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Creation and Science

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Faith, Reason, and Creation

A brief examination of the historical discussion of creation can help make clear what creation means and illuminate as well contemporary discussions, since many of the issues raised today about creation and science were the subject of sustained reflection in earlier times – even if we recognize significant differences in what the natural sciences tell us about the world.

Church Fathers, Greek Philosophy, and Creation

When theologians in the second, third, and fourth centuries came to define the Christian view of nature, human nature, and God – as distinct from the views found in the pagan intellectual world in which they lived – they found in Genesis, interpreted in the light of Christian faith, a source for a view of God as creator which they developed into an understanding of the origin of the universe characteristically their own.

The Hellenistic world in which the early Christian theologians sought to understand their faith shared an intellectual patrimony which, despite its diversity, maintained that the universe is eternal. From Heraclitus and Parmenides to Plato and Aristotle, and from the Stoics to Plotinus, the ancient philosophers appeared to

speak with one voice. Whether there be nothing but change or change be an illusion, whether we distinguish between a world of becoming and a world of being, or between potentiality and actuality, one thing is clear: there is no absolute temporal beginning of the universe.

For the Church Fathers, Christian revelation stood out in stark contrast to this traditional view of an eternal universe. For early Christians to say that the world is eternal is to make it equal to God. God alone is eternal; the world is finite, and this includes temporal finitude; the world began to be. Furthermore an eternal universe appeared to be a necessary universe, a universe which was not the result of the free act of a transcendent God.

Also for the Church Fathers, the view that the world is eternal, in the specific sense of being without a finite temporal duration, seemed inevitably to require a cyclical view of history, a view that would raise fundamental problems for Christianity. Only a temporally finite world could constitute the scene for the religious drama of Fall and Redemption, with its central, unique, unrepeatable event: the coming of Christ. Only in a world temporally finite did it seem possible to make sense of the Christian understanding of each person's destiny providentially designed by a loving God. If salvation history is to make sense, time cannot be cyclical.

Crucial as well was the recognition that creation is out of nothing. There is no pre-existent material which God

uses in the act of creating. Creation is not a transforming of formless material into the structure of the world; creation is the complete and total production of all that is. Any kind of cosmological dualism must be rejected. All that is has God as its source. If everything that is depends upon God for its very existence, creation must be out of nothing. If there were some pre-existent material with which God worked, that material would not depend upon God for its existence.

A world that has an absolute beginning in time and which is created out of nothing seemed incomprehensible to both philosophy and science. After all, ancient scholars thought it was surely the case that the world is eternal and that it was impossible to get something from nothing. Not even an all-powerful being can accomplish what is in principle impossible. Must one reject science (and, in the process, reason) in order to accept a central truth of Christianity? How Christian thinkers wrestled with such a question offers important insights for debates about creation and science in our day.

Thomas Aquinas on Creation

Mediaeval discussions about creation (especially the intelligibility of *creatio ex nihilo*), divine agency, and the autonomy of nature, and ultimately the very possibility of the natural sciences' discovering real causes in nature, provide a rich source of insights for us today. These

discussions occurred in the religious communities of Islam, Judaism, and Christianity. What Avicenna, Maimonides, and Thomas Aquinas, for example, saw so clearly, that creation is an account of the existence of things, not of changes in and among things, allows us to conclude that there is no contradiction between creation, so understood, and any conclusion in the natural sciences. The natural sciences have as their domain of explanation the world of changing things. Whether the changes so described are biological or cosmological, without beginning or end, or temporally finite, they remain processes. We will return to this theme in the next chapters when we look at features of the contemporary debate about creation and science.

The key to Thomas Aquinas' analysis is the distinction he draws between creation and change, or, as he often remarked: *creatio non est mutatio* (creation is not a change). Creation, as a metaphysical and theological notion, affirms that all that is, in whatever way or ways it is, depends upon God as cause. The natural sciences, whether Aristotelian (with which Thomas was primarily concerned) or those of our own day, have as their subject the world of changing things: from subatomic particles to acorns to galaxies. Whenever there is a change there must be something that changes.

Creation, on the other hand, is the radical causing of the whole existence of whatever exists. To cause completely

something to exist is not to produce a change in something, is not to work on or with some existing material. If, in producing something new, an agent were to use something already existing, the agent would not be the *complete* cause of the new thing. But such complete causing is precisely what creation is. To create is to cause existence, and all things are totally dependent upon the Creator for the very fact that they are. As Thomas remarks in his treatise, *On Separated Substances* [chapter 9]: "Over and above the mode of becoming by which something comes to be through change or motion, there must be a mode of becoming or origin of things without any mutation or motion, through the influx of being."

Modern arguments about order and design (like mediaeval arguments about motion and an unmoved mover) are arguments in natural philosophy and not in metaphysics. To the extent that "to create" is susceptible to rational examination, it is a topic in metaphysics and not in natural philosophy, nor in the individual empirical sciences.

Creatures are what they are (including those which are free), precisely because God is present to them as cause. Were God to withdraw, all that exists would cease to be. Creaturely agency and the integrity of nature, in general, are guaranteed by God's creative causality.

Furthermore, for Thomas, creation is not primarily some distant event; rather, it is the on-going complete causing of the existence of all that is. At this very

moment, were God not causing all that is to exist – from subatomic particles to the color of the sky, to our own thoughts, hopes, and dreams – were God not to be causing everything that is, there would be nothing at all.

Human creations and Creation

To avoid confusion, we need to recognize the different senses of how we use the term "to create." We often speak of human creations, especially with respect to the production of works of art, music, and literature. What it means for God to create is radically different from any kind of human making. When human beings make things they work with already existing material to produce something new. The human act of creating is not the complete cause of what is produced; but God's creative act is the complete cause of what is produced; this sense of being the complete cause is captured in the expression "out of nothing." To be such a complete cause of all that is requires an infinite power, and no creature, no human being, possesses such infinite power. God wills things to be and thus they are. To say that God is the complete cause of all that is does not negate the role of other causes which are part of the created natural order. Creatures, both animate and inanimate, are real causes of the wide array of changes that occur in the world, but God alone is the universal cause of being as such. God's causality is so different from the causality of creatures that there is no

competition between the two, that is, we do not need to limit, as it were, God's causality to make room for the causality of creatures. God causes creatures to be causes.

Creation as an Origin, Not a Beginning

Thomas Aquinas is particularly insightful in distinguishing between the origin of the universe and the beginning of the universe. Beginning refers to a temporal event, and an absolute beginning of the universe would be an event which is coincident with the beginning of time. Creation is an account of the origin, or source of existence, of the universe, and, as such, Thomas thinks that creation can be demonstrated in the discipline of metaphysics.

For Thomas there are two senses of creation out of nothing, one philosophical, the other theological. The philosophical sense means that God, with no material cause, makes all things to exist as entities that are really different from Him, yet completely dependent upon His causality. The theological sense of creation denies nothing of the philosophical sense but adds to it, among other things, the notion that the created universe is temporally finite. The Creator is prior to what is created, but the priority is not *fundamentally* temporal. Each creature has its origin in the Creator and is wholly dependent upon the Creator for its existence; the dependence is metaphysical not temporal. To be created

out of nothing does not mean that the creature is *first* nothing and *then* something.

Thomas saw no contradiction in the notion of an eternal created universe. For, even if the universe had no temporal beginning, it still would depend upon God for its very being. The radical dependence on God as cause of being is what creation means. Thomas, of course, accepted as a matter of faith that the Bible revealed that the world had an absolute temporal beginning, which obviously meant that it had to be created, but he thought that reason alone (in philosophy or science) could not know whether the universe had a temporal beginning or whether it was eternal. He did think, however, that reason alone (in metaphysics), by reflecting on what it means for things to exist, could conclude for sure that there must be an Uncaused Cause of all that is.[1]

Theology of Creation and Science

When it came to explaining the opening verses of Genesis, especially the events described in the "six days of creation," Thomas observed that what was central to Christian faith was the "fact of creation" and not the "manner or mode" of formation of the world. Questions concerning order, design, and chance in nature refer to the "manner or mode" of formation of the world. Attempts in the natural sciences to explain these facets of nature do not challenge the "fact of creation." A world

with a temporal beginning concerns the kind of world God has created. It may very well be easier to accept that a world which has an absolute temporal beginning is a created world, and such a world may be especially appropriate for understanding sacred history, important as it is for believers. But an eternal world, one without a beginning to time, would be no less a created world.

Creation understood theologically completes and perfects what philosophy discloses about God as cause of the existence of all that is. With respect to the relationship between creation and science, the subject of this book, the insights of faith concerning the Trinitarian nature of God as Creator, with the dynamic inner life of the three Divine Persons being freely expressed externally in the creation of all that is, connected to the drama of the Fall and Redemption, and seeing "in the beginning" to mean in/through Christ, are not particularly relevant. That theological feature of creation which is relevant is the temporal beginning of the world. But even this concerns more the kind of universe God creates than it does the core sense of creation, which is ontological dependence. Accordingly, throughout the discussion of creation and science, it will be the philosophical sense of creation – a sense which is indeed included in the Christian theology of creation – which will occupy our attention.

Cosmology and Creation

With an understanding of the traditional sense of creation out-of-nothing, especially as set forth by Thomas Aquinas, we are better prepared to return to some of the themes noted in the "Introduction" and thus to examine contemporary challenges to the doctrine of creation, based on appeals to science.

Fascination with origins is common-place in the natural sciences. The cover of the September 2009 issue of *Scientific American* announced the theme for a wide variety of essays on "Understanding Origins." Topics included: the origins of teeth, of cooking, of chocolate, of paper money, of the internal combustion engine, and of intermittent windshield wipers. Most prominently displayed on the cover, however, were origins of life and of the universe. Michael Turner of the University of Chicago was the author of the essay on the origin of the universe and he optimistically claimed that "cosmologists are closing in on the ultimate processes that created and shaped the universe." Turner drew a compelling picture of the many advances in cosmology over the last one hundred years which have radically transformed our understanding of the universe and its development, from

a kind of "formless soup of elementary particles" into "the richly structured cosmos of today."

The 'Limitless Power of Science'

Developments in cosmology and particle physics have long encouraged flights of fancy about what the natural sciences can discover about the world. Perhaps one of the more extravagant claims about what contemporary science can tell us about the origin and nature of the universe can be found in an essay, "The Limitless Power of Science," written by the Oxford physical chemist, Peter Atkins, several years ago. Atkins claimed that the domain of scientific discourse is truly limitless; there is no corner of the universe, no dimension of reality, no feature of human existence, which is not properly the subject of the modern natural sciences! Atkins has little use for philosophy as a guide to truth, but it is religion which is the special object of his ire; theology, he thinks, has contributed nothing to our understanding of reality. On the other hand:

> Scientists liberate truth from prejudice, and through their work lend wings to society's aspirations. While poetry titillates and theology obfuscates, science liberates. The grave responsibility of scientists is to use their voices to blow back the fog that shrouds the minds of those who have not yet seen.

The science embraced by Atkins truly knows no limits. Creation itself falls within its grasp. Science, he writes, must be able to account for the "emergence of everything from absolutely nothing. Not almost nothing, not a subatomic dust-like speck, but absolutely nothing. Nothing at all. Not even empty space." Following in Atkins' footsteps, Christopher Hitchens in his popular book, *God is Not Great* contends: "Religion has run out of justifications. Thanks to the telescope and the microscope, it no longer offers an explanation of anything important." In fact, as the sub-title of his book urges, he thinks religion "poisons everything." It is a view widely shared in the circles of the "new atheism."

'Nothing for a Creator to do'

Even if we were to reject the overly exuberant rhetoric of Atkins and Hitchens, it seems easy to draw connections between developments in cosmology concerning the beginning of the universe and theological reflections about creation. Nevertheless, we ought to be alert to what it is that cosmology explains, or seeks to explain, and what creation means. Stephen Hawking once famously remarked that his cosmological model, which denied a beginning to the universe, "left nothing for a creator to do." Here are Hawking's now famous words:

> So long as the universe had a beginning, we could suppose it had a creator. But if the universe is really completely self-contained, having no boundary or edge, it would have neither beginning nor end: it would simply be. What place, then, for a creator?

New theories concerning what happened "before the Big Bang" as well as those which speak of an endless series of big bangs are often attractive because they too deny a fundamental beginning to the universe and thus appear to make a Creator irrelevant.

Recently, there has been considerable fascination with various multiverse hypotheses, according to which our universe is but one of a very large number – or perhaps an infinite number – of universes. If our universe is but one of an infinite number, it just happens to be and does not need an explanation for its particular characteristics. Multiverse proposals are often advanced to avoid what for many are unpleasant consequences of arguments about the "fine-tuning" of the initial conditions of our universe: fine-tuning which many think would be evidence for God as fine-tuner. But fine-tuning is not creation; furthermore, however many "universes" there may be, even an infinite number, they would all depend upon God's creative act in order to be.

The Big Bang as Evidence for Creation

There are other scholars who have embraced traditional Big Bang cosmology, which seems to affirm an absolute beginning to the universe, as providing scientific support for, if not actual confirmation of, the Genesis account of creation. The argument is that an initial "singularity" such as the Big Bang, outside the categories of space and time, points to a supernatural cause of the beginning of the universe. If one can say that, in fact, the universe began to exist, then, so the argument goes, there must be a cause of this fact, and this cause must obviously be external to the universe; hence there must be a Creator. In a way, the debate is about whether or not cosmology discloses a beginning of the universe and thus whether cosmology rejects or embraces the idea of creation. Despite fundamental differences as to what contemporary cosmology tells us about the beginning of the universe (from those theories which deny there is a beginning to those which accept the "singularity" as such a beginning), all these views tend to identify what it means for the universe to be created with its having a temporal beginning. They equate to be created with to have a beginning; they miss the fundamental point that creation concerns origins not beginnings.

Creation and the 'First Principle of Cosmology'

There is a broader methodological issue at play here: what precisely is the competence of the natural sciences when it comes to discussions about the origin of the universe? One cosmologist, Lee Smolin, in *Three Roads to Quantum Gravity* (2001), raises this topic and offers a succinct account of the self-sufficient universe which he thinks must be embraced by scientists:

> We humans are the species that makes things. So when we find something that appears to be beautifully and intricately structured, our almost instinctive response is to ask, 'Who made that?' The most important lesson to be learned if we are to prepare ourselves to approach the universe scientifically is that this is not the right question to ask. It is true that the universe is as beautiful as it is intrinsically structured. But it cannot have been made by anything that exists outside of it, for by definition the universe is all there is, and there can be nothing outside it. And, by definition, neither can there have been anything before the universe that caused it, for if anything existed it must have been part of the universe. So the first principle of cosmology must be 'There is nothing outside the universe.'. . . The first principle means that we take the universe to be, by definition, a closed system. It means that the explanation for anything in the universe can involve only other things that also exist in the universe.

Thus, whatever kind of "creation" science can disclose, or be used to deny, through particle accelerators or elaborate mathematical models, it would be a scientific account of origins employing, as Smolin would say, principles drawn from within the universe. But such a conception of "creation" is not what philosophers and theologians mean when they speak of creation.

The Big Bang is Not Creation

The distance between minute fractions of a second after the Big Bang and creation is, in a sense, infinite. We do not get closer to creation by getting closer to the Big Bang. Since creation is not really an event at all, it is not within the explanatory domain of cosmology; it is a subject for metaphysics and theology. Some cosmologists have used insights from quantum mechanics to offer accounts of the Big Bang itself. They speak of the Big Bang in terms of "quantum tunnelling from nothing," analogous to the way in which very small particles seem to emerge from vacuums in laboratory experiments. Thus, they think that to explain the Big Bang in this way eliminates the need to have a Creator.

But the Big Bang "explained" in this way is still a change and, as we have seen, creation, properly understood

is not a change at all. Similarly, the "nothing" in these cosmological models which speak of "quantum tunnelling from nothing" is not the nothing referred to in the traditional sense of creation out of nothing. The "nothing" in cosmological reflections may very well be nothing like our present universe, but it is not the absolute nothing central to what it means to create; it is only that about which the theories say nothing. The crucial point here is that to offer a scientific account of the Big Bang is not to say anything about whether or not the universe is created.

Confusions concerning creation and cosmology, as I have suggested, run the gamut from denials of creation because the universe is conceived as having no beginning, to explanations of a beginning in exclusively scientific terms which avoid any appeal to a Creator, to an endless series of universes within universes, or to opposing claims that the Big Bang itself offers a kind of scientific warrant for belief in God's creation of the universe.

Creation as a Concept in Metaphysics and Theology, not in Cosmology

Contrary to all these claims about implications of cosmological theories for creation, we need to recognize that creation is a metaphysical and theological affirmation that all that is depends upon God as cause. The natural sciences have as their subject the world of changing things. Whenever there is a change there must be

something that changes. Whether these changes are biological or cosmological, without beginning or end, or temporally finite, they remain processes.

Creation, on the other hand, is the radical causing of the whole existence of whatever exists. Creation is not a change. To cause completely something to exist is not to produce a change in something, is not to work on or with some existing material. When God's creative act is said to be "out of nothing," what is meant is that God does not use anything in creating all that is: it does not mean that there is a change from "nothing" to "something." Cosmology and all the other natural sciences offer accounts of change; they do not address the metaphysical and theological questions of creation; they do not speak of why there is something rather than nothing. It is a mistake to use arguments in the natural sciences to deny creation. It is also a mistake to appeal to cosmology as a confirmation of creation. Reason (as well as faith) can lead to knowledge of the Creator, but the path is in metaphysics not in the natural sciences. Discussions of creation are different from arguments from order and design to a source of order and design. Creation offers an explanation of why things exist at all.

As we have seen, Thomas Aquinas thought that neither science nor philosophy could know whether the universe had a beginning. He did think that metaphysics could show us that the universe is created, but he would have warned

against those today who use Big Bang cosmology, for example, to conclude that the universe has a beginning and therefore must be created. He was always alert to reject the use of bad arguments in support of what is believed.

The "singularity" in traditional Big Bang cosmology may represent the beginning of the universe we observe, but we cannot conclude that it is the absolute beginning, the kind of beginning which would indicate creation. As some contemporary cosmologists recognize, there could very well be something before the Big Bang. Indeed, Gabriele Veneziano, a theoretical physicist at CERN and one of the fathers of string theory in the late 1960s, observes that "the pre-bang universe has become the latest frontier of cosmology." The title of his essay in The *Scientific American* (2004) is instructive: "The Myth of the Beginning of Time."

But, since reason remains silent about an absolute beginning, all theories about a universe without such a beginning remain speculations. Thus, in the midst of such theories about an eternal universe or some kind of multiverse, were faith to insist on a beginning there is no conflict between faith and science. Speculations about a universe without a beginning are not the same as scientific truth about the universe. Remember, as well, that the core sense of creation refers to a dependency upon God, not the beginning of time.

Evolution and Creation

Discussions about creation and evolution can easily become obscured in broader political, social, and philosophical contexts. Indeed, evolution and creation have taken on cultural connotations, serve as ideological markers, with the result that each has come to stand for a competing world-view. For some, to embrace evolution is to affirm an exclusively secular and atheistic view of reality, and evolution is accordingly either welcomed or rejected on such grounds.

Writing in *The Evolution-Creation Struggle* (2005), Michael Ruse argues that "creationism" and what he calls "evolutionism" represent rival religious views of the world: "rival stories of origins, rival judgments about the meaning of human life, rival sets of moral dictates. . . ." What Ruse calls "evolutionism" is a collection of cultural claims which have their roots in, but ought to be distinguished from, the scientific discipline of evolutionary biology. Similarly, too often "creation" is confused with various forms of "creationism," which embrace either a literalistic reading of the Bible or think that creation *must* mean a kind of divine intervention in cosmic history with God's directly creating each individual species of living things.

The choice for many seems to be between a purely natural explanation of the origin and development of life, an explanation in terms of common descent, genetic mutations, and natural selection as the mechanism of biological change, on the one hand, and, on the other hand, an explanation which sees divine agency as the source of life in all its diversity and that human beings, created in the image and likeness of God, have a special place in the universe. The difference *appears* stark: either Darwin or God.

One source of confusion in such an analysis is to see God's creative act essentially as the explanation for order and design in nature: that is, to identify creation with the causing of order and design. As evolutionary biology, for example, claims to be able to explain order and design without an appeal to an orderer or designer, but exclusively on the basis of natural processes, it appears to many that there is no longer a role for God to play. It is an error, however, to think that an explanation of order is an explanation of existence, and creation refers to God as cause of existence.

Self-organization in Living Things

In contemporary biology, there have been important discussions about understanding living things in terms of "self-organization." As we saw in the "Introduction," Stuart Kauffman writes of the "ceaseless creativity" in

nature and that, accordingly, we ought to conclude that nature itself is creativity enough; there is no need for a Creator. As reductionism and mechanism are being replaced by appeals to dynamic, intrinsic, organizing principles, the conclusion often reached is that changes in nature are exhaustively based on principles and entities in the natural world, and that there is no need for any external "interference" to explain the change. Terrence Deacon, author of *The Symbolic Species: The Co-evolution of Language and the Brain* (1997), makes the following claim: "Evolution is the one kind of process able to produce something out of nothing. . . [A]n evolutionary process is an origination process . . . Evolution is the author of its spontaneous creations."

Previously, in a Newtonian universe, when nature was conceived in exclusively inert and mechanistic terms, there were appeals to a source of activity beyond nature, although such appeals would often never be more than the affirmation of a kind of deism: to see God as only getting things started, so to speak; although there may be times when he has to tinker with the mechanism he has produced. But as Thomas Aquinas has shown us, creation is not essentially some distant event, it is the on-going, complete causing of all that is. The God of deism is not the Creator affirmed by Christianity. Furthermore, as I have already indicated, for many thinkers today there is no category beyond

change and the specific behavior of individual things that requires an explanation. It is important to distinguish between the particular claims which evolutionary biology makes about the development and diversity of living things, explanations which are properly in the domain of the natural sciences, and philosophical claims concerning whether or not additional explanations of these realities are necessary. An important point here is that to defend the competence of the natural sciences to describe what happens in nature ought not to be equated with a denial of creation.

The extent to which biologists, when they speak about self-organization, move beyond the domain of biology to make broad claims about "self-creation" and that, accordingly, there is no need to appeal to a source of existence of living things, is the extent to which their claims are broadly metaphysical. An important feature of these philosophical claims, namely, that "self-creation" and "self-sufficiency" evident in the natural order eliminate the need to appeal to God, involves conceptions of God and creation which, even if shared by some believers, are really not the same as those found in traditional philosophy and theology. Remember that all the natural sciences explain change in and among existing things, and creation is not a change.

The 'Divine Foot' and the Methodology of Naturalism

Much like Lee Smolin in his arguments concerning cosmology, the Harvard biologist, Richard Lewontin, has warned that science must guard against allowing a "Divine Foot into the door" of explanations of nature. All truly scientific explanations, he argues, must be framed in terms of what is often called the methodology of naturalism - a methodology which must be rigorously protected and which, for many, involves a commitment to a metaphysical naturalism which is a modern form of materialism.

The fear of the "Divine Foot" is based on a philosophical understanding (and ultimately, I would argue, misunderstanding) of the Creator and of divine agency. For Lewontin, God would be a competing cause in the world. The fear is that any causality one attributes to God must, accordingly, be denied to creatures. This is precisely the fear which informs many who defend creation against evolution as well as those who defend evolution against creation: both opposing sides view the general terms of the discourse in the same way. In either case, God and creatures are seen (erroneously) to be causes which, although differing significantly in degree, fall within the same explanatory category. Accordingly, the more one appeals to nature as self-explanatory, the less one appeals to God – or vice versa.

God as Cause and Creatures as Causes

The problem which those who defend a self-sufficiency in nature and its processes see is that any appeal to a cause outside of nature is either superfluous or contradictory to the very claim that nature is the domain of self-organizing activities. There is a confusion here, however, about different orders or levels of explanation.

If we ask, for example, why wood is heated in the presence of fire, we can explain the phenomenon in terms of the characteristics of both wood and fire. Thomas Aquinas remarks that if a person answers the question of why the wood is heated by saying that God wills it, the person "answers appropriately, provided he intends to take the question back to a first cause; but not appropriately, if he means to exclude all other causes." For Thomas, there is no question that there are real causes in the natural order: "if effects are not produced by the action of created things, but only by the action of God, it is impossible for the power of any created cause to be manifested through its effects." If no created things really produced effects, then "no nature of anything would ever be known through its effect, and thus all the knowledge of natural science is taken away from us."[2]

Thomas thinks that to defend the fact that creatures are real causes, far from challenging divine omnipotence, is a powerful argument for divine omnipotence. As he says, to deny the power of creatures to be the causes of things is

to detract from the perfection of creatures and, thus to detract from the perfection of God.

God is so powerful that He causes things to be and to be in certain ways. God's will transcends and constitutes the whole hierarchy of created causes, both causes which always and necessarily produce their effects and causes which at times fail to produce their effects. We can even say that God causes chance events to be chance events. The role of chance mutations at the genetic level, so important in current evolutionary theory, does not call into question God's creative act.

God is the cause of being as such — and to cause being as such is precisely what to create means. God's causation does not compete with the causation of creatures, but rather supports and grounds it. Since it is characteristic of the causes in nature precisely to be causes, God's causal determination of them is not such as to deny their proper autonomy. God causes creatures to exist in such a way that they are the real causes of their own operations. God is at work in every operation of nature, but the autonomy of nature is not an indication of some reduction in God's power or activity; rather, it is an indication of His goodness. It is not the case of partial or co-causes with each contributing a separate element to produce the effect. God and creatures can each be the complete cause of what happens, but they are causes in radically different senses – different in kind, not in degree.

In fact, God is a cause which, as one scholar aptly puts it, "differs differently" from all other causes. A robust understanding of what it means for God to create shows us that God does not only give being to things when they first begin to exist, He also causes being in them so long as they exist. He not only causes the operative powers to exist in things when these things come into being, He always causes these powers in things. Thus, if God's creative act were to cease, every operation would cease; every operation of any thing has God as its ultimate cause.

Finally, we can see that there is no need to choose between a robust view of creation as the constant exercise of divine omnipotence and the causes disclosed by the natural sciences. God's creative power is exercised throughout the entire course of cosmic history, in whatever ways that history has unfolded. No matter how random one thinks evolutionary change is, for example; no matter how much one thinks that natural selection is the master mechanism of change in the world of living things; the role of God as Creator, as continuing cause of the whole reality of all that is, is not challenged. We need to remember the fundamental point that creation is not a change, and thus there is no possibility of conflict between the explanatory domain of the natural sciences — the world of change — and that of creation.

Order, Design, and Chance in Nature

It is important to distinguish an analysis of creation from questions concerning order and design in nature, questions which are properly the subject of the empirical sciences and natural philosophy. The biologist Francisco Ayala, who has also written on the philosophical and theological implications of evolutionary biology, notes that

> . . . it was Darwin's greatest accomplishment to show that living beings and their configurations can be explained as the result of a natural process, natural selection, without any need or resort to a Creator or other external agent. . . [H]is mechanism, natural selection, excluded God as accounting for the obvious design of organisms. . . Darwin's revolutionary achievement is that he extended the Copernican revolution to the world of living things. The origin and adaptive natures of organisms could now be explained, like the phenomena of the inanimate world, as the result of natural laws manifested in natural processes.[3]

The Neo-Darwinian synthesis adds to Darwin's insight the claim that the natural process begins with chance mutations at the level of genes. Randomness and chance, as the source of whatever order and design we observe in nature, would seem to make any appeal from the evidence of biology to an author of that order unjustified. It is,

however, one thing to say that the explanatory categories of evolutionary biology do not go beyond descriptions of chance and randomness as the basis for change; it is another thing to say that there is nothing more needed to account for biological change than chance and randomness.

Despite the rhetoric of some proponents of evolutionary theory and of most opponents, the natural processes at work in evolutionary change are not themselves random. As Ayala points out, "the traits that organisms acquire in their evolutionary histories are not fortuitous but are determined by their functional utility to the organisms, and they come about in small steps that accumulate over time, each step providing some reproductive advantage over the previous condition." Still, the hereditary variations with which natural selection works come about as the result of genetic mutations which are random in the sense that they occur without any relation to whether or not they are beneficial to the organisms in which they occur.

These random mutations are not events without causes. Again, in the words of Ayala, "the theory of evolution manifests chance and necessity jointly intertwined in the stuff of life; randomness and determinism interlocked in a natural process that has spurted the most complex, diverse, and beautiful entities in the universe." Furthermore, in addition to stochastic processes at the genetic level, the

wider environment, physical and biological, plays an important role in the outcome of natural selection.

The reality of chance events in the evolution of living things, and whatever indeterminacy and unpredictability result, do not justify making chance an ultimate explanatory principle. Chance events occur *within* nature: within the context of a reality susceptible to rational investigation because it is intelligible, and it is this intelligibility which makes possible the laws of nature. Indeed, chance is really meaningless apart from a recognition of purpose and order. It is only because we do recognize that things act to achieve ends regularly that we recognize the failure of this to happen, that is, chance. We ought not to "absolutize" chance and randomness and make them universal principles of change, or to think that their existence in nature is a challenge to God's providential ordering of the world.

Some thinkers do use arguments which have their roots in Neo-Darwinism to deny divine providence, but only if one illegitimately raises biological arguments to the level of metaphysical and theological claims does such an error occur. Thus, the real problem lies not in the commitment of evolutionary biology to explanations in terms of randomness and contingency, but rather in unwarranted extrapolations about the absence of meaning and purpose in nature.

Providence and Transcendence

To affirm that God's purpose is achieved in a world in which there are real natural causes operating according to their own principles requires us to keep in mind that God is a transcendent cause. As we have seen, God is the universal cause of existence as such, but God is also the cause of causes. Here is the way the Catholic Church's International Theological Commission puts it:

> God's action does not displace or supplant the activity of creaturely causes, but enables them to act according to their natures and, nonetheless, to bring about the ends He intends. In freely willing to create and conserve the universe, God wills to activate and to sustain in act all those secondary causes whose activity contributes to the unfolding of the natural order which He intends to produce.[4]

Such a scenario is only intelligible if we recognize that God's causality functions at a different metaphysical level from that of any other cause. As we saw, God's causal agency does not compete with the causes in nature; nor really does God's causality "supplement" a less than adequate set of secondary causes. However much these secondary causes depend completely upon God for the fact that they exist, they exist in such a way as to be the causes of the changes which occur in nature.

The argument that the existence of randomness and chance in biological processes challenges the existence of the Creator only makes sense were one to think that for the universe to be created means that there is, finally, no place for chance events in it. Such a view mistakenly identifies a creator as a kind of super-cause *among* other causes. As we shall see, some theologians, in order to protect the autonomy of natural processes, are ready to reject divine omnipotence or to refer to God's withdrawing, so to speak, to grant an independence to nature.

At least we can say that God's providence is not threatened by evolution viewed in terms of random variations, unless, of course, one mistakenly argues that the natural sciences are the *only* source of truth about the world. An important lesson here is that we do not need to defend divine providence by rejecting evolutionary biology, but only by rejecting certain philosophical claims which deny providence.