Creation, Evolution, and Thomas Aquinas

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The analysis of creation and the distinctions Thomas Aquinas draws among the domains of metaphysics, the natural sciences, and theology can serve an important role in contemporary discussions of the relationship between creation and evolution.

Investigations of the nature and origins of life concern various scientific, philosophical, and theological disciplines. Although any discussion of evolution and creation requires insights from each of these three areas, it is not always easy to keep these disciplines distinct: to know, for example, what is the appropriate competence of each field of inquiry. Nor is it always easy to remember that a truly adequate view of life and its origins requires the insights of all three. As Jacques Maritain observed, we must distinguish in order to unite. (1)

The debate in the United States about what ought to be taught in the schools reveals how discussions about creation and evolution can easily become obscured in broader political, social, and cultural contexts. Evolution and creation take on cultural connotations, serve as ideological markers, with the result that each comes 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. As Daniel Dennett would say, (2) Darwin's ideas are truly dangerous, especially for anyone who wishes to embrace a religious view of the world. Or, as the author of the entry on "evolution" in the fifteenth edition of *The New Encyclopedia Brittanica* put it: "Darwin did two things: he showed that evolution was a fact contradicting scriptural legends of creation and that its cause, natural selection, was automatic with no room for divine guidance or design."(3)

There are two fundamental pillars of evolutionary biology which are important for contemporary discussions of the relationship among biology, philosophy, and theology. The first is the claim of common ancestry: the view that all living things are historically and organically interconnected. Commentators describing the recent publication of a kind of rough draft of the total genetic constitution of the human species, its genome, have been quick to point out that, since human genes look much like those of fruit flies, worms, and even plants, we have further confirmation of common descent from "the same humble beginnings and that the connections are written in our genes."(4) To affirm a fundamental continuity among living things challenges the notion that distinct species were created by God through special interventions in nature. Common descent challenges as well the theological view that human beings, created in the image and likeness of God, represent an ontological discontinuity with the rest of nature.(5) Specifically, it would seem that any notion of an immaterial human soul must be rejected if one is to accept the truths of contemporary biology.

More troublesome, so it seems, is the commitment to natural selection as the mechanism by which biological change has occurred.(6) As a result of chance variations at the genetic level, variations in organisms result in some being better adapted to their environment and, as a result, nature "selects" these better adapted organisms and eliminates competitors. It is through this process of natural selection that evolutionary biology explains the way in which we can account for the diversity of species in the world

Although there are debates among evolutionary theorists about the randomness and contingency at the basis of evolution, many biologists argue that *at the very least* biology itself does not reveal any fundamental order, purpose, or meaning in nature. For some the randomness of evolutionary change is conclusive evidence that there is no purpose whatsoever in nature. Richard Dawkins once remarked that "although atheism might have been logically tenable before Darwin, Darwin made it possible to be an intellectually fulfilled atheist." (7) On another occasion Dawkins wrote that the universe revealed by evolutionary thought "has precisely the properties we should expect if there is, at bottom, no design, no purpose, no evil and no good, nothing but blind, pitiless indifference."(8) Daniel Dennett writes in no less stark terms: "Love it or hate it, phenomena like this [DNA] exhibit the heart of the power of the Darwinian idea. An impersonal, unreflective, robotic, mindless little scrap of molecular machinery is the ultimate basis of all agency, and hence meaning, and hence consciousness, in the universe." (9) Sir Francis Crick, co-discoverer of the double-helix structure of the DNA molecule, writes at the beginning of *The Astonishing Hypothesis* (1994): "The Astonishing Hypothesis is that 'You,' your joys and your sorrows, your memories and your ambitions, your sense of personal identity and your free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules."

Despite some oversimplifications in this brief summary, it ought to be clear that the contemporary natural sciences, and in particular biology, present challenges to traditional theological and philosophical notions of nature, human nature, and God. (10) Too often, however, these perceived challenges are the result of fundamental confusions. As we shall see, those scientists like Dawkins and Dennett fail to distinguish between the order of biological explanation and the order of philosophical explanation. They do not recognize that creation is first of all a category of metaphysical reflection and that, furthermore, the materialism which they embrace is a position in natural philosophy not required by the evidence of biology itself. Similarly, many of the critics of the general conclusions of evolutionary biology, as we shall see, also confuse the order of biological explanation and the order of philosophical explanation. Defenders of "special creation" and of "irreducible complexities" in nature think that divine agency will show up in such gaps of nature. But "gaps" of nature are the provenance of the specialized empirical sciences. Divine agency, rather, ought to be seen in the fundamental teleology of all natural things, in the need for a First Mover, and in the complete dependence of all things on God as the source of their existence. It is natural philosophy, a more general science of nature than the specialized empirical sciences which examines the first two topics, and it is metaphysics which proves that all that is comes from God as cause.

I think that we can find important parallels between the reactions to Aristotelian science in mediaeval Islam, Judaism, and Christianity and the reactions to Darwinian and Neo-Darwinian theories of evolution in the modern and contemporary world. By re-visiting the mediaeval discussion of creation and the natural sciences, especially as found in the thought of Thomas Aquinas, we may be able to resolve a good deal of confusion concerning the relationship between creation and evolution. Obviously, the contemporary natural sciences are in crucial ways quite different from their Aristotelian predecessors. Aquinas and others in the Middle Ages would have found strange indeed Darwinian arguments of common descent by natural selection. Nevertheless, I think that the understanding of creation forged by Aquinas and the *principles* he advanced for distinguishing between creation and the natural sciences remain true.

To understand how the thought of Aquinas is important for contemporary discourse on creation and evolution we need to return, however briefly, to the intellectual world of the Latin Middle Ages. Throughout the thirteenth century, brilliant scholars such as Albert the Great and Thomas Aquinas wrestled with the implications for Christian theology of the most advanced science of their day, namely, the works of Aristotle and his Muslim commentators, which had recently been translated into Latin. Following in the tradition of Avicenna, Averroes, and Maimonides, Aquinas developed an analysis of creation that remains, I think, one of the enduring accomplishments of Western culture. In emphasizing the contribution of Aquinas, I do not want, however, to deny the sophisticated analyses of his Muslim and Jewish predecessors, analyses which Aquinas often cited. (11)

Thomas Aquinas' Understanding of Creation

It seemed to many of Aquinas' contemporaries that there was a fundamental incompatibility between the claim of ancient science that something cannot come from nothing and the affirmation of Christian faith that God produced everything from nothing. Furthermore, for the Greeks, since something must always come from something, there must always be something; the universe must be eternal.

The scientific works of Aristotle and several of his mediaeval commentators provided an arsenal of arguments which appear, at least, to be contrary to the truths of Christianity. In particular, how is one to reconcile the claim, found throughout Aristotle, that the world is eternal with the Christian affirmation of creation, a creation understood as meaning that the world is temporally finite, that is, has a temporal beginning of its existence? In 1215 the Fourth Lateran Council had solemnly proclaimed that God created all that is from nothing [*de nihil condidit*] and that this creation occurred *ab initio temporis*. In 1277 the Bishop of Paris, Étienne Tempier, issued a list of propositions condemned as heretical, among them the claim that the world is eternal. As chancellor of the University of Paris, the bishop was well aware of the debates about creation and the eternity of the world which raged through the thirteenth century. (12) The controversy was part of the wider encounter between the heritage of classical antiquity and the doctrines of Christianity: an encounter between those claims to truth founded on reason and those founded on faith. If faith affirms that the world has a temporal beginning, can reason demonstrate this must be true? What can reason demonstrate about the fact of creation itself, as distinct from the question of a temporal beginning? Indeed, can one speak of creation as distinct from a temporally finite universe? These are some of the questions which thirteenth century Christian thinkers confronted as they wrestled with the heritage of Greek science. These questions are distant adumbrations of discourse in our own day about the meaning of creation in the context of the insights of evolutionary biology.

A master principle which informs Aquinas' analysis of creation is that the truths of science cannot contradict the truths of faith. God is the author of all truth and whatever reason discovers to be true about reality ought not to be challenged by an appeal to sacred texts.

On the specific questions of creation out of nothing and the eternity of the world, the key to Aquinas' analysis is the distinction he draws between creation and change. The natural sciences, whether Aristotelian 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. The ancient Greeks are right: from nothing, nothing comes; that is, if the verb "to come" means to change. All change requires an underlying material reality.

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 build a house or paint a picture involves working with existing materials and either action is radically different from creation. To create is to cause existence, and all things are totally dependent upon a Creator for the very fact that they are. The Creator does not take nothing and make something out of nothing. Rather, any thing left entirely to itself, wholly separated from the cause of its existence, would be absolutely nothing. Creation is not some distant event; it is the complete causing of the existence of everything that is. Creation, thus, as Aquinas shows, is a subject for metaphysics and theology; it is not a subject for the natural sciences. Although Scripture reveals that God is Creator, for Aquinas, the fundamental understanding of creation is accessible to reason alone, in the discipline of metaphysics; it does not necessarily require faith. Aquinas thought that by starting from the recognition of the distinction between what things are, their essences, and that they are, their existence, one could reason conclusively to an absolutely first cause which causes the existence of everything that is. (13) Aquinas shows that there are two related senses of creation, one philosophical, the other theological. The philosophical sense discloses the metaphysical dependence of everything on God as cause. The theological sense of creation, although much richer, nevertheless incorporates all that philosophy teaches and adds as well that the universe is temporally finite.

Aquinas saw no contradiction in the notion of an eternal created universe. He thought that it was a matter of biblical revelation that the world is not eternal. He also thought that reason alone could not conclude whether the world had a temporal beginning. But even if the universe were not to have had a temporal beginning, it still would depend upon God for its very being, its existence. The root sense of creation does not concern temporal origination; rather it affirms metaphysical dependence.(14) For Aquinas, there is no conflict between the doctrine of creation and any physical theory. Theories in the natural sciences account for change. Whether the changes described are cosmological or biological, unending or finite, they remain processes. Creation accounts for the existence of things, not for changes in things. An evolving universe, just like Aristotle's eternal universe, is still a created universe. No explanation of evolutionary change, no matter how radically random or contingent it claims to be, challenges the metaphysical account of creation, that is, of the dependence of the existence of all things upon God as cause. When some thinkers deny creation on the basis of theories of evolution, or reject evolution in defense of creation, they misunderstand creation or evolution, or both.

Divine Agency and the Autonomy of Nature

For some in the Middle Ages any appeal to the autonomy of nature, that is, any appeal to the discovery of real causes in the natural order, seemed to challenge divine omnipotence. One reaction, made famous by some Muslim thinkers, known as the *kalam* theologians, was to protect God's power and sovereignty by denying that there are real causes in nature. Thus, they would say that when fire is burning a piece of paper it is really God who is the true agent of the burning; the fire is but an instrument. Accordingly, events that occur in the natural world are only occasions in which God acts.(15)

There is another dimension to this argument about God's power and the existence of causes in nature. Averroes, for example, rejected the doctrine of creation out of nothing, because he thought that to affirm the kind of divine omnipotence which produces things out of nothing is to deny a regularity and predictability to the natural world. Thus, for Averroes, to defend the intelligibility of nature one must deny the doctrine of creation out of nothing.(16) Averroes' position seemed to Muslim theologians to be a direct threat to orthodox belief in God: for Averroes denies God's omnipotence in the name of the sciences of nature. This debate between *kalam* theologians and Averroes (17) anticipates, as we shall see, discussions in our own day about evolutionary biology and divine action in the world.

Contrary to the positions both of the *kalam* theologians and of their opponent, Averroes, Aquinas argues that a doctrine of creation out of nothing, which affirms the radical dependence of all being upon God as its cause, is fully compatible with the discovery of causes in nature. God's omnipotence does not challenge the possibility of real causality for creatures, including that particular causality, free will, which is characteristic of human beings. Aquinas would reject any notion of divine withdrawal from the world so as to leave room, so to speak, for the actions of creatures. Aquinas does not think that God "allows" or "permits" creatures to behave the way they do.(18) Similarly, Aquinas would reject a process theology which denies God's immutability and His omnipotence (as well as His knowledge of the future) so that God would be said to be evolving or changing with the universe and everything in it.(19) For Aquinas such views fail to do justice either to God or to creation. 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 freedom and the integrity of nature, in general, are guaranteed by God's creative causality. On the other hand, the occasionalism of *kalam* theologians (e.g., al-Ghazali) protected the God of revelation from being marginalized from nature and history, but at too high a price, the denial of real causes in nature. If we follow Aquinas' lead, 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 explanatory domain of evolutionary biology.(20)

Aquinas shows us how to distinguish between the being or existence of creatures and the operations they perform. God causes creatures to exist in such a way that they are the real causes of their own operations. For Aquinas, 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 important to recognize that divine causality and creaturely causality function at fundamentally different levels. In the

Summa contra Gentiles, Aquinas remarks that "the same effect is not attributed to a natural cause and to divine power in such a way that it is partly done by God, and partly by the natural agent; rather, it is wholly done by both, according to a different way, just as the same effect is wholly attributed to the instrument and also wholly to the principal agent."(21) It is not the case of partial or co-causes with each contributing a separate element to produce the effect. God, as Creator, transcends (22) the order of created causes in such a way that He is their enabling origin. Yet the "same God who transcends the created order is also intimately and immanently present within that order as upholding all causes in their causing, including the human will." For Aquinas "the differing metaphysical levels of primary and secondary causation require us to say that any created effect comes totally and immediately from God as the transcendent primary cause and totally and immediately from the creature as secondary cause."(23)

Creation and Genesis

Some defenders as well as critics of evolution, as we shall see later, think that belief in the Genesis account of creation is incompatible with evolutionary biology. Aquinas, however, did not think that the Book of Genesis presented any difficulties for the natural sciences, for the Bible is not a textbook in the sciences. What is essential to Christian faith, according to Aquinas is the "fact of creation," not the manner or mode of the formation of the world. In commenting on different views concerning whether all things were created simultaneously and as distinct species, Aquinas remarks: "There are some things that are by their very nature the substance of faith, as to say of God that He is three and one. . . about which it is forbidden to think otherwise. . . . There are other things that relate to the faith only incidentally. . . and, with respect to these, Christian authors have different opinions, interpreting the Sacred Scripture in various ways. Thus with respect to the origin of the world, there is one point that is of the substance of faith, *viz.* , to know that it began by creation. . . . But the manner and the order according to which creation took place concerns the faith only incidentally." Aquinas notes that although the interpretation regarding successive creation, or what we might call "episodic creation," is "more common, and seems superficially to be more in accord with the letter," still that of simultaneous creation is "more conformed to reason and better adapted to preserve Sacred Scripture from the mockery of infidels."(24)

Aquinas' firm adherence to the truth of Scripture without falling into the trap of literalistic readings of the text offers valuable correction for exegesis of the Bible which concludes that one must choose between the literal interpretation of the Bible and modern science. For Aquinas, the literal meaning of the Bible is what God, its ultimate author, intends the words to mean. The literal sense of the text includes metaphors, similes, and other figures of speech useful to accommodate the truth of the Bible to the understanding of its readers. For example, when one reads in the Bible that God stretches out His hand, one ought not to think that God has a hand. The literal meaning of such passages concerns God's power, not His anatomy. Nor ought one to think that the six days at the beginning of Genesis literally refer to God's acting in time, for God's creative act is instantaneous and eternal.(25)

Aquinas, following the lead of Augustine, thinks that the natural sciences serve as a kind of veto in biblical interpretation. Augustine observed that when discussing passages of the Bible that refer, or seem to refer, to natural phenomena one should defer to the authority of the sciences, when available, to show what the text cannot mean. In examining, for example whether the light spoken of in the opening of Genesis (before the creation of the Sun and the Moon) is physical light, Augustine says that if physicists show us that there cannot be physical light without a luminous source then we know that this particular passage does not refer to physical light. (26) The Bible cannot authentically be understood as affirming as true what the natural sciences teach us is false.

Creation and Evolution in the Contemporary World

If we look at the way in which the relationship between creation and evolution is presented today we often see creation identified with the view that the great diversity of living things is the result of specific divine interventions; that God, for example, produced in a direct way, without intermediaries, the different kinds of minerals, plants, and animals that exist. If this were true, then the record of the past, regardless of its age, would reveal fundamental discontinuities: discontinuities which could only be accounted for by an appeal

to direct divine action *in* the world. Arguments in support of this view are advanced on the basis of evidence adduced from both Scripture and science. (27)

To insist that creation *must* mean that God has periodically produced new and distinct forms of life is to confuse the fact of creation with what Aquinas would call the manner or mode of formation of beings in the world. Such an insistence has its source in a literalistic reading of Genesis, which Aquinas would reject. Proponents of "episodic creation" also appeal to a variety of arguments based on science to support their claims. Thus, we have the argument that evolutionary continuity is scientifically impossible because, for example, the fossil record fails to support Darwin's idea of the gradual development of new forms of life and that, accordingly, we must recognize the sudden appearance of new kinds of life. Another claim is that the only kind of genetic transformation that can be demonstrated produces variation within kinds — what is called microevolution — but not macroevolution, that is, from one kind to another. There are also appeals to the second law of thermodynamics to argue that it is not possible for more complex forms of life to develop from less complex forms, since the principle of entropy would be violated. (28) One of the more sophisticated defenses of what has been called "special creation" can be found in the work of Alvin Plantinga, (29) who thinks that to argue that God created man, as well as the many kinds of plants and animals, separately and by special acts, is more probable than the thesis of common ancestry. Plantinga takes the famous example of the development of the mammalian eye, points to the extraordinary complexity of it and of the whole visual system, and concludes: "That it [the evolution of the eye in Darwinian terms] is *possible* is clear; that it *happened* is doubtful; that it is *certain*, however, is ridiculous." (30) Plantinga's real opponents are people such as Dawkins and Dennett who argue that the grand evolutionary synthesis necessarily implies a commitment to a naturalism which excludes God.(31) For Plantinga, creation, understood in the Christian sense, must mean special or episodic creation.

Perhaps the best known of the scientific arguments against the master narrative of evolution is the work of the biochemist, Michael Behe, who argues that there are specific life forms (e.g., the cell) and biotic subsystems which are, in his terms, "irreducibily complex," and which could not possibly be brought about by means of natural selection.(32) Irreducibly complex systems and life forms disclose "intelligent design" and lead us, ineluctably, to the existence of a designer.

The theological arguments based on Behe's work are similar to arguments for creation based on Big Bang cosmology. Traditionally, the Big Bang has been seen as a singularity at which the laws of physics break down. Physics cannot explain the primal Big Bang; thus we seem to have strong evidence, if not actual proof, for a Creator.(33) Philosophers such as William Lane Craig have argued that contemporary Big Bang cosmology confirms the doctrine of creation out-of-nothing since it shows that the universe is temporally finite.(34) It does not seem, however, that the singularity affirmed in modern cosmology encompasses the *absolute* beginning of the universe. As we have seen, Aquinas does not think that the sciences themselves can conclude whether or not the universe is temporally finite. Obviously, as Aquinas was aware, if we were to know that there is an absolute beginning to the universe we would know that the universe is created out of nothing and that God exists.(35) Of course, what some cosmologists have termed an inexplicable singularity, recent theorists have sought to make explicable. Alexander Vilenkin has developed an explanation of the Big Bang itself in terms of "quantum tunneling from nothing." Stephen Hawking argues that an understanding of quantum gravity will enable us to do away with the notion of a singularity altogether, and he concludes that without an initial singularity there is nothing for a Creator to do. Hawking identifies creation with a temporal beginning of the universe. Thus, he thinks that by denying such a beginning he denies creation. But Big Bang cosmology, even with recent variations, neither supports nor detracts from the doctrine of creation, since cosmology studies change and creation is not a change. The Big Bang is not a primal event before which there is absolutely nothing.(36)

Behe's "irreducible complexities" are biological "singularities." In the hands of defenders, the existence of such "singularities" is strong, if not conclusive, evidence for an agent outside the regular course of nature. Most biologists respond to Behe's claims of irreducible complexity by distinguishing between our not being able *to explain* the origin of complex structures like the cell in terms of evolutionary biology and Behe's conclusion that *in principle* no such explanation is possible and that, therefore, we must admit the role of an intelligent designer. They might very well accept the former — the epistemological claim — but they

would reject the latter — the ontological claim. As several commentators have observed, those, who argue for "irreducible complexity" and then move to claims about intelligent design, represent a contemporary version of what has been called the "god of the gaps." This is the view that the natural order *itself* and the changes in it require an appeal to a divine agent operating within the world as a *supplement* to other agents and causes in the world. Seventeenth century "physico-theologians" such as Robert Boyle were exponents of this type of argument from design. In the same tradition, early in the eighteenth century, William Whewell, defender of the geological theory of catastrophism, argued that a uniformitarian explanation of change in terms of natural causes could not explain the diversity of species in the world. "We see in the transition from an earth peopled by one set of animals to the same earth swarming with entirely new forms of organic life," he wrote, "a distinct manifestation of creative power, *transcending the known laws of nature*: and, it appears to us, that geology [i.e., catastrophism] has thus lighted a new lamp along the path of natural theology."(37) In an important sense, if we have belief in God depend on the existence of "gaps in the explanatory chain . . . [we ultimately] pit religion *against* science. . . . It is also to make evolution and creation seem like exclusive concepts. Creation [in such a view] is portrayed as a series of interventions in natural process, and evolutionary natural process is held to be in principle insufficient to bring about major features of the world. A theory of evolution thus necessarily appears as a threat to the foundations of religious belief."(38)

It seems to me that if we recognize that there are sciences of nature, then such gaps can only be epistemological difficulties to be overcome. If nature is intelligible in terms of causes discoverable in it, we cannot think that changes in nature require special divine agency. The "god" in the "god of the gaps" is more powerful than any other agent in nature, but such a god is not the God of orthodox Christianity, Islam, and Judaism. Such a god can easily become a disappearing god as gaps in our scientific knowledge close.(39)

The "god of the gaps" or the intelligent designer of Behe's analysis is not the Creator; at least this god is not the Creator described by Aquinas. Nor is the argument from design to the existence of a Designer really the same as Aquinas' argument for the existence of God from order and purpose in nature. According to Aquinas, natural things disclose an *intrinsic* intelligibility and directedness in their behavior, which require that God be the source. Finality and purpose, keys to an argument for the existence of God, have their foundation in nature as a principle in things. Eight hundred years before Aquinas, Augustine makes a crucial distinction between God's causal activity and what in our own day has come to be called "intelligent design." "It is one thing to build and to govern creatures from *within* and from the summit of the whole causal nexus — and only God, the Creator, does this; it is another thing to apply *externally* forces and capacities bestowed by Him in order to bring forth at such and such a time, or in such and such a shape, what has been created. For all things were created at the beginning, being primordially woven into the texture of the world; but they await the proper opportunity for their existence."(40)

An important fear that informs the concerns of many believers is that theories of evolution, cosmic and biological, "transfer the agency of creative action from God" to the material world itself, and that this transferral is a rejection of the religious doctrine of creation.(41) The theological concern is that to recognize the complete competence of the natural sciences to explain the changes that occur in the world, without any appeal to specific interventions by God, "is essentially equivalent to . . . [denying] divine action of any sort in this world."(42) We have already seen how Aquinas responded to very similar fears in the Middle Ages. Aristotelian science seemed to threaten the sovereignty and omnipotence of God. But remember that Aquinas recognized that a world in which the natural processes are explicable in their own terms does not challenge the role of the Creator. One need not choose between a natural world understandable in terms of causes within it and an omnipotent Creator constantly causing this world to be. Aquinas thinks that a world of necessary connections between causes and effects, connections which he thinks are the hallmarks of its intelligibility, does not mean that the world is not dependent upon God.(43) Necessity in nature is not a rival to the fundamentally different kind of necessity attributed to God.(44)

Those like Richard Dawkins and Daniel Dennett, who argue for a denial of creation on the basis of evolutionary biology, see the incompatibility between evolution and divine action in fundamentally the same way as theistic opponents of evolution.(45) They fail to distinguish between the claims of the

empirical sciences and conclusions in natural philosophy and metaphysics. That is, they assume that the natural sciences *require* a materialist understanding of all of reality.(46) Furthermore, they mistakenly conclude that arguments for creation are essentially arguments from design in nature, and, thus, the creation which Dawkins and Dennett deny is really not the fundamental notion of creation set forth by thinkers such as Thomas Aquinas. We can see some of these misunderstandings in the following quotation from the Harvard geneticist, Richard Lewontin:

When science speaks to members of the general public the problem is to get them to reject irrational and supernatural explanations of the world, the demons that exist only in their imaginations, and to accept a social intellectual apparatus, *Science*, as the only begetter of truth. . . . We take the side of science in spite of the patent absurdity of some of its constructs, in spite of its failure to fulfill many of its extravagant promises of health and life, in spite of the tolerance of the scientific community for unsubstantiated just-so stories, because we have a prior commitment, a commitment to materialism. It is not that the methods and institutions of science somehow compel us to accept a material explanation of the phenomenal world, but, on the contrary, that we are forced by our *a priori* adherence to material causes to create an apparatus of investigation and a set of concepts that produce material explanations, no matter how counter-intuitive, no matter how mystifying to the uninitiated. Moreover, that materialism is absolute, for we cannot allow a Divine Foot in the door.(47)

The reference to science as "the only begetter of truth" follows logically from the philosophical commitment to materialism. Even Francisco Ayala, a distinguished biologist familiar with theological arguments, writes the following:

[I]t was Darwin's greatest achievement to show that the directive organization of living beings can be explained as the result of a natural process, natural selection, without any need to resort to a creator or other external agent. . . . Darwin's theory encountered opposition in religious circles, not so much because he proposed the evolutionary origin of living things (which had been proposed many times before, even by Christian theologians), but because his mechanism, natural selection, excluded God as accounting for the obvious design of organisms. . . . This is the conceptual revolution that Darwin completed — that everything in nature, including the origin of living organisms, can be explained by material processes governed by natural laws. This is nothing if not a fundamental vision that has forever changed how mankind perceives itself and its place in the universe.(48)

To refer to "a creator or *other* external agent" or to be concerned about not letting "a Divine Foot in the door" mistakenly locates creation on the same metaphysical level as agency in this world, and makes divine causality a competitor with other forms of causality. In such a scenario, the more we attribute causality to nature, the more we must reduce the causality attributed to God — or vice versa. As I have argued, Aquinas helps us to see the error in this kind of opposition.

Human Nature and the Creation of the Soul: A Preliminary Approach

Can "everything in nature," as Ayala says, "be explained in terms of material processes?" Surely not everything *about* nature can be explained in terms of material processes. As we have seen, that everything is created — that is, completely dependent upon God as cause of existence — is a truth *about* nature which cannot be explained by material causality. Aquinas would say that the natural sciences are fully competent to account for the changes that occur in the natural world, but this does not mean that "everything *in* nature" can be explained in terms of material causes. Before we can judge whether all things in nature can be explained by material causes we must know what the things in nature are which need to be explained. To know what the natural world is like we need both the empirical sciences *and* a philosophy of nature.

Throughout this essay I have sought to make a clear distinction between creation and change: to argue, that is, that creation is a concept in metaphysics and theology, not in the natural sciences. But I would argue, in addition, that the natural sciences alone, without, that is, a philosophy of nature, cannot provide an adequate account of the natural order itself. Furthermore, an exclusively material explanation of nature, that is, an

explanation which relies *only* on the discovery of constituent parts, does not describe nature as it really is. A thorough refutation of materialism is not within the scope of this essay; it would involve a recognition that any whole, whether it be a chemical compound or a living organism, is more than the sum of its material parts. The whole exists and behaves in ways different from the existence and behavior of its constituent parts. Water, for example, exhibits properties not found in either oxygen or hydrogen. We cannot account for the "more" of the whole in terms of the sum of the material parts. At the very least, we should recognize, as Richard Lewontin did in the passage quoted above, that to claim that *only* materialist explanations of reality are acceptable is a philosophical assumption not required by the "methods and institutions of science."

When Aquinas remarks that the sciences of nature are fully competent to account for the world of physical reality he includes in the category of "sciences of nature" what we would call philosophy of nature. This is a more general science of nature than is proper to any one of the empirical sciences. Thus, a philosophy of nature, as distinct from the metaphysical study of creation, discusses questions such as what is change; what is time; whether bodies are composed of matter and form; is a materialist account of nature, or a dualist, or some other account true? The debate about randomness and chance in biological processes and whether there is purpose or finality discoverable in nature are also topics to be examined in natural philosophy.(49)

A good example of the kind of analysis needed, which brings a sophisticated philosophical reflection to the discoveries of the empirical sciences, is William Stoeger's discussion of chance and purpose in biology. Stoeger points out that the natural sciences discover an order and directedness *inherent* in physical reality: "in the laws, regularities, and evolving conditions as they function together to constitute the processes and relationships which emerge at each stage of cosmic history." These laws and conditions are more than a pattern of regularities that we observe; "that pattern must have some sufficient cause in nature itself." Although "chance events are frequent and important in biological evolution, rendering its actual course indeterminate or unpredictable in exact outcome from any particular stage, these events and their short- and long-term effects — whether they be of point mutations at the level of molecular DNA, or the impact of a meteorite — are always within a context of regularities, constraints, and possibilities." Thus, to refer to such events as "pure chance" or "to assert blithely that evolution proceeds by purely chance events is much less than a precise description of this source of unpredictability in biological evolution." To speak of regularities in nature, or of there being laws of nature, means that there are processes oriented towards certain general ends. "If there were no end-directed or end-seeking behavior in physical reality, there would be no regularities, functions, or structures about which we could formulate laws of nature." Furthermore, even though the contemporary natural sciences often seek to discover efficient causes without reference to purposes (final causes), "any ordering of efficient causes and their effects implicitly acknowledges and presupposes that the efficient causes and the processes which embody them are directed towards the realization of certain specific types of ends. Efficient causes always have certain specifiable *effects*. "(50)

It ought to be clear that to recognize, as Aquinas does, that reason alone is sufficient to describe the various processes that occur *in* nature does not mean that current theories of evolution do in fact provide a fully adequate scientific account of the origin and development of life. If we were to seek a complete analysis of biology in light of Thomistic natural philosophy there would be many questions which would have to be raised: not the least of which would be the arguments Aquinas advances for the existence of the human soul and the fundamental ontological distinction between human beings and the rest of nature.(51) Aquinas thinks that the human soul, given that its proper function is not that of any bodily organ, must be both immaterial and therefore specially created by God. Such an application of his doctrine of creation to the human soul depends on his arguments about the existence and nature of the soul, arguments which he advances in natural philosophy. Any understanding of the human person as the composite of body and soul which is consistent with evolutionary biology requires an understanding of the doctrine of creation and the compatibility of divine agency and natural causes. Hence the importance of the analysis of creation I have been offering for the particular discussion of human nature and contemporary biology. It is not my purpose here to examine Aquinas' conception of human nature and, in particular, how he defends the view that man is composed of body and soul. Let me just note, however, that Aquinas is not a dualist; he does not think that the body is one entity and the soul another. A human being is one thing, understood in terms of the

unity of two principles, one material, the other spiritual. Aquinas' analysis of the human soul is an integral part of his explanation of living things, which is itself part of his even broader understanding of the distinction between form and matter, the co-principles of all physical reality.(52)

A rejection of Aquinas' specific claims about the human soul would not in any way challenge the truth of his analysis of creation. Nor does Aquinas' analysis of creation and its compatibility with contemporary evolutionary thought require us to accept or reject any evolutionary theory. Analyses of evolutionary theory occur in the disciplines of biology and natural philosophy. It is important to remember the point I made at the beginning of this essay, that we must recognize the appropriate competence of each of the various disciplines which investigate the nature and origins of life. Throughout I have sought to show the value of Aquinas' thought for distinguishing creation from evolution. Whatever exists is caused to be by God; this is a conclusion in metaphysics; whether human souls are among the things that exist is a question to be answered in natural philosophy; whether living things have evolved by natural selection is the subject of evolutionary biology.

Conclusion

We should remember, however, that evolutionary biology's commitment to common descent by natural selection is essentially an explanation of origin and development; it is a historical account. Several years ago Carl Friedrich von Weizsäcker wrote: "For philosophers, the most important discovery of modern science has been the history of Nature."(53) However much we recognize the value of this insight, we need to guard against the genetic fallacy: that is, making judgments about what things are exclusively on the basis of how things have come to be. There is also the danger of historicism — an embrace of flux and change as the *only* constants — which denies essences, natures (and species), and according to which the *only* explanatory principle is historical development. However necessary evolutionary biology is for understanding nature, it is not a substitute for the complete study of *what* things are and *how* they behave. These are questions which engage not only the empirical sciences but also the philosophy of nature. What things are and how they function involve discussions in terms of matter and form, potentiality and actuality, substance and accident, the nature of change, etc. It would be wrong to say that there is nothing in the natural order which cannot be accounted for by causes which the empirical sciences discover since the human soul exists in the natural order. The discovery of the existence of the human soul takes place in the realm of the philosophy of nature, not in that of the empirical sciences.(54) Thus we must recognize that any evolutionary theory remains an incomplete scientific account of living things. At the very least the question of the completeness or incompleteness of evolutionary theories as accounts of living things is a philosophical question, not resolvable by the empirical sciences themselves.

Although we do not have to appeal to divine action *in* the natural world to account for what the empirical sciences discover, it does not follow that a materialist account of reality is true. As we have seen, materialism is a philosophical position; it is not a conclusion of the empirical sciences. We must not confuse the order of explanation in the empirical sciences with the orders of explanation in natural philosophy and in metaphysics.

Thomas Aquinas as biblical exegete, metaphysician, and philosopher of nature offers us a rich array of insights for contemporary discourse on the relationship among sacred texts, the natural sciences, and philosophy. He can help us to avoid the whirlpool of a reductionist materialism as well as the stumbling block of biblical literalism. His principles continue to serve as an anchor of intelligibility in a sea of confusing claims. Rather than excluding Darwin from the curriculum, the schools should add Aquinas.

ENDNOTES

1. *Distinguer pour unir, ou Les degrés du savoir* (Paris: de Brouwer, 1932).

2. *Darwin's Dangerous Idea: Evolution and the Meanings of Life* (New York: Simon & Schuster, 1995).

3. Gavin de Beer, "Evolution,"*The New Encyclopedia Brittanica,* 15th edition (1973-74).

4. David Baltimore, writing in *The New York Times,* 25 June 2000, p. 17. Baltimore thinks that the discoveries of the human genome project "should be, but won't be, the end of creationism." Ernan McMullin, commenting on the contributions of molecular biology to the thesis of common ancestry, writes that a comparison of the DNA, as well as of the proteins which DNA encodes, among different types of organisms "shows that there are striking similarities in chemical composition among them. These similarities are just the kind that one would expect from the hypothesis of common ancestry. . . ." The molecular-level differences among species give an indication of the relative order of branching among the species. "What is impressive here is the *coherence*of the results given by examining many different macromolecules in this light. Without common descent, this intricate network of resemblances would make no sense." McMullin does not think that evidence from molecular biology in some sense proves that there is a common ancestry; he claims that there is a remarkable "consilience" between this evidence and the hypothesis of common ancestry. "Evolution and Special Creation," *Zygon* 28:3 (September 1993), pp. 299-335, at pp. 317 and 319.

5. Jon Seger, an evolutionary biologist and geneticist, observed that the human genome project is "evolution laid out for all to see. There's nothing peculiar or distinctive about us." According to Nicholas Wade, editor of the special science section of *The New York Times* dedicated to the announcement of the successes of the human genome project, "[t]he conditions of human existence, the reach of human abilities, the purpose of life — at least in a biological sense — have boundaries that are engraved in the genome's gnomic text." *The New York Times,* 28 June 2000, pp. 21 and D1.

6. For a good recent book on the challenges of evolutionary biology to traditional theology, see John F. Haught, *God After Darwin: A Theology of Evolution* (Boulder, Colorado: Westview Press, 2000). Another good source on this subject is: Mariano Artigas, *Las fronteras del evolucionismo* (Madrid: Ediciones Palabra, 1991).

7. *The Blind Watchmaker* (New York: W.W. Norton,1986), p. 6.

8. *River Out of Eden* (New York: Harper Collins, 1995), pp. 132-3.

9. *Darwin's Dangerous Idea: Evolution and the Meanings of Life* (New York: Simon & Schuster, 1995), p. 203.

10. A distinguished evolutionary biologist, Ernst Mayr, in summarizing recently the importance of Darwin's influence on modern thought, sees a fundamental incompatibility between Darwinian biology and traditional theology and philosophy: "Darwinism rejects all supernatural phenomena and causation. The theory of evolution by natural selection explains the adaptedness and diversity of the world solely materialistically. . . . Darwinism refutes typology [essentialism]. . . . Darwin's theory of natural selection made any invocation of teleology unnecessary. . . . Of all of Darwin's proposals, the one his contemporaries found most difficult to accept was the theory of common descent applied to Man. For theologians and philosophers alike, Man was a creature above and apart from other living beings." Ernst Mayr, "Darwin's Influence on Modern Thought," *Scientific American* (July 2000), pp. 79-83, at pp. 81-2. See, also, Mayr, One Long Argument: *Charles Darwin and the Genesis of Modern Evolutionary Thought* (Cambridge, MA: Harvard University Press, 1993).

11. For an account of Aquinas' indebtedness to his Muslim and Jewish predecessors, see Steven E. Baldner and William E. Carroll, *Aquinas on Creation* (Toronto: Pontifical Institute of Mediaeval Studies Press, 1997), pp. 12-34.

12. See Luca Bianchi, *L'errore di Aristotele: La polemica contro l'eternità del mondo nel XIII secolo* (Firenze: La Nuova Italia Editrice, 1984); Il Vescovo e i Filosofi: *La condanna parigiana del 1277 e l'evoluzione dell'aristotelismo scolastico* (Bergamo: Pierluigi Lubrina Editrice, 1990); and *Censure et liberté intellectuelle à l'université de Paris* (XIIIe - XIVe siècles), (Paris: Les Belles Lettres, 1999).

13. An account of Aquinas' first magisterial discussion of creation can be found in Baldner and Carroll, *Aquinas on Creation*.

14. The complete dependence of the creature on the Creator means that there is a kind of priority of non-being to being in any creature, but this priority is not fundamentally temporal. It is, as Aquinas said, a priority according to nature, not according to time. Both Albert the Great and Bonaventure argued, contrary to the view of Aquinas, that to be created necessarily means to have being after non-being. Thus, unlike Aquinas, they inextricably linked creation with temporal origination. See Baldner and Carroll, *Aquinas on Creation*.

15. The best known representative of this position in Islam was al-Ghazali (1058-1111); see *The Incoherence of the Philosophers*, trans. by Michael E. Marmura (Provo, Utah: Brigham Young University Press, 1997). Maimonides (1135-1204), an ardent critique, describes the position of the kalam theologians in this way: "They [the theologians] assert that when a man moves a pen, it is not the man who moves it; for the motion occurring in the pen is an accident created by God in the pen. Similarly the motion of the hand, which we think of as moving the pen, is an accident created by God in the moving hand. Only God has instituted the habit that the motion of the hand is concomitant with the motion of the pen, without the hand exercising in any respect an influence on, or being causative in regard to, the motion of the pen." *The Guide of the Perplexed* I.73; trans. by S. Pines (Chicago: University of Chicago Press, 1963), p. 202.

16. Averroes (1126-1198) thought that if one were to maintain that what exists could come from what does not exist (i.e., creation out-of-nothing), then "anything whatever might proceed from anything whatever, and there would be no congruity between causes and effect. . . ." *Tahfut al-Tahfut* 452, trans. Simon Van den Bergh (Cambridge: E.J. Gibb Memorial Trust, 1987), 1:273.

17. A good account of this debate in mediaeval Islam and Judaism can be found in: Herbert Davidson, *Proofs for Eternity, Creation, and the Existence of God in Medieval Islamic and Jewish Philosophy* (Oxford: Oxford University Press, 1987).

18. Aquinas' view of divine causality raises the specter of the so-called "problem of evil." Aquinas is able to respond successfully to objections that his view of God's causality makes God the source of evil; an exposition of Aquinas' views on this matter are, however, well beyond the scope of this essay.

19. Aquinas' understanding of divine action and its relation to biological change would allow us to avoid various attempts to accommodate the contingency affirmed in some evolutionary theories by re-thinking divine omnipotence, omniscience, and God's a-temporality. Keith Ward, Regius Professor of Divinity at Oxford, is a good example of this latter approach. Ward thinks that the traditional attempt to make God the "efficient cause of all things, without compromising the simplicity and unchangeability which are characteristics of the Aristotelian picture of God" was "an heroic failure," since it "could not account for the contingency of the universe." This is so because "[t]hat which is wholly necessary can only produce that which is necessary. A contingent universe can only be accounted for if one makes free creativity a characteristic of the First Mover, which entails placing change and contingency within the First Mover itself." *Religion and Creation* (Oxford: Clarendon Press, 1996), p. 202. According to Ward, God's omniscience "is the capacity to know everything that becomes actual, whenever it does so. . . . The classical hypothesis [of a God who does not change] does not . . . seem compelling." (italics added, p. 188) In a sense, God must wait to know what is actual since there is an inherent contingency in nature itself, and, as actualities change so does God's knowledge. Ward's arguments are far more

sophisticated than can be adequately set forth in a footnote, but for the claim that the Thomistic view of divine agency and the world of change is a great success, rather than "an heroic failure," see William E. Carroll, "Aquinas and the Metaphysical Foundations of Science," *Sapientia* 54:1 (1999), pp. 69-91.

20. There is a temptation in some circles to examine genetic mutations in the light of the insights of quantum mechanics and to discuss divine action in the context of the ontological indeterminism associated with the quantum world. It was William Pollard, who in 1958, wrote: "The phenomenon of gene mutation is the only one so far known in these sciences which produces gross macroscopic effects but seems to depend directly on changes in individual molecules which are in turn governed by the Heisenberg uncertainty principle." *Chance and Providence: God's Action in a World Governed by Scientific Law* (London: Faber and Faber, 1958), p. 56. Recent reflections on genetic mutation and divine action are part of the wider notion that quantum mechanics shows us that there is a kind of metaphysical space which allows for divine action which does not "interfere" with nature. Thus special divine action can be seen as the "providential determination of otherwise undetermined events. . . . God's action will take the form of realizing one of several potentials in the quantum system, not of manipulating sub-atomic particles as a quasi-physical force." In an excellent essay on this topic, Robert J. Russell adopts "the theological view that God's special action can be considered as objective and non-interventionist if the quantum events underlying genetic mutations are given an indeterminist interpretation philosophically. If it can be shown scientifically that quantum mechanics plays a role in genetic mutations, then by extension it can be claimed theologically that God's action in genetic mutations is a form of objectively special, non-interventionist divine action. Moreover, since genetics plays a key role in biological evolution, we can argue by inference that God's action plays a key role in biological evolution. . . ." Russell, thus, presents a sophisticated form of theistic evolution. Robert J. Russell, "Special Providence and Genetic Mutation: A New Defense of Theistic Evolution," in *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action*, edited by Robert J. Russell, William R. Stoeger, and Francisco J. Ayala, pp. 191-223, at p. 213 and p. 206, italics in original (Vatican City: Vatican Observatory Publications, 1998).

21. *Summa contra Gentiles* III 70.8

22. For a discussion of the sense of divine transcendence as used by Aquinas and how it differs from the modern conception of transcendence (as contrasted with immanence), see Kathryn Tanner, *God and Creation in Christian Theology: Tyranny or Empowerment?* (Oxford: Basil Blackwell, 1988); and William Placher, *The Domestication of Transcendence* (Louisville, KY: Westminster Press, 1996).

23. Brian J. Shanley, O.P., "Divine Causation and Human Freedom in Aquinas," *American Catholic Philosophical Quarterly* 72:1 (1998), pp. 100 and 108. Shanley argues that no real explanation of exactly how God's causality functions is possible, since God transcends the mundane world of causation. Recently, Michael Miller has argued that Bernard Lonergan, following in the tradition of Aquinas, provides a more philosophically satisfying account of divine causation without sacrificing divine transcendence: in "Transcendence and Divine Causality," *American Catholic Philosophical Quarterly* 73:4 (Autumn 1999), pp. 537-554. David Burrell observes that the "terms 'primary' and 'secondary' [causality] come into play when we are faced with the situation where one thing is by virtue of the other. So each can properly be said to be a cause, yet what makes one secondary is the intrinsic dependence on the one which is primary. This stipulation clearly distinguishes a secondary cause from an instrument, which is not a cause in its own right: it is not the hammer which drives the nails but the carpenter using it." Burrell, *Freedom and Causation in Three Traditions* (Notre Dame, IN: University of Notre Dame Press, 1993), p. 97. See also William E. Carroll, "Aquinas and the Metaphysical Foundations of Science," Sapientia 54:1 (1999), pp. 69-91.

24. Thus Aquinas concludes, "this last opinion [Augustine's] has my preference;" yet he adds that he will undertake to defend both positions. In II Sent., dist. 12, q. 3, a. 1.

25. Throughout his commentary on Genesis, Aquinas adheres to the following principle: there is a distinction between primary and secondary material in the Bible. When writing about the codifying of articles of faith in a creedal statement, Aquinas responds to the objection that "all things contained in Holy Scripture are matters faith" and because of their multitude "cannot be reduced to a certain number." "[O]f things to be believed some of them belong to faith, whereas others are purely subsidiary, for, as happens in any branch of knowledge, some matters are its essential interest, while it touches on others only to make the first matters clear. Now because faith is chiefly about the things we hope to see in heaven, 'for faith is the substance of things hoped for,' [Hebrews xi.1] it follows that those things which order us directly to eternal life essentially belong to faith; such as the three Persons of almighty God, the mystery of Christ's incarnation, and other like truths. . . . Some things, however, are proposed in Holy Scripture, not as being the main matters of faith, but to bring them out; for instance, that Abraham had two sons, that a dead man came to life at the touch of Elisha's bones, and other like matters narrated in Scripture to disclose God's majesty or Christ's incarnation." *Summa theologiae* II-II, q. 1, a. 6, ad 1

26. Augustine, *On the Literal Meaning of Genesis* I:38-39

27. For an excellent analysis of this view, see Howard Van Till, "The Creation: Intelligently Designed or Optimally Equipped?' *Theology Today* /55:3 (October 1998), pp.344-364.

28. Van Till, p. 350.

29. Alvin Plantinga, "When Faith and Reason Clash: Evolution and the Bible," *Christian Scholar's Review* 21 (1991), pp. 8-32; "Evolution, Neutrality, and Antecedent Probability: A Reply to McMullin and Van Till," *Christian Scholar's Review* 21 (1991), pp. 80-109.

30. Plantinga, "When Faith and Reason Clash . . ." (italics in the original), p. 26.

31. One well-known critic of evolutionary thought, Philip Johnson, rejects attempts to accommodate evolution and belief in the Creator: "I think that most theistic evolutionists accept as scientific the claim that natural selection performed the creating, but would like to reject the accompanying metaphysical doctrine that the scientific understanding of evolution excludes design and purpose. The problem with this way of dividing things is that the metaphysical statement is no mere embellishment but the essential foundation of the claim." *Darwin on Trial*, 2nd edition (Downers Grove, IL: Intervarsity Press, 1993), p. 168.

32. Michael Behe, Darwin's *Black Box: The Biochemical Challenge to Evolution* (New York: The Free Press, 1996).

33. In the 1950s and 1960s, Soviet cosmologists were prohibited from teaching Big Bang cosmology; it was termed "theistic science."

34. Among William Lane Craig's many works in defense of this position one should examine the book he co-authored with Quentin Smith, *Theism, Atheism, and Big Bang Cosmology* (Oxford: Oxford University Press, 1993). Robert J. Russell claims that, whereas Big Bang cosmology does not confirm creation out of nothing, the notion of t=0 in that cosmology remains relevant for the doctrine of creation. Robert J. Russell, "T=0: Is it Theologically Significant?" in *Religion and Science: History, Method, and Dialogue*, edited by W. Mark Richardson and Wesley J. Wildman, pp. 201-224 (New York: Routledge, 1996).

35. Although Aquinas does not think that one can use reason alone to conclude that the universe is temporally finite and thus know, on this basis, that it is created out of nothing, he does think, as we have seen, that in the discipline of metaphysics one can know that the universe is created. Remember the distinction Aquinas draws between creation understood philosophically, as

dependence in the order of being, and creation known through faith, which does affirm an absolute temporal beginning.

36. The fact that the natural sciences, including cosmology, study change excludes an absolute beginning of the universe from their purview, since such a beginning could not be a change. Any change presupposes some reality which is there to change. For a detailed discussion of the relationship between Big Bang cosmology and creation, see: William E. Carroll, "Thomas Aquinas and Big Bang Cosmology," *Sapientia* 53:1 (1998), pp. 73-95; "Big Bang Cosmology, Quantum Tunneling from Nothing, and Creation," *Laval théologique et philosophique* 44 (1988), pp. 59-75.

37. W. Whewell, "Lyell: Principles of Geology," British Critic 9 (1831), p. 194. Cited in Ernan McMullin, "Introduction: Evolution and Creation," *Evolution and Creation*, edited by Ernan McMullin (Notre Dame, IN: University of Notre Dame Press, 1985), p. 35. Italics added.

38. McMullin, ibid.

39. This, in part, is the theme of Michael J. Buckley in *At the Origins of Modern Atheism* (New Haven, CT: Yale University Press, 1987).

40. De trinitate III.9. Also: "All the normal course of nature is subject to its own natural laws. According to these all living creatures have their determinate inclinations. . . and also the elements of non-living material things have their determinate qualities and forces, in virtue of which they function as they do and develop as they do. . . . From these primordial principles everything that comes about emerges in its own time and in the due course of events." Augustine, De genesi ad litteram IX.17. Howard Van Till has written a great deal on the relationship between patristic discussions of creation and the contemporary debate about evolution and creation, and he argues that Augustine and others recognize a "functional integrity" to nature: that the universe was brought into being in a less than fully formed state, "but gifted with the capacities to transform itself, in conformity with God's will, from unformed matter into a truly marvelous array of physical structures and life forms." Howard Van Till, "Basil, Augustine, and the Doctrine of Creation's Functional Integrity," The Canadian Catholic Review 17:3 (July 1999), p. 35. This article originally appeared in *Science and Christian Belief* 8:1 (April 1996), pp. 21-38.

41. Howard Van Till, "Basil, Augustine, and the Doctrine of Creation's Functional Integrity," *The Canadian Catholic Review* 17:3 (July 1999), p. 24.

42. ibid., p. 28.

43. The Aristotelian idea of scientific knowledge requires the discovery of such a causal nexus. Contemporary theories of science often eschew an appeal to the discovery of such necessary connections in nature. Furthermore, the "intelligibility" of the world is frequently seen exclusively in terms of mathematical formalism rather than in the intrinsic principles found in nature and in the relations among things, where Aquinas would locate it.

44. Aquinas distinguishes between necessary things which have a cause of their necessity and God who is necessary in Himself. See *Summa contra Gentiles* II, 55; *Summa theologiae* I, q. 22, a. 4; Baldner and Carroll, Aquinas on Creation, pp. 28-29; and Carroll, "Aquinas and the Metaphysical Foundations of Science," op. cit. , p. 79, n. 38.

45. We have already seen Alvin Plantinga's argument that creation must mean "special creation," and, in note 31, I quoted Philip Johnson's rejection of theistic evolution because he thought it was an oxymoron.

46. Although many authors writing on the relationship among philosophy, theology, and the natural sciences recognize the philosophical and theological shortcomings (and errors) in analyses like those of Dawkins and Dennett, I think that a Thomistic approach is the best way to have a constructive engagement among these disciplines.

47. Richard Lewontin's review of Carl Sagan's *The Demon-Haunted World: Science as a Candle in the Dark*, in the *New York Review of Books* (January 9, 1997).

48. Francisco J. Ayala, "Darwin's Revolution," in *Creative Evolution?!* edited by John H. Campbell and J. William Schopf (Boston: Jones & Bartlett, 1994), pp.4-5. See his recent "Arguing for Evolution," in *Science Teacher* 67: 2 (February, 2000), pp. 30-32.

49. The debate about contingency in evolutionary processes and the implications of such contingency for notions of purpose, meaning, and finality in nature occurs in the domain of natural philosophy, and is, as I have suggested, quite separate from the topic of creation and evolution. Perhaps the most famous representative of theistic evolution is Pierre Teilhard de Chardin, who claimed that evolutionary change reveals a steady "complexification" as part of "a grand orthogenesis of everything living toward a higher degree of immanent spontaneity." *The Phenomenon of Man* (New York: Harper, 1965), p. 151. He was so convinced of the progressive directionality of evolution that he thought its goal was an Omega Point in which consciousness will be fully realized and would provide an ultimate explanation for the entire course of evolution. With greater circumspection, Christian DeDuve, has argued that the kind of progressive development revealed in the history of evolution follows almost inevitably given the right environment. The universe, as he says, is "pregnant with life." "In this organic cloud, which pervades the universe, life is almost bound to arise, in a molecular form not very different from its form on Earth, wherever physical conditions are similar to those that prevailed on our planet some four billion years ago. This conclusion seems to me inescapable. Those who claim that life is a highly improbable event, possibly unique, have not looked closely enough at the chemical realities underlying the origin of life. Life is either a reproducible, almost commonplace manifestation of matter, given certain conditions, or a miracle. Too many steps are involved to allow for something in between." *Vital Dust* (New York: Basic Books, 1995), p. 292. De Duve, a Nobel laureate in biochemistry, is particularly concerned to refute the views of Stephen J. Gould, who rejects any appeals to "trends" or directionality in the course of evolutionary history. Commenting on the appearance of the human species, Gould writes that if we were to "replay the tape a million times from a Burgess beginning. . . I doubt that anything like Homo sapiens would ever evolve again." Gould describes man as a "tiny twig on an improbable branch of a contingent limb on a fortunate tree." *Wonderful Life* (Cambridge, MA: Harvard University Press, 1989), pp. 289, 291. Ernan McMullin provides an excellent account of the dispute in contemporary biological theory about purpose and randomness in: "Cosmic Purpose and the Contingency of Human Evolution," *Theology Today* 55:3 (October 1998), pp. 389-414. For the same issue in a wider context, see Mariano Artigas, *The Mind of the Universe: Understanding Science and Religion* (Philadelphia: Templeton Foundation Press, 2000) and Ian Barbour, *When Science Meets Religion: Enemies, Strangers, or Partners?* (San Francisco: Harper, 2000).

50. Stoeger also raises the theological question of the relationship between chance events and God's action in the world. He correctly observes that the fundamental issue here is the problem of temporality and divine action, a topic discussed above in this essay. William R. Stoeger, "The Immanent Directionality of the Evolutionary Process, and its Relationship to Teleology," in *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action*, edited by Robert J. Russell, William R. Stoeger, and Francisco Ayala, pp. 163-190, at pp. 169, 172, 179-180, and 187.

51. Recently, Pope John Paul II, after noting that evolution was "more than a hypothesis," referred to the need to reject, as "incompatible with the truth about man," those philosophical interpretations of contemporary biology which see "the mind as emerging from the forces of living matter, or as a mere epiphenomenon of this matter." The Pope asked rhetorically whether the "ontological discontinuity" which separates man from the rest of nature does not "run counter to that physical

continuity which seems to be the main thread of research into evolution in the fields of physics and chemistry." He answered his own question: "The sciences of observation describe and measure the multiple manifestations of life with increasing precision and correlate them with the time line. The moment of transition to the spiritual cannot be the object of this kind of observation, which nevertheless can discover at the experimental level a series of very valuable signs indicating what is specific to the human being. But the experience of metaphysical knowledge, of self-awareness and self-reflection, of moral conscience, freedom, or again, of aesthetic and religious experience, falls within the competence of philosophical analysis and reflection, while theology brings out its ultimate meaning according to the Creator's plan." John Paul II, "Message to the Pontifical Academy of Sciences," (22 October 1996), reprinted in a special edition of *The Quarterly Review of Biology* 72:4 (December 1997), pp. 381-283, at p. 383. This edition of the review also contains commentary on the Pope's message by Michael Ruse, Richard Dawkins, and others.

52. That the rational soul is the informing principle of each human being follows from Aquinas' view that each individual substance, inanimate and animate, must have an informing principle, and that the differences among informing principles are correlative to the differences among existing substances. Soul (anima) is the term used to indicate the form of a living thing, and Aquinas would distinguish among the souls characteristic of plants, those of animals, and those of human beings. We might remember here, a famous remark by Aristotle: "There is no part of an animal which is purely material or purely immaterial." Parts of Animals I. Charles Kahn notes that Aristotle (and by extension, Aquinas) was neither a dualist nor a monist, for Aristotle "treats the issues of thought and perception not within the dual categories of mind and matter but within the fourfold scheme of natural bodies, living things, sentient animals, and rational animals (i.e., humans). . . . [Aristotle's conception of the soul puts him] outside the post-Cartesian tradition . . . and is thus exempt from the Cartesian curse of mind-body opposition with all the baffling paradoxes and philosophical blind alleys that this antithesis gives rise to." Kahn, "Aristotle on Thinking," in *Essays on Aristotle's 'De Anima'* edited by Martha C. Nussbaum and Amélie Oksenber Rorty, (Oxford: Calrendon Press, 1992), p. 359. Aquinas would add to this fourfold list, angels and God. "Both Aristotle and Aquinas understand the human being as occupying a certain level on the ascending scale, as a special kind of animal. An animal is a special kind of physical body. If the level below always constitutes a conditio sine qua non, each level is nevertheless qualitatively irreducible. No bottom-up explanation will work. Soul is not something added to, or which falls inside, or is united to a physical thing. Soul is what makes you the kind of living thing you are, and a human soul makes you a human being. . . . The incorporeality of nous and of intellect means that we, human beings, are of a very special sort, irreducible to physical things or sentient animals, not that we are trapped in a material world. . . [so that we] must look into ourselves for a transcendent voice that can only be heard by turning away from the physical." Roger Pouivet, "Aristotle and Aquinas on Soul," unpublished paper presented at the Institute of Thomistic Studies, Jacques Maritain Center, University of Notre Dame, 14-21 July 2000.

53. Forward to Bernd-Olaf Küppers, *Der Ursprung biologischer Information* (Munich: R. Piper and Co., 1986); Information and the Origin of Life, trans. By Paul Wooley (Cambridge, MA: MIT Press, 1990), p. xi.

54. However much we recognize that the existence of the human soul is a topic in natural philosophy, we need to remember that natural philosophy must always be grounded in the discoveries of the empirical sciences. Contemporary biologists need not concern themselves with what it is that makes the living body just the sort of body that it is. The answer to this question in natural philosophy is the soul. Biologists may very well be content to say that living beings are what they are and do what they do because they have the sort of bodies they have; they may feel no need to ask the further philosophical question of why the living body is just such a body. The philosophical answer to that question is the soul, the substantial form of the living being, and nothing about the biological sciences requires the gratuitous philosophical reductionism which denies or ignores the existence of the soul. If one accepts the reductionism and materialism of authors such as Dawkins and Dennett, there would be no justification in reality for treating living

things differently from non-living things, nor for making distinctions in the treatment of different living things.

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