

## FAITH, PHYSICAL DETERMINISM, AND SCIENTIFIC METHOD

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In recent years, some high-profile debates over Darwinian theories of evolution have proven useful in bringing to light important divisions within the Christian community on certain fundamental questions. Two of the more notable participants in these debates are Christoph Cardinal Schönborn, O.P., Archbishop of Vienna, and Stephen M. Barr, a Catholic physicist and member of The Bartol Research Institute, a research center in the Department of Physics and Astronomy at the University of Delaware. The differences between their respective views are as instructive as they are significant. For instance, they differ in their views concerning the proper explanatory reach of modern science. Cardinal Schönborn holds that modern science is competent to “explore [quantitatively] measurable and mechanical causes,” which fall within the scope of modern science’s “purely quantitative-mechanical methods.”<sup>1</sup> Moreover, he endorses the claim that, as long as one does not exceed the proper methodological limits of modern scientific inquiry, one cannot deal directly with or explain supersensible objects such as mind, purpose, God, and the “natures or essences of things.”<sup>2</sup> Barr, in contrast, denies that modern science “deals only with sensible phenomena rather than with the reality underlying them, or that it studies just the accidental quantitative aspects of things rather than their essences.”<sup>3</sup> He adds: “All such views, whether they stem from nominalism, Humeanism, Kantianism, instrumentalism, or positivism, involve a gross underestimation of the

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<sup>1</sup> Christoph Cardinal Schönborn, “Reasonable Science, Reasonable Faith,” *First Things* (April 2007): 24-25.

<sup>2</sup> *Ibid.*, 23.

<sup>3</sup> Stephen Barr, “Quantifying Quantum,” *First Things* (June/July 2007): 6.

explanatory successes of modern science and the power of human reason.”<sup>4</sup>

These Catholic thinkers differ also as regards their respective conceptions of randomness. In accord with his Christian understanding of divine providence, Cardinal Schönborn appears to endorse what I call the “ignorance interpretation” of randomness—the strictly epistemological claim that an admission of randomness is no more than an admission of the limits of human knowledge of the underlying causes of natural phenomena at both the macroscopic and the submicroscopic levels of reality. The ignorance interpretation is consistent with the thought of Thomas Aquinas, whom Cardinal Schönborn cites often in support of his own stance. Barr, in contrast, appears to endorse a more radical view of randomness, what I call the “acausal interpretation” of randomness—the ontological stance that natural events, at least at the submicroscopic level of reality, cannot be understood within the framework of classical determinism.<sup>5</sup> Arguing in favor of the Copenhagen interpretation of Heisenberg’s principle of uncertainty,<sup>6</sup> he believes it to be “quite congenial to the worldview of

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<sup>4</sup> One should note that Cardinal Schönborn has consistently held that the power of human reason extends far beyond the methodological boundaries of modern science. Indeed, he has criticized scientism or the philosophical view that modern science constitutes the supreme or the only form of genuine human knowledge of reality.

<sup>5</sup> Stephen Barr, “Faith and Quantum Theory,” *First Things* (March 2007): 21-25.

<sup>6</sup> According to one formulation of Heisenberg’s uncertainty principle in quantum theory, it is impossible in principle to measure simultaneously and with perfect accuracy the values of two magnitudes, namely, the position and momentum of a subatomic “wavicle,” inasmuch as the precision of the measurement of the value of one of these magnitudes will be proportionate to the imprecision of the measurement of the other value. According to the Copenhagen (philosophical) interpretation of that principle, which jumps from an epistemological premise to a metaphysical conclusion, perfectly accurate measurements of the values of such magnitudes taken conjointly and simultaneously necessarily elude the grasp of mathematical science, *because*, in the case of a subatomic “wavicle,” it does not possess *simultaneously* an exact position and an exact momentum. Stated differently, and more generally, a perfectly accurate measurement of any past or present state of physical reality is impossible in principle because any past or present

the biblical religions,” partly because it sweeps away the putative error of physical determinism, which he regards as incompatible with an essential preamble of the Christian faith, namely, the doctrine of free will.<sup>7</sup>

Barr’s view of randomness and his opposition to physical determinism fuel his attempts to answer Cardinal Schönborn’s criticism of neo-Darwinian orthodoxy.<sup>8</sup> In opposition to Barr’s stance, I shall attempt to defend the following two propositions: (1) it would be a mistake to hold that, in comparison with physical determinism, the Copenhagen interpretation of Heisenberg’s uncertainty principle is more congenial to the Christian faith, and (2) physical determinism poses no real threat to human freedom properly understood. In my attempt to answer Barr’s criticism of physical determinism in the name of faith (and freedom), I shall also comment on what I deem to be an overreaching conception of the proper compass of modern science.<sup>9</sup>

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state of physical reality is inherently indeterminate. Thus, according to this ontological interpretation, no future state of nature could in principle be foreknown or predicted with strict certitude, but only probabilistically, because the present (or past) state of nature is not determinate *per se*. The dispute surrounds the *ontological* assertion of physical indeterminism and the associated denial of universal causality. As Barr puts it, opponents “regard the Copenhagen interpretation as an abandonment of scientific realism, disbelieve in the kind of wave-particle duality that would have, say, a single particle going through two windows at once, and see the probabilities of quantum theory as reflecting the operation of hidden causes, as they do in classical physics, rather than any true indeterminacy.” Stephen Barr, “Correcting Quantum,” 16. See Stanley Jaki’s valuable essay, “Determinism and Reality,” in *Patterns or Principles and Other Essays* (Bryn Mawr, Pennsylvania: Intercollegiate Studies Institute, 1995), 114-44.

<sup>7</sup> See Barr, “Correcting Quantum,” 25.

<sup>8</sup> See my reply to Barr, “Neo-Darwinism and Catholic Teaching,” *The National Catholic Bioethics Quarterly*, Vol. 6, No. 4 (Winter 2006): 622.

<sup>9</sup> To anticipate, the overreaching conception that I have in mind is inconsistent with the indispensable need of philosophy of nature and metaphysics. As Cardinal Schönborn correctly emphasizes: “If we are going to bring more clarity to the modern debate by employing the means of natural philosophy, several steps are necessary. We must first and foremost recover an understanding of what the modern scientific method is able to explain and

Let us begin by turning to Barr's own understanding of physical determinism. In his view, if the physical universe unfolds in precisely the manner required by classical physics, there would be no place for free will. As he puts it:

[I]f the state of the physical world were completely specified at one instant, its whole future development would be exactly and uniquely determined. Whether a man lifts his arm or nods his head *now* would (in a world governed by classical physical laws) be an inevitable consequence of the state of the world a billion years ago.<sup>10</sup>

With that view in mind, Barr proceeds to argue against classical determinism in favor of the Copenhagen interpretation of Heisenberg's uncertainty principle, which, in Barr's eyes, unlocks nature's door to free will.<sup>11</sup> He notes that the Copenhagen interpretation of Heisenberg's

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what it is intrinsically unable to explain. We must recognize that by its method it cannot deal directly with top-down causation or with the natures or essences of things. It proceeds instead by means of mathematical and mechanical explanations that, in the old expression, 'save the phenomena'... *Scientism*—by which I mean the philosophy (usually implicit and unrecognized) that modern science is the only way of gaining objective knowledge of reality—must be overcome." Christoph Cardinal Schönborn, "Reasonable Science, Reasonable Faith," 23.

<sup>10</sup> Barr, "Faith and Quantum Theory," 23.

<sup>11</sup> "Most of those who suggest that quantum indeterminacy may have something to do with free will are saying something quite different. They do not say that quantum indeterminacy explains free will, but rather that it provides an opening for free will. Free will is conceived of as a faculty arising, at least in part, from something that is non-physical. However, in order for the non-physical to have room to operate, matter—in particular the human brain—must not be completely under the rigid control of physical cause and effect.... The laws of physics... must be flexible enough that more than one outcome is possible in a particular situation: for free will to be possible, the laws of physics must have indeterminacy built into them. The key point is that quantum indeterminacy allows free will, it does not produce it." Stephen Barr, *Modern Physics and Ancient Faith* (Notre Dame, Indiana: University of Notre Dame Press, 2003), 179. The foregoing excerpt from Barr's book is part of a chapter devoted to the question of "Determinism and Free Will," 175-89. Such a discussion falls outside the compass of modern

uncertainty principle “implies that even if one had all the information there is to be had about a physical system, its future behavior cannot be predicted exactly, only probabilistically.”

Acknowledging that not all scientists, including believers and agnostics, share his positive assessment of the Copenhagen interpretation, Barr observes that some contemporary scientists would endorse the less common view that “God does not play dice,” that is to say, they reject the Copenhagen interpretation in favor of classical determinism. One such scientist cited by Barr is Peter Hodgson, a believer who, according to Barr, “insists that Bohmian theory is the only metaphysically sound alternative [to the Copenhagen interpretation].”<sup>12</sup> Barr notes that the Bohmian interpretation does not employ the hotly disputed concept of a particle-wave duality, which necessitates the insertion of probability theory into quantum theory. This insertion of probability theory into quantum theory is required, according to Barr, because “in no other way can one make sense of *the same entity* being both a wave and a particle.”<sup>13</sup> Bohmian theory, in contrast, which preserves the older view that “waves are waves and

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science. See Peter A. Pagan, “Darwinian Ideology or Universal Teleology? Science, Causation, and Providence,” *The National Catholic Bioethics Quarterly*, Vol. 6, No. 2 (Summer 2006): 303, n. 36. The same can be said of the legitimate intellectual endeavor to show that modern science (as opposed to scientism) and revealed religion are complementary, not competing, approaches to truth and being. *Modern Physics and Ancient Faith* must be understood, then, as an extended *philosophical* exercise offered by a theorist with expertise in modern physics.

<sup>12</sup> Stephen Barr, “Faith and Quantum Theory,” 25. In a subsequent correction printed in *First Things* (August/September 2007), 16, Barr retracts his earlier claim that Hodgson is among those scientists who *both* reject the Copenhagen interpretation *and* maintain that “Bohmian quantum theory is ‘the only metaphysically sound alternative to the Copenhagen interpretation.’” One can consistently reject the former without embracing the latter. Barr adds that Hodgson regards another theory, “stochastic electrodynamics,” as perhaps more promising than the Bohmian view. In comparison with Barr, Hodgson seems to adopt a more provisional stance, at least as regards what we may *affirm* scientifically. Hodgson’s *denial* of the Copenhagen interpretation, in contrast, is not in the least tentative.

<sup>13</sup> Barr, “Faith and Quantum Theory,” 25. Italics in original.

particles are particles,” is more consistent with classical determinism. Barr regards Bohmian theory as a fundamentally new alternative to, not merely an interpretation of, quantum theory. He rejects Bohmian theory because it unravels what he takes to be “one of the great theoretical triumphs in the history of physics: the unification of particles and forces,” and because “it brings back Newtonian determinism and mechanism,” which, in Barr’s view, undermines human freedom.

It is not my purpose here to defend or refute Bohmian theory. I wish to focus, instead, on the argument that, because classical determinism necessarily undermines human freedom, and the Copenhagen interpretation is the only *reasonable* option that seems to undermine classical determinism, one may safely conclude that the Copenhagen interpretation is presently the scientific option most in accord with a biblical faith perspective.<sup>14</sup> Surely the denial of free will cannot be reconciled with Christian orthodoxy, a point I shall assume in this context. The affirmation of free will, however, does not obviously bolster a purely scientific argument in support of the Copenhagen interpretation that Barr favors. With respect to the position I would endorse in opposition to Barr’s more common stance, I suggest that

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<sup>14</sup> Barr also discusses the many-worlds interpretation of quantum theory, which is favored by Don Page, among other theorists. The many-worlds interpretation is not deterministic, which appeals to Barr, but he considers its philosophical ramifications to be essentially irrational (“Faith and Quantum Theory,” 24). Here I must concur with Barr. One should note that in his now famous op-ed piece, “Finding Design in Nature” (*New York Times*, 7 July 2005), which has elicited numerous illuminating exchanges, Cardinal Schönborn is no less critical of the many-worlds interpretation or, as he puts it, the “multiverse hypothesis in cosmology.” I might add that it seems fair to say that Barr’s “Faith and Quantum Theory” casts significant light on his own understanding of the scientific concept of randomness, a central issue in the academic dialogue initiated by Cardinal Schönborn, who defends global teleology in opposition to the idea of randomness as it is typically conceived within neo-Darwinian circles (e.g., Stephen J. Gould, Kenneth Miller). On the idea of randomness as it is ordinarily conceived, see Peter A. Pagan, “Darwinian Ideology or Universal Teleology?” 296-98, 304-06; idem, “Darwin and Design,” in *Truth Matters*, ed. John Trapani (Washington, D.C.: American Maritain Association, 2004), 120-21.

believers critically examine two basic questions. First, would believers be well advised to endorse a scientific theory that does away with classical determinism? Second, does classical determinism really undermine the doctrine of free will, a doctrine that is indispensable from the perspective of Christian orthodoxy?

In response to the first question, let us consider the view held by Peter Hodgson. Consistent with modern science's methodological limits, Hodgson rightly observes that "[p]hysics can take no account of Divine intervention or of acts of free will, so in the course of scientific research the world is assumed to be strictly determined."<sup>15</sup> That is not to say, however, that Hodgson advocates Laplacian determinism. Hodgson's methodological stance is more nuanced than Barr's published statements indicate. As Hodgson observes:

First of all, the world is not just a completely determined world. We are in the world, and we have free will....If this were not so we would be just robots....It is not only ourselves, but also God who can act on the world. *Everything, ultimately, is caused by God.* Aquinas distinguished two types of divine causality, primary and secondary. By primary causality God causes everything, but He also acts by secondary causality when he creates matter and gives it certain definite properties. Thereafter the matter behaves in accord with these properties. *This does not happen by unbreakable necessity*, because God has complete power over nature and can suspend or alter the laws of nature....This means that Laplacian determinism is unacceptable...both God and human beings can cause...effects [that Laplacian determinism cannot explain].<sup>16</sup>

Classical determinism has proven to be a valuable methodological assumption within the domain of physical theory. Without that assumption, modern science would scarcely have attained this point in its history. This important working assumption, however, need not be extended to cover the whole range of being, if reality cannot, in mechanistic fashion, be reduced to matter in motion. Moreover,

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<sup>15</sup> Peter E. Hodgson, *Science and Belief in the Nuclear Age* (Ann Arbor, Michigan: Sapientia Press, 2005), 127.

<sup>16</sup> Hodgson, *Science and Belief*, 126-27; italics added.

believers who appreciate the importance of a realist metaphysics of being as being may, within the domain of physical theory, safely employ a mechanistic model of physical reality without falling into the error of thinking that such a scientifically fruitful model could yield a fully adequate knowledge of nature, which includes corporeal beings made in the image of God: human persons.<sup>17</sup>

If, however, one holds that modern physical theory by itself can supply a proper demonstrative grasp of the hidden but intelligible essences of things, as Barr seems to believe,<sup>18</sup> then a mechanistic model of the physical world, even as it is filtered through the specialized lens of modern science, cannot but prove to be problematic from a Christian faith perspective. In that event, one would be forced to choose between modern science and revealed religion. Such a choice would be most unfortunate, but this choice is unnecessary. One must resist the temptation to increase the scope of modern physical theory beyond its proper borders. By resisting this temptation, one can avoid the false choice between the deliverances of faith and those of modern scientific

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<sup>17</sup> See, for instance, my reply to Barr in "Neo-Darwinism and Catholic Teaching," 623-24.

<sup>18</sup> Barr comments on "the thorny question of instrumentalism and the relation of quantum theory to reality. Many people have said that the traditional [Copenhagen] interpretation of quantum physics necessarily entails an instrumentalist view of science. That depends on what one means by instrumentalism. I believe that science, including quantum physics, makes objectively true statements about the real world and helps us to understand that world as it really is in itself. I reject views that say that modern science is merely useful or successful in manipulating (as opposed to understanding) the world, or that it merely 'saves the appearances,' or that it deals with sensible phenomena rather than with the reality underlying them..." Stephen Barr, "Quantifying Quantum," 5-6; emphasis added. Certain phrases used here by Barr signal clearly that his criticism is aimed at the position espoused by, among others, Cardinal Schönborn. In this connection, see the cardinal's essay, "Reasonable Science, Reasonable Faith," 23. Further insight is offered in "Intelligence and Design," *First Things* 175 (August/September, 2007): 14-6. The latter contains Cardinal Schönborn reply to letters written in response to "Reasonable Science, Reasonable Faith."



rationality.<sup>19</sup> It does not appear that either Barr or various contemporary intelligent design theorists, whose views he rejects, have managed to overcome this serious temptation. Hodgson, however, has not succumbed to this temptation. Thus, in accord with Hodgson's understanding of the value of classical determinism as a working assumption within the domain of modern physical theory, one may rightly deny the non-scientific claim that "[w]hether a man lifts his arm or nods his head *now* would (in a world governed by classical physical laws) be an inevitable consequence of the state of the world a billion years ago." This denial is not so readily available to those who, in accord with the doctrine of philosophical materialism (e.g., Charles Darwin), do not recognize the reality of immaterial principles such as the human intellect.

Barr might still continue to insist that Hodgson's approach does away with "the mysteriousness of quantum theory by sacrificing much of its beauty."<sup>20</sup> The underlying value of beauty in science was expressed by Barr in his book, *Modern Physics and Ancient Faith*:

In the classical [deterministic] case, a deviation from the behaviors predicted by the physical laws due to a non-physical influence would show up as a *violation* of those laws. The laws would say that an atom should move a certain way, and it would move in a different way...it will never be possible to know if such violations of the laws of physics go on in the human brain. But the idea that they do is, to many people, rather ugly and philosophically unsatisfying. On the other hand, in a quantum process, several alternative outcomes are truly allowed to

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<sup>19</sup> Another solution is offered by fideism, which dissolves the speculative union between the supernatural light of faith and the natural light of reason, but that solution is unequivocally rejected by Catholic orthodoxy. A third solution is to reinterpret the entire deposit of faith so as to make it conform to the uncompromising demands of modern science. That is the path of rationalism, also rejected by Catholic orthodoxy. What both solutions have in common is the failure to grasp the proper methodological limits of modern science.

<sup>20</sup> Barr, "Faith and Quantum Theory," 25.

happen by the laws of physics, and so a choice can be made without a 'violation' of physical law.<sup>21</sup>

Setting aside the question whether suspensions of physical laws are truly inconsistent rather than more consonant with the beauty and mystery of creation, which includes images of God, one may doubt the assertion that these violations are philosophically unsatisfactory. Arguing from the uninterrupted constancy of physical laws, David Hume famously denied the empirical possibility of miracles. The natural order would seem to preclude miracles if it were true that physical laws are absolutely inviolable, which is something Hume could hardly argue consistently, for he rejected something indispensable to experimental science, namely, the ontological principle of causality. Yet perfectly reasonable believers opposed to fideism, such as Thomas Aquinas and Peter Hodgson, affirm the reality of supernatural miracles. Here one might quote the latter:

The foregoing has shown that the success of quantum mechanics does not imply that the world is indeterminate and so does not provide the means whereby God can intervene. Even if it did provide those means, they would not be able to account for all recorded interventions, since they violate other physical principles. For example, the feeding of five thousand [via the miraculous increase of loaves and fish] is contrary to the law of the conservation of matter... It is an impoverished conception of God to suppose that he is bound by his own laws. God is the supreme lord of nature, who can make and unmake its laws and bring it into being... It is unnecessary to think of God trying to change the course of events by keeping within the limits of quantum indeterminacy.<sup>22</sup>

Although miracles imply violations of physical laws recognized in modern science, persons who embrace a perfectly rational faith, i.e., a faith that is fully consistent with the truths within the range of unaided

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<sup>21</sup> Stephen Barr, *Modern Physics and Ancient Faith*, 181; italics in original.

<sup>22</sup> Peter Hodgson, *Science and Belief*, 220. For additional nuances, see Thomas Aquinas, *Summa Theologiae*, Ia, q. 105, aa. 6-7; Ia-IIae, q. 93, a. 5; q. 113, a. 10.

human reason, need not deny supernatural miracles.<sup>23</sup> For the violations in question aren't necessarily contrary to philosophical reason. Such violations are deemed irrational by philosophical materialists, agnostics, and by victims of heterodox religious catechesis. By way of contrast, Hodgson, who admits the reality of supernatural miracles, cannot justly be accused of supporting a deformed theology worthy of a clever deist or a Humean positivist. Indeed, Hodgson's reflections on natural science exhibit an admirable coordination of the wings of faith and reason without diminishing either one.

The fact that physical laws are broken does not mean that scientists must abandon the methodological assumption of physical determinism. For scientists as such cannot pretend to supply a complete explanation of everything without stepping outside the proper boundaries of physical science. It is true that physical science can lead scientific investigators to what are sometimes called "boundary questions,"<sup>24</sup> but the adequate answers to such questions must be left to metascientific forms of knowledge, including metaphysics and sacred theology.

If physical *indeterminism* actually obtained at the very foundations of material nature, it would seem necessary to adopt an essentially new conception of miracles, one that does not recognize the fact that physical laws can be and have been broken. Surely a most unusual understanding of miracles would be required. The transmutation of water into wine, for example, would need to be understood in terms of statistical probabilities; a miracle would be construed not as a truly

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<sup>23</sup> By way of clarification, one should mention that when we say that divine miracles violate the laws of nature, we do not intend to suggest that God actually violates the natures or laws established by God Himself. For it makes no sense to hold that God can act against Himself. What we mean, rather, is that when a miraculous action occurs, such as the multiplication of loaves and fish, the act wholly transcends the natural order of operation of finite secondary causes. Thus, a divine miracle is neither according to nature nor contrary to nature, but beyond nature—"supernatural." This is one sense of the supernatural that is not admitted by those who favor philosophical naturalism. See Thomas Aquinas, *Summa Theologiae*, Ia-IIae, q. 113, a. 10.

<sup>24</sup> See Mariano Artigas, *The Mind of the Universe: Understanding Science and Religion* (Philadelphia and London: Templeton Foundation Press, 2000), 13-25.

*supernatural* event, but only as a highly *improbable* one. Indeed, if we were to adopt the Copenhagen interpretation of quantum mechanics, we could no longer consider the affirmation of a miraculous event to be logically inconsistent with the doctrine of philosophical naturalism, which strictly precludes the reality of supernatural causes. A first-rate theologian such as Augustine or Thomas Aquinas, however, would have considered a purely naturalistic conception of miracles to be quite foreign to an authentically Christian vision of reality. A miracle compatible with philosophical naturalism is a miracle in name only. If one admits genuine miracles, it is unclear how one could find “rather ugly and philosophically unsatisfying” the idea that physical laws are broken through the insertion of free human acts. The recognition that physical laws have been and continue to be broken in no way contradicts the claim that natural scientists as such should prefer the methodological assumption of physical determinism rather than the Copenhagen interpretation, which is not a purely scientific conjecture anyway.

Here I would pause to note that Barr emphasizes that the Copenhagen interpretation concerns “someone’s (the observer’s) *knowledge*,”<sup>25</sup> the imperfect knowledge of created human minds. We must not forget, however, that scientists transcend natural science’s proper boundaries the moment they explicitly introduce human reason into the subject matter of modern scientific discourse.<sup>26</sup> If such emphasis on the mind of the human observer is an essential feature of quantum theory as construed by the currently dominant Copenhagen school of thought, then one could hardly deny that the Copenhagen interpretation is inherently metaphysical in nature, exceeding the proper scope of modern science. This is not to deny, of course, that the practice of modern science invariably depends on philosophical assumptions (e.g., that there is an inherent order in nature, that every effect demands an antecedent cause, that nature is inherently knowable, etc.). But these assumptions cannot be proven within the

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<sup>25</sup> Barr, “Faith and Quantum Theory,” 24.

<sup>26</sup> Darwinians, of course, typically fail to grasp the radical and naturally unbridgeable ontological gap between non-rational animals and free moral agents, which is why the Catholic Church cannot abide Darwinian orthodoxy (e.g., *The Descent of Man*).

proper domain of modern science, which is concerned with explaining sensible objects or, as it is sometimes said, "saving the phenomena."<sup>27</sup>

As regards the methodological assumption of physical determinism, I wish to emphasize that it need not be treated as an absolutely universal assumption without exception. A methodological assumption can be considered true within a limited domain of inquiry, without implying that the same assumption must be applicable beyond the domain of inquiry in which the assumption is considered true. Thus methodological naturalism, according to which a scientific researcher as such must seek only natural explanations of observed events, need not imply philosophical naturalism, according to which observed events could have nothing but purely natural explanations, inasmuch as philosophical naturalism positively denies even the logical possibility of supernatural causes. Philosophical naturalism makes no allowance for genuine miracles like the multiplication of loaves and fish. In other words, methodological naturalism does not deny the reality of supernatural causes. It simply doesn't consider them. Philosophical naturalism, in contrast, absolutely precludes supernatural causes. In similar fashion, physical determinism can be employed as a valuable methodological assumption in physical theory, without necessarily implying that such determinism is applicable at every level of reality. That is to say, physical determinism does not logically imply metaphysical determinism or strict necessitarianism. If one recognizes that human persons are free moral agents, then one can hardly deny that even an exceptionally powerful created mind, e.g., an angelic intelligence, in possession of an exhaustive scientific knowledge of the actual state of the material universe and its vast web of physical causes at a particular historical instant, could not predict with infallible accuracy the exact state of the same universe tomorrow morning, let alone a billion years from now.

Metaphysical determinism does not obtain because we are free agents, and the proof that we are free agents lies beyond the reach of modern science. The truth that we are free agents is a scientifically

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<sup>27</sup> See, for instance, Cardinal Schönborn, "Reasonable Science, Reasonable Faith," 23: "Modern scientific method] proceeds...by means of mathematical and mechanical explanations that, in the old expression, 'save the phenomena.'"

indemonstrable assumption of modern science. If we were not free agents, genuine scientific activity among human persons would not be possible. As I pointed out some years ago to a hard-core determinist with an advanced degree in physics, if it were true that we are absolutely determined in all of our actions, then there would be no real point to arguing over whether determinism is true even at the level of human action. For our past, current, and future beliefs and mental activities would be wholly beyond our control. Genuine human rationality involves far more than does an artificially intelligent computer system. Unlike the spiritual exercise of human rationality, an artificially intelligent machine is strictly determined in all of its operational functions. The reality of human action, which is necessarily rooted in human reason, and the assumption of absolute determinism are mutually incompatible. Of course, the metascientific recognition that we are free agents does not explain the inner nature of freedom itself. Such an explanation requires metaphysical analysis. In terms of explaining the reality of human freedom properly understood, which is not to be equated with freedom of indifference, the Copenhagen interpretation of Heisenberg's uncertainty principle is useless. Here Barr is simply mistaken when he claims that indeterminism opens the way to free will.<sup>28</sup> For the intellectual path to true freedom was never obstructed by physical determinism. Barr seems to assume that the exercise of genuine freedom must be consistent with the inviolable operation of physical laws. In the context of physical determinism, however, the exercise of human freedom would entail the regular violation of physical laws, which in Barr's view would be ugly and philosophically unsatisfying. Within the framework of physical indeterminism, however, no such violations would obtain. So, in Barr's view, physical *indeterminism* is aesthetically pleasing and philosophically satisfying.

We must be careful to note, however, that there is a significant ambiguity associated with the common scientific defense of physical *indeterminism*, which relies heavily on probability theory and the idea of randomness. Not a few believe that the universal principle of causality is undermined by Heisenberg's uncertainty principle in quantum

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<sup>28</sup> See Barr, *Modern Physics and Ancient Faith*, chap. 20: "Determinism and Free Will."

theory. It is said that “an event is causally conditioned if it can be foretold with certainty.”<sup>29</sup> Such a view of causation is certainly held by writers like David Hume, who reduced causation to the idea of constant conjunction acquired through cognitive habituation. (How such habituation could be acquired without genuine causation is another question.) Given such an understanding of causation, if we cannot discern that a particular sort of effect is regularly preceded in time by a particular sort of causal mechanism, then it would seem that the effect must be without a cause. Nevertheless, one need not understand the principle of causality in terms of the perception of constant temporal conjunction. The repeated failure to identify an adequate causal explanation underlying an observed event does not logically entail a complete absence of causation. A “billiard-ball” model of causality will not suffice for those interested in pursuing a deeper, less superficial, level of explanation. We must go beyond a shallow mechanistic or Humean understanding of causality and develop a metaphysically robust conception of causation, such as that employed in the writings of Aristotle and Thomas Aquinas.

As long as one refuses to allow within natural science the dubious importation of mechanistic philosophy or philosophical materialism, upon which the ideology of global evolutionism depends, the methodological assumption of physical determinism need not bar the metaphysical recognition of intellect and free will. Physical determinism is a vital working assumption within the circumscribed conceptual topography of empiriometric science. Contrary to the metaphysically immodest claims of scientism, however, one must constantly be mindful of the fact that modern science is not competent to deal with the whole range of reality, which cannot properly be reduced to material beings within reach of our own faculties of sensory perception.<sup>30</sup> Being in all of its intelligible fullness and depth falls properly within the domain of metaphysics, not that of physical science.

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<sup>29</sup> Vincent E. Smith, *Science and Philosophy* (New York: Bruce, 1965), 88, quoting Planck, *Where is Science Going* (New York: Norton, 1932), 45.

<sup>30</sup> Compare Mariano Artigas, *The Mind of the Universe*, 10-12, 108-12, 35-44.

One can hardly overemphasize this vital philosophical truth today, and it is particularly relevant in the present context. For Barr's *philosophical* position in this regard is wide of the mark. In comparison with the views he expressed in his essay, "Faith and Quantum Theory," aspects of Barr's underlying philosophy of science are made more explicit in his subsequent reply to letters. As noted earlier, Barr denies that modern science "deals only with sensible phenomena rather than with the reality underlying them, or that it studies just the accidental quantitative aspects of things rather than their essences."<sup>31</sup> Such a denial stands in marked contrast to Pope John Paul's position on the proper reach of natural science:

Scientific proofs in the modern sense of the word are valid only for things perceptible to the senses, since it is only on such things that scientific instruments of investigation can be used.

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<sup>31</sup> Stephen Barr, "Quantifying Quantum," 6. One should note that the grammar of essences as conceived by thinkers such as Aristotle and Thomas Aquinas is not properly a feature of the language of modern science. It is true, of course, that modern scientists employ the term "species" when discussing differences among the varieties of animals (and plants), but the idea of species used in modern evolutionary biology is not the same as the philosophical concept of species. In the modern biological sense, the term "species" refers to a population of individuals capable of interbreeding. Biologists typically draw the line of demarcation between one species of animal and another at the point where no interbreeding among individuals can occur and reproductive isolation is observed. The differences between species are rather superficial differences in degree, not radical differences in kind. The boundaries between various species are fluid, not definite and unchanging. In short, modern evolutionary biology presupposes a nominalist understanding of species, and there is no recognition of extramental essences. When one employs the philosophical concept of species, in contrast, one enters the ontological realm of definite and unchanging essences, and the presence of formal causes is central. Cf. Dennis Bonnette, *Origin of the Human Species* (Amsterdam; Atlanta, Georgia: Editions Rodopi B.V., 2001), 19-26, 43-47, 87-91. Since Barr has previously argued in favor of neo-Darwinian evolutionary theory, one must ask whether he and Cardinal Schönborn are using the term "essence" in precisely the same sense. If Barr does not share the cardinal's concept of essence, then Barr should clarify what exactly he has in mind when he asserts that modern science goes beyond sensible appearances and studies the underlying essences of things.



[...] Science must recognize its limits and its inability to reach the existence of God. It can neither affirm nor deny his existence.<sup>32</sup>

Cardinal Schönborn's position is perfectly in accord with that particular view of the methodological limits of modern science. The late Mariano Artigas expresses a closely related view on those very same limits. "Empirical science, by its very nature, is limited to those aspects of reality that can be studied using experimental control."<sup>33</sup> Even if one does not take Pope John Paul's statements on the limitations of modern science to be the final word on this important methodological question, one must grant that his statements concerning the theories and discoveries of modern science, including evolutionary biology, need to be interpreted within the context of his philosophical understanding of the proper epistemic reach of modern science.<sup>34</sup> Furthermore, if Pope John Paul's understanding of that reach

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<sup>32</sup> John Paul II, "The Proofs for God's Existence," general audience of July 10, 1985, n. 1, [http://www.vatican.va/holy\\_father/john\\_paul\\_ii/audiences/alpha/data/aud19850710en.html](http://www.vatican.va/holy_father/john_paul_ii/audiences/alpha/data/aud19850710en.html).

<sup>33</sup> Mariano Artigas, *The Mind of the Universe*, 8. John Criscione offers a similar observation: "The scientific method, as practiced in the hard sciences, is useful for the rational investigation of repeatable observations or repeatable phenomena, such as the gravitational attraction of two objects. To extend it to cover unrepeatable phenomena, the scientific method has to be weakened....Members of the hard sciences need a method that is strong, and it is imperative that scientists not weaken it. We cannot have it both ways. We either restrict application of the scientific method to appropriate phenomena or it loses its validity....[S]cientists should accept the limits of a potent scientific method rather than dilute it in order to cover the universe [which involves more than can be grasped by the senses alone]." John C. Criscione, "Intelligence and Design," 11-12. Regarding the limits of experimental science, Cardinal Schönborn concurs: "[E]xperimentation on repeatable phenomena has certainly been one of the hallmarks of the scientific revolution, and arguably its single most important feature, providing us with a plethora of knowledge about the natural world unavailable to the philosopher and his method based on common experience alone. So I think Dr. Criscione's point is very well taken and a key element of any reevaluation of the nature and limits of modern science," 12.

<sup>34</sup> To cite Pope John Paul II's public statements on evolutionary theory, for example, in support of one's own evolutionary convictions, while

is correct, then Barr's explicit reference to the human mind as an essential feature of his defense of the Copenhagen interpretation entails that his line of argument is philosophical, not purely scientific, in character. For the reality of mind is not something that falls within the restricted competence of modern physical theory, but is a scientifically indemonstrable presupposition.

Barr would defend his more ambitious conception of the epistemic range of modern science with the charge that the more modest conception endorsed by Cardinal Schönborn "involve[s] a gross underestimation of the explanatory successes of modern science and the power of human reason."<sup>35</sup> One should pause to take note that this charge is not simple, but complex. The first part of Barr's charge asserts that the more modest conception of the epistemic reach of modern science does not adequately represent the explanatory range of modern science. The second part of his charge alleges that the more modest conception fails to do full justice to man's rational faculty. If one distinguishes the two parts of Barr's charge, it becomes apparent that such rhetoric lacks any real logical force. For the first part of his charge begs the question, inasmuch as it assumes that his more ambitious conception of the explanatory reach of modern science is the correct one.<sup>36</sup> His position seems to blur the line of demarcation between

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repudiating his prior understanding of the limits of modern scientific method, would be to risk a serious distortion of his actual teaching.

<sup>35</sup> One should note that Cardinal Schönborn has consistently held that the power of human reason extends far beyond the methodological boundaries of modern science. Indeed, he has criticized scientism or the metascientific view that modern science constitutes the only or the supreme form of genuine human knowledge of reality.

<sup>36</sup> Here one might object that I, no less than Barr, am begging the question, since I seem to be assuming that the more modest view of the epistemic reach of modern science is the correct one. In response, I would point to the important distinction between the premodern notion of science and the modern conception of physical science. The epistemic reach of the former, which includes philosophy of nature and philosophical psychology, extends far beyond that of the latter. Within the framework of the premodern notion of science, one can indeed deal with deeper questions, such as human freedom and responsibility, which modern scientists typically do not consider to be within the purview of their specialized disciplines. When

science and philosophy, inasmuch as he seems to proceed as if empiriometric science is the modern equivalent of natural philosophy, which does consider the natures of corporeal beings. In addition, the second part of his charge is of special interest. For it appears to insinuate that the proper scope of modern science is equal to that of human reason! If he intended to suggest as much, then his position could not easily be distinguished from that of scientism, which he claims to disavow. Here, the words of Pope John Paul are instructive:

[While recognizing the significant methodological limitations of modern science], however, we must not draw the conclusion that scientists in their scientific studies are unable to find valid reasons for admitting the existence of God. If science as such cannot reach God, the scientist who has an intelligence, the object of which is not limited to things of sense perception, can discover in the world reasons for affirming a Being which surpasses it. Many scientists have made and are making this discovery.<sup>37</sup>

According to this vital qualification, the scope of natural science is subordinate to the metascientific range of human reason. Whether or not Barr's position implies scientism, his esteem for modern scientific rationality appears to surpass by far the value he places on philosophical reason, including metaphysics.<sup>38</sup> The not uncommon

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modern scientists do attempt to deal with those more fundamental questions pertaining to the underlying spiritual core of human existence, they tend to run into serious difficulties, as long as they remain within the proper boundaries of modern physical theory. If one ignores the foregoing distinction, one will be prone to commit the sort of Kantian missteps that lead one to undervalue speculative reason. In that regard, see Pope Benedict XVI's highly relevant Regensburg Lecture <[http://www.vatican.va/holy\\_father/benedict\\_xvi/speeches/2006/september/documents/hf\\_ben-xvi\\_spe\\_20060912\\_university-regensburg\\_en.html](http://www.vatican.va/holy_father/benedict_xvi/speeches/2006/september/documents/hf_ben-xvi_spe_20060912_university-regensburg_en.html)>.

<sup>37</sup> Pope John Paul II, "The Proofs for God's Existence," n. 1.

<sup>38</sup> "Almost all scientists are instinctively and professionally suspicious of anything that smells like 'teleology'... For almost two millennia this kind of [teleological] thinking prevailed in the physical sciences, and it is generally agreed that it led nowhere. *Teleology was found to be a sterile approach to understanding the physical world.* Many accounts of the history of science

failure to appreciate the fundamental role of metaphysical reason, however, is a central concern both of Cardinal Schönborn and of the Catholic Church's magisterium: as reflected, for instance, in the teachings of Pope John Paul II and Pope Benedict XVI.<sup>39</sup> Barr wishes to

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emphasize that the Scientific Revolution occurred only when scientists abandoned teleology in favor of investigating the physical mechanisms that underlie phenomena. That is why any talk about how certain features of the physical world are necessary in order for human life to exist seems to many scientists like a giant step backward, an attempt to smuggle *discredited teleological notions* back into science. They sincerely worry that people will be led astray from the high road of scientific thinking into the *barren wastelands of fruitless metaphysical speculation*....Teleological thinking can indeed be a showstopper as far as doing real scientific research is concerned. For many centuries it was." Stephen M. Barr, *Modern Physics and Ancient Faith*, 138–39; emphasis added. The irony is that positive opposition to teleological thinking is not a truly scientific posture. Of course, the objective and universal truth of teleology (i.e., final causality) cannot be demonstrated without moving beyond the proper boundaries of natural science; nevertheless, teleology is scientific in the sense that it is an antecedent necessary condition or presupposition of natural science. Cardinal Schönborn appreciates this critical point: "It is true that modern scientists have typically rejected these notions [formal and final causes], but they haven't eliminated them, only ignored them. More precisely, they have *presupposed and relied upon* them while simultaneously claiming their nonexistence. Yet the very best scientists do not limit themselves to purely reductionistic, 'bottom-up' explanations. They know that things are not exhaustively explained by explanations of their parts. They may not use the old terminology, but by their exploration of hierarchy and form such scientists are returning to the tradition of natural philosophy. And natural philosophy leads to metaphysics, to the understanding of being as such" ("Intelligence and Design," 14). On natural science's presuppositions, see Mariano Artigas, *The Mind of the Universe*, 22–23, 27–53. On the theistic, indeed Judaeo-Christian, foundations of modern science, Stanley Jaki's historico-critical work is recognized internationally, although his prolific scholarship is often underrated within scientific circles, especially those under the spell of scientism. Cf. Peter A. Pagan, "Darwin and Design," 103–04.

<sup>39</sup> "The philosopher...does not arbitrarily limit what must be explained, nor the possible modes of explanation. Without doubt [as compared with reductionism], the philosopher's stance is more rational, because he seeks to understand and explain all reality, not an arbitrary subset. The philosopher can explain whatever the 'scientist' can explain (sometime[s] by simply

defend the harmony between scientific truths and truths of theological faith. Yet, in the last analysis, one cannot succeed in this vital task without relying on the bridge supplied by philosophy, especially a realist metaphysics, and this critical bridge is necessarily compromised as long as one elides the real distinction between philosophy and modern natural science.

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repeating the scientific explanation) and more, but the 'scientist' cannot explain his own starting point. This 'self-limitation of reason,' in the Holy Father's pregnant phrase from Regensburg, is truly one of the great pathologies of the modern West": Cardinal Schönborn, "Intelligence and Design," 15. See also my "Neo-Darwinism and Catholic Teaching," 623.