genocide is at least part of the answer.

How Does God Not Act?

We could imagine God dealing with creatures in arbitrary ways, but long before the development of modern science, people recognized that there are regularities in natural phenomena, "seed time and harvest, cold and heat, summer and winter, day and night" (Gen. 8:22). Near the beginning of the scientific revolution a distinction was developed between God's "absolute" and "ordained" powers. God could exercise absolute power and do anything not involving self-contradiction, but God has ordained certain rational patterns to which divine action conforms. The ability of scientists to formulate laws describing phenomena strengthened belief that God exercises an ordained power and that the patterns to which many phenomena conform are mathematical.[49] This means that they can be understood without reference to God.

This philosophical distinction is helpful, but it is not distinctively Christian. We are concerned not with the activity of a generic deity but with the God of Israel who has made himself known in Jesus Christ. Already in Isaiah we read, "Truly, you are a God who hides himself, O God of Israel, the Savior" (Isa. 45:15). Pascal had that verse in mind when he wrote: "What meets our eyes denotes neither a total absence nor a manifest presence of the divine, but the presence of a God who conceals Himself. Everything bears this stamp."[50] We return to the point made earlier: Saying that God acts in the world is a confession of faith, not a result of scientific observation.

In the Incarnation, "Christ Jesus, who, though he was in the form of God, did not regard equality with God as something to be exploited, but emptied himself, taking the form of a slave, being born in human likeness" (Phil. 2:6–7). The Greek verb "empty," *kenóō*, gives us English "kenosis." In this passage, it means that the Son of God chose to be limited to the human condition.

Some authors have argued that the concept of kenosis should be used only in connection with the Incarnation, and not with creation.[51] But if Jesus Christ is the fullest revelation of God, if "true theology and recognition of God are in the crucified Christ,"[52] then there is no reason to insist on that limitation. Gordon Fee comments on the hymn that contains those verses from Philippians that state, "in 'pouring himself out' and 'humbling himself to death on the cross' Christ Jesus has revealed the character of God himself."[53] The works of the Trinity, in creation and inspiration as well as in redemption, are kenotic.[54]

Kenosis, self-limitation, was not just a temporary tactic but also is the divine *modus operandi*. A number

of authors have used this concept in discussions of divine action.[55] But because different writers use the idea differently, I need to be clear about what I mean by it.[56] The kenotic aspect of divine action is that God constrains his cooperation with creatures to the capacities of created entities, limiting it in accord with rational laws which themselves are God's creation. God does not do things that "violate" those laws.

Authors who have emphasized kenosis in discussing divine action have not always given adequate attention to the fact that kenosis cannot by itself be a theology of divine action. In the collection of essays on this theme that he edited, Polkinghorne is the only contributor who addresses this point at any length, saying that "kenotic creation and divine action are opposite sides of the same theological coin."[57] Kenosis is not a statement about what God does in the world but about what God does not do, and must be combined with some positive statement about how God does act, such as the model of divine cooperation. God is never absent or inactive. Bonhoeffer overstated the matter when he wrote that God "is weak and powerless in the world."[58] It is in what humans may judge as weakness that God's power is seen (1 Cor. 1:25). God is always present and working (John 5:17), but with self-imposed limitations.

God's limitation to what can be done in accord with what we call "the laws of nature" means that we can understand the world in terms of things within the world that interact through natural processes. What we observe are the "tools" with which God works and not the worker who uses them. Created things play a double role: they are instruments with which God works and, in Luther's phrase, "masks of God" which hide the worker from our observation.[59] God is hidden in the divine work of continuing creation, as God is hidden in his saving work on Golgotha.

Toward the Beginning and Back Again[60]

The present tense in previous sections was deliberate. We naturally try first to understand our immediate space-time neighborhood, and our prayers for divine action, such as that for daily bread, show the same concern. But what about the past? What was God doing then?

Later we will consider God's act of bringing the universe into being and the sometimes controversial concept of *creatio ex nihilo*. But it is also important to realize that all the divine works of the traditional "six days"—everything in Genesis 1 after the first verse—can be understood in the way we have described. What God has been doing between the initial act of creation and the present can be described with the model of divine action that has just been sketched.

It is instructive to consider first how science has proceeded in understanding the universe. Scientific knowledge about the remote past of the universe was not gained by grand speculation. Knowledge of gravitation, dynamics, and properties of light and matter gained on Earth and from observations of the moon and planets made it possible to move gradually outward from the solar system. Distances to nearby stars were measured, their spectra studied, and masses of some in binary systems determined. Distances to more and more remote stars, and eventually to other galaxies, were found in stepwise fashion so that, because of the finite speed of light, we could also see farther and farther back in time.[61] A large statistical sample of stars with known properties made it possible to understand stellar evolution, and advances in nuclear physics explained the source of stellar energy.

Eventually the limits of our galaxy were determined, and it was found to be one of billions of such systems. The relationship between distances and spectral redshifts of galaxies pointed to a general expansion of the universe. One theory—that expansion began from a hot, dense state—predicted that redshifted "relic radiation" should still pervade the universe. (When a mixture of gas and radiation is slowly compressed, the radiation heats up faster than the gas.) This prediction has been verified from observations of the cosmic microwave background. Abundances of light nuclei from fusion reactions during the first minutes of expansion provide further confirmation of the basic big bang scenario.

The point of this brief survey is that science enables us to understand cosmic history back to very early stages in terms of the same well-established laws that prevail on Earth today. We still do not understand the nature of dark energy and dark matter, which make themselves known only on cosmic scales, but we observe their effects.

Insights of the biological sciences into the past cannot be described so simply. Here we have to rely on signals from the past in the form of "time capsules" such as fossils, which require more complex interpretation than electromagnetic waves. (All data is theory laden, but some data are more laden than others.) In addition, biological phenomena cannot be described by precise quantitative laws to the extent that physical phenomena can. This is not to disparage the life sciences but to recognize that the phenomena with which they deal are very complicated.

In spite of these difficulties, workers in the life sciences have learned a great deal. Recognition that earlier forms of life had become extinct influenced the development of evolutionary theories,[62] but patterns of current geographical distributions of species and anatomical similarities between species were also important. The way in which Darwin presented his theory of natural selection by analogy with artificial selection shows the connection of that theory with experience of today's world.[63] With the rediscovery of Mendel's work in genetics, evolutionary science was on its way to our present understanding of the history of terrestrial life. Here too there are unsolved problems, chief among them the origin of life on Earth.

Well-established theories, general relativity, and the standard model of particle physics can, as a conservative estimate, take us back to within about 10^{-11} seconds of the beginning of expansion.[64] We can be confident that we know, in broad outline, what has taken place in the observable universe during the 13.8 Gyr since that time.

A theological description of divine action is not the same as a scientific description of physical processes. But our theological model of divine action by means of God's kenotic cooperation with creatures links the two descriptions. Since we have treated divine action in the present in that way, it makes sense to pursue the same course that we did with a scientific description of the past, extrapolating our theological understanding back toward the beginning.

Now we can return to the present. What has God been doing during this 13.8 Gyr? In broad outline, the answer is simple. In the first minutes of expansion, God was making the present particle content of the cosmos by means of the strong and electroweak interactions while governing cosmic expansion gravitationally. As the universe continued to expand in accord with the laws of these interactions (whose source is the Word of God), atoms formed and the relic radiation propagated freely. Galaxies, stars, and planetary systems came into being as God worked with gravitation and forces governing the structure of materials. Cooperating with hydrogen and helium nuclei in their interactions, God ignited stars and made heavier elements, spreading them out in supernova explosions to become part of new generations of stars and planetary systems.

On at least one planet of one system, the Word of God and "the Lord and giver of life" somehow brought life into being. Over billions of years, new lifeforms evolved as God worked with complex biochemical processes and the forces that shape environments to come to the present day. Denis Edwards discusses this evolution of life as an aspect of cosmic evolution, with some attention to the issues of theodicy to which the evolutionary process gives rise.[65] On this planet, God has created a creature able to understand its world, to reflect on its own existence, to hear God's address, and to trust and obey that address—or to turn away. This is a universe in which flesh could come into being in order for the Word to become flesh.[66]

The Origin of the Universe

What, if anything, can science say about an absolute beginning of the universe? Theories have been proposed that would take us even closer to the beginning of expansion than 10–11 seconds, or before that beginning to a contracting phase, or that would eliminate a beginning altogether.[67] There is not room here to discuss these ideas further. But we do need to deal with claims that science can explain the origin of the universe from "nothing," and thus make the idea of a creator superfluous.

Such claims, made most prominently by Krauss and Hawking,[68] are based on the idea that in conditions like those very early in cosmic expansion, particles could be pulled from the quantum vacuum to become the material content of the universe. While a detailed treatment of this idea requires the machineries of general relativity and quantum field theory, a simple model suggests how basic ideas of special relativity, gravitation, and quantum theory allow the possibility. Massive particles could make quantum jumps from a state of zero energy if their negative

gravitational potential energy just cancelled their rest mass and kinetic energies.[69]

Making the material content of the universe from a quantum vacuum that is itself God's creation would be another illustration of ideas that we have already considered. We see again the divine kenosis in which God wills and allows something other than Godself to exist. "The κένωσις, which reaches its paradoxical climax in the Cross of Christ, began with the Creation of the world."[70]

But the quantum vacuum is not "nothing." Krauss's book begins with that fact and then uses a "bait and switch" trick to say that origination from a quantum vacuum would be "creation out of nothing." But the argument requires the reality of quantum fields as instantiations of certain laws. *Creatio ex nihilo,* in the theological sense, means creation in spite of absolute nothingness, the "*nihil negativum*."[71] It is not creation from some "nothing" that has the potential to be "something." Claims that somehow the universe can create its own laws "from nothing" are futile. There is always "something" smuggled in. It is sometimes said that one implication of quantum theory is that "whatever is not forbidden is allowed." But "nothing," in the sense of the theological tradition, means forbidding.

The Christian doctrine of *creatio ex nihilo* is only secondarily about the universe, and primarily about the God for whom nothing is impossible.[72] It is a claim that the Father, working through the Son of God and the Holy Spirit together, established basic patterns of a universe and, in Hawking's phrase, "breathes fire into the equations."[73]

An Open Creation

If God were constrained to act within the limits of deterministic laws of physics, then God would be locked into one particular course of action. It would be hard to see how there could be divine guidance of the course of evolution beyond hardwiring the entire course of it at the beginning, which is implausible. There would be no room for miracles in the sense of phenomena which are not predictable by science.

It can be only an act of faith, and not a matter of knowledge, to hold that the laws of nature are reducible to the laws of physics. Polkinghorne, for example, has argued that we should not be dogmatic about this.[74] If the laws of nature, and of life in particular, are not thus reducible, there might be more flexibility for kenotic divine action than quantum and chaos theories suggest. But having said that, we should consider what our current understanding of physics can say about God's freedom to act in the world.

Both sensitivity to initial conditions of some nonlinear systems (chaos theory) and to quantum mechanics have been suggested as loci for such freedom.[75] There is, strictly speaking, no quantum chaos because quantum dynamics are described by the linear Schrödinger equation. But the uncertainty principle places a limitation on how precisely the initial conditions for any system can be known. That may lead to a practical impossibility of prediction of the system's behavior after a short time even though that behavior is theoretically determined by the initial conditions. God's use of this effect to determine, for example, the effect on weather of a butterfly's wings flapping would be an undetectable interference with the laws of physics.[76]

While the Schrödinger equation determines the evolution of a system's state (wave function) between measurements, it does not give the result of a measurement. Thus the fundamental laws of quantum mechanics do not determine completely the future configuration and motions of the world.

This may point not only to a limitation of present-day quantum theory but also to a basic feature of the world, ontological indeterminacy. If so, God, without violating the laws of physics, could act to determine the final quantum state of systems that have interacted as long as the statistical laws for an ensemble of such systems were respected. The laws of physics would not completely determine the future of the universe.

Russell has argued, as part of an overall picture of divine action in the cosmos, that God could act at the quantum level and influence interactions involving DNA to produce mutations, and thus guide the evolutionary process.[77] The idea that God could give some direction to evolution will be criticized by evolutionary biologists who insist that evolution is unguided. While their voices must be heard, it is important to remember that the branch of science relevant to biological systems at the quantum level is physics.

The proposal that God is the final "determiner of indeterminacies" is potentially important but raises problems. If God does this in every interaction, we are back to Barbour's "monarchical" model of a divine ruler who determines absolutely everything and gives creatures no freedom. The opposite idea, that all final states "just happen" with no special divine influence, makes one wonder if God could have any control of creation at all. A suggestion that God determines some, but not all, final states, would be clumsy. It seems appropriate to end discussion of divine action at the quantum level with some uncertainty. ✯

Notes

[1]This an expanded version of a paper given at the annual meeting of the American Scientific Affiliation at Oral Roberts University in 2015. Biblical citations are from the NRSV.

[2]George L. Murphy, "A Positive Approach to Creation," *Journal of the American Scientific Affiliation* 32, no. 4 (1980): 230–36.

[3]See John H. Walton, "Hebrew Corner 3: 'create (*bara'*),'" Zondervan Academic, September 12, 2008, http://zondervanacademic.com/blog/we-have-been-di/, for occurrences in the Old Testament.

[4]Benjamin Wirt Farley, *The Providence of God* (Grand Rapids, MI: Baker Book House, 1988), 16.

[5]Rudolf Bultmann, *Jesus Christ and Mythology* (New York: Charles Scribner's Sons, 1958), 69; Ian Barbour, *Religion in an Age of Science* (New York: HarperCollins, 1990), 254–56.

[6]Dietrich Bonhoeffer, *Letters and Papers from Prison*, enlarged ed. (New York: Macmillan, 1972), 360.

[7]*The Sacramentary* (New York: Catholic Book Publishing, 1972), 370–71.

[8]Eberhard Jüngel, *God as the Mystery of the World* (Grand Rapids, MI: Eerdmans, 1983), 218.

[9]George L. Murphy, "Chiasmic Cosmology: An Approach to the Science-Theology Dialogue," *Trinity Seminary Review* 13, no. 2 (1991): 83–92; ___, "The Theology of the Cross and God's Work in the World," *Zygon* 33, no. 2 (1998): 221–31; ___, "Chiasmic Cosmology and Creation's Functional Integrity," *Perspectives on Science and Christian Faith* 53, no. 1 (2001): 7–13, http://www.asa3.org/ASA/PSCF/2001/PSCF3-01Murphy.html; ___, *The Cosmos in the Light of the Cross* (Harrisburg, PA: Trinity Press International, 2003); ___, "Divine Action and Divine Purpose," *Currents in Theology and Mission* 36, no. 1 (2009): 32–38.

[10]Farley, *The Providence of God*.

[11]Thomas Aquinas, *The Summa Theologica of Saint Thomas Aquinas*, vol. 1 (Chicago, IL: Encyclopaedia Britannica, 1952), pt. 1, QQ 104–106, 535–49; Heinrich Schmid, *The Doctrinal Theology of the Evangelical Lutheran Church*, 3rd ed. rev. (Minneapolis, MN: Augsburg, 1961), 170–94; Heinrich Heppe, *Reformed Dogmatics* (Grand Rapids, MI: Baker Book House, 1978), 251–80.

[12]Ian Barbour, *Religion in an Age of Science*, chap. 9; ___, *Religion and Science: Historical and Contemporary Issues* (New York: HarperCollins, 1997), chap. 12.

[13]Jürgen Moltmann, *The Trinity and the Kingdom*, trans. Margaret Kohl (New York: Harper & Row, 1981), 1–20; Ted Peters, *God as Trinity: Relationality and Temporality in Divine Life* (Louisville, KY: Westminster/John Knox, 1989), 81–90.

[14]Jürgen Moltmann, *God in Creation* (San Francisco, CA: Harper & Row, 1985); Colin E. Gunton, *The Triune Creator: A Historical and Systematic Study* (Grand Rapids, MI: Wm. B. Eerdmans, 1998); Christopher Southgate, ed., *God, Humanity and the Cosmos* (Harrisburg, PA: Trinity Press International, 1999), especially chap. 7; John Polkinghorne, *Science and the Trinity: The Christian Encounter with Reality* (New Haven, CT: Yale University Press, 2004); Denis Edwards, *How God Acts: Creation, Redemption, and Special Divine Action* (Minneapolis, MN: Fortress Press, 2010); Ian A. McFarland, *From Nothing: A Theology of Creation* (Louisville, KY: Westminster John Knox Press, 2014).

[15]Alan Richardson and John Bowden, eds., *The Westminster Dictionary of Christian Theology* (Louisville, KY: Westminster John Knox Press, 1983), s.v. "Appropriation," H. E. W. Turner.

[16]"Irenaeus against Heresies," in *The Ante-Nicene Fathers*, vol. 1 (reprint; Grand Rapids, MI: Eerdmans, 1979), 4.20.1 (p. 487) and 5.6.1 (p. 531).

[17]The Episcopal Church, *The Book of Common Prayer* (New York: Church Publishing, 1986), 327, 335.

[18]Dorothy L. Sayers, *The Mind of the Maker* (London: Methuen, 1941).

[19]Raymond E. Brown, S.S., *The Gospel According to John I–XII* (Garden City, NY: Doubleday, 1966), 4–6, 23–27. Some commentators suggest that the Greek philosophical logos idea may have influenced the evangelist. For the concept throughout scripture, see, e.g., Burton H. Throckmorton, *Creation by the Word* (Boston, MA: United Church Press, 1968).

[20]Geoffrey W. Bromiley, trans. and ed., *Theological Dictionary of the New Testament*, vol. 4 (Grand Rapids, MI: Eerdmans, 1967), s.v. "λέγω, λόγος κτλ," section B, Kleinknecht.

[21]E.g., Justin Martyr, "The First Apology of Justin," in *The Ante-Nicene Fathers*, vol. 1, 163–87.

[22]Robert W. Jenson, *Systematic Theology*, vol. 1, *The Triune God* (New York: Oxford, 1997), 141.

[23]K. R. Hagenbach, *Compendium of the History of Doctrine*, vol. 2 (Edinburgh: T&T Clark, 1852), 320; Dietrich Bonhoeffer, *Creation and Fall: A Theological Exposition of Genesis 1–3* (Minneapolis, MN: Fortress, 1997), 34.

[24]Wolfhart Pannenberg, *Systematic Theology*, vol. 2, trans. Geoffrey W. Bromiley (Grand Rapids, MI: Eerdmans, 1994), 109.

[25]Thomas F. Torrance, *Divine and Contingent Order* (New York: Oxford, 1981), especially chap. 1.

[26]Amos Yong, *The Spirit of Creation* (Grand Rapids, MI: Wm. B. Eerdmans, 2011).

[27]Elizabeth A. Johnson, *Women, Earth and Creator Spirit* (Mahwah, NJ: Paulist Press, 1993), especially chap. 5.

[28]George L. Murphy, "The Third Article in the Science-Theology Dialogue," *Perspectives on Science and Christian Faith* 45, no. 3 (1993): 162–68.

[29]Robert W. Jenson, "The Holy Spirit," in *Christian Dogmatics*, vol. 2, ed. Carl E. Braaten and Robert W. Jenson (Philadelphia, PA: Fortress, 1984), 170–73.

[30]Moltmann, *God in Creation*, 96.

[31]Jacques Monod, *Chance and Necessity* (London: Collins, 1972); Arthur Peacocke, *Theology for a Scientific Age*, enlarged ed. (Minneapolis, MN: Fortress, 1993), 115–21.

[32]Polkinghorne, *Science and the Trinity*, 81.
[33]For more detailed discussion, see George L. Murphy, "Energy and the Generation of the World," *Zygon* 29, no. 3 (1994): 259–74, https://doi.org/10.1111/j.1467-9744.1994.tb00666.x.
[34]For the relevant part of the council's definition of faith in which this statement of Pope Leo I is endorsed, see *The Nicene and Post-Nicene Fathers*, 2nd series, vol. 14 (reprint; Grand Rapids, MI: Wm. B. Eerdmans, 1979), 345.
[35]Murphy, "Energy and the Generation of the World"; Gunton, *The Triune Creator*, 175–76.
[36]Fred Sanders, "Preserving, of Course, the Properties of Each" (Beckwith), *The Scriptorium Daily*, November 2, 2016, http://scriptoriumdaily.com/preserving-of-course-the-properties-of-each-beckwith/.
[37]Cf. the way Sayers, *The Mind of the Maker*, associates the Father with the idea of the work.
[38]Barbour, *Religion in an Age of Science*, chap. 9; ___, *Religion and Science*, chap. 12.
[39]John Polkinghorne, "Natural Science, Temporality, and Divine Action," *Theology Today* 55, no. 3 (1998): 334.
[40]W. Heitler, *The Quantum Theory of Radiation*, 3rd ed. (London: Oxford Clarendon Press, 1954).
[41]Austin Farrer, *Faith and Speculation* (New York: New York University Press, 1967), especially chaps. 4 and 5. On the concept of cause, see, e.g., Zachary Hayes, O.F.M., *What Are They Saying about Creation?* (New York: Paulist Press, 1980), 35–36.
[42]Bethany Sollereder, "A Modest Objection: Neo-Thomism and God as a Cause among Causes," *Theology and Science* 13, no. 3 (2015): 345–53, https://doi.org/10.1080/14746700.2015.1053762.
[43]Barbour, *Religion and Science*, 305–12.
[44]E.g., David Hollaz, quoted in Schmid, *The Doctrinal Theology of the Evangelical Lutheran Church*, 187.
[45]Cf. Athanasius, "On the Incarnation of the Word," in *Nicene and Post-Nicene Fathers*, 2nd series, vol. 4 (Grand Rapids, MI: Wm. B. Eerdmans, 1978), 37.
[46]Murphy, *The Cosmos in the Light of the Cross*, 77.
[47]The Episcopal Church, *The Book of Common Prayer*, 833.
[48]Tom Settle, "The Dressage Ring and the Ballroom: Loci of Double Agency," in *Facets of Faith and Science*, vol. 4, ed. Jitse M. van der Meer (Lanham, MD: University Press of America, 1996), 17–40.
[49]Margaret J. Osler, *Divine Will and the Mechanical Philosophy* (Cambridge, UK: Cambridge University Press, 1994).
[50]Blaise Pascal, *The Pensées* (Harmondsworth, UK: Penguin, 1961), 222, #602.
[51]E.g., Colin Gunton, *Christ and Creation* (Grand Rapids, MI: Wm. B. Eerdmans, 1992), 85.
[52]Luther, "Heidelberg Disputation 1518," in *Luther's Works*, vol. 31 (Philadelphia, PA: Fortress, 1957), 53.
[53]Gordon D. Fee, *Paul's Letter to the Philippians* (Grand Rapids, MI: Wm. B. Eerdmans, 1995), 196.
[54]George L. Murphy, "Kenosis and the Biblical Picture of the World," *Perspectives on Science and Christian Faith* 64, no. 3 (2012): 157–65.
[55]E.g., Nancey Murphy and George F. R. Ellis, *On the Moral Nature of the Universe* (Minneapolis, MN: Augsburg Fortress, 1996); John Polkinghorne, ed., *The Work of Love: Creation as Kenosis* (Grand Rapids, MI: Wm. B. Eerdmans, 2001).
[56]Murphy, *The Cosmos in the Light of the Cross*, 30, 80–85; George L. Murphy, "Kenosis and Divine Action," *Dialog* 52, no. 4 (2013): 280.
[57]John Polkinghorne, "Kenotic Creation and Divine Action," in *The Work of Love*, ed. Polkinghorne, 96. Paul Fiddes and Sarah Coakley touch on the point in their essays.
[58]Bonhoeffer, *Letters and Papers from Prison*, 360–61.
[59]Martin Luther, "Psalm 147" in *Luther's Works*, vol. 14 (St. Louis, MO: Concordia, 1958), 114.
[60]George L. Murphy, "From the Small Catechism to the Big Bang," *Glaube und Denken* 10 (1997): 29–46.
[61]Steven Weinberg, "The Cosmic Distance Ladder," in *Gravitation and Cosmology: Principles and Applications of the General Theory of Relativity* (New York: John Wiley & Sons, 1972), 427–40. More recent methods are described in Saul Perlmutter, "Supernovae, Dark Energy and the Accelerating Universe," *Physics Today* 56, no. 4 (2003): 53–60, https://doi.org/10.1063/1.1580050.
[62]Loren Eiseley, "How Death Became Natural," in *The Firmament of Time* (New York: Atheneum, 1962).
[63]Charles Darwin, *On the Origin of Species* (London: J. M. Dent & Sons, 1972), chapters 1 and 2.
[64]"Thermal History of the Early Universe," http://www.helsinki.fi/~hkurkisu/cosmology/Cosmo6.pdf, p. 71.
[65]Denis Edwards, *How God Acts* (Minneapolis, MN: Fortress, 2010). On the theodicy question, see also George L. Murphy, "Necessary Natural Evil and Inevitable Moral Evil," *Perspectives on Science and Christian Faith* 68, no. 2 (2016): 111–18, particularly 111–14.
[66]George L. Murphy, "The Incarnation as a Theanthropic Principle," *Word & World* 13, no. 3 (1993): 256–62.
[67]Aquinas, *The Summa Theologica*, vol. 1, pt.1, Q 46, Art. 2, 253–55, argued that it is an article of faith, not a conclusion of reason, that the world had a beginning.
[68]Lawrence M. Krauss, *A Universe from Nothing* (New York: Free Press, 2012). My review of this book is in *Perspectives on Science and Christian Faith* 65, no. 2 (2013): 137–38; Stephen Hawking and Leonard Mlodinow, *The Grand Design* (New York: Bantam, 2012), chap. 8.
[69]George L. Murphy, "Einstein + Newton + Bohr = Quantum Cosmology," *The Physics Teacher* 35 (1997): 480–81, https://doi.org/10.1119/1.2344773.
[70]Emil Brunner, *Dogmatics* II (Philadelphia, PA: Westminster, 1952), 20.
[71]Dietrich Bonhoeffer, *Creation and Fall* (Minneapolis, MN: Fortress, 1997), 33–34.
[72]McFarland, *From Nothing*, is an exposition of this doctrine.
[73]Stephen Hawking, *A Brief History of Time* (New York: Bantam, 1988), 174.
[74]John Polkinghorne, "The Laws of Nature and the Laws of Physics," in *Quantum Cosmology and the Laws of Nature*, 2nd ed., ed. Robert John Russell et al. (Berkeley, CA: The Center for Theology and the Natural Sciences, 1999), 429–40. Other contributions to this volume are also relevant to our topic.
[75]Robert John Russell, Nancey Murphy, and Arthur R. Peacocke, eds., *Chaos and Complexity*, 2nd ed. (Berkeley, CA: The Center for Theology and the Natural Sciences, 1997).
[76]Nicholas Saunders, *Divine Action and Modern Science* (Cambridge, UK: Cambridge University Press, 2002), 87–90 and chap. 7, discusses relationships and distinctions between predictability and determinism.
[77]Robert John Russell, *Cosmology from Alpha to Omega* (Minneapolis, MN: Fortress, 2008), chapters 5 and 6.