

The Impossible Possibility: Divine Causes in the World of Nature

by Philip Clayton

Physical science, it appears, leaves no place for divine action. Modern science presupposes that the universe is a closed physical system, that interactions are regular and lawlike, that all causal histories can be traced, and that anomalies will ultimately have physical explanations. But traditional assertions of God acting in the world conflict with all four of these conditions: they presuppose that the universe is open, that God acts from time to time according to his purposes, that the ultimate source and explanation of these actions is the divine will, and that no earthly account would ever suffice to explain God's intentions.

Moreover, one must worry about equivocation: the meanings of the word "cause" used of a chemical catalyst and of God's upholding the universe appear to diverge so widely that perhaps the same notion should not be used to express both claims. Only if we can give some broader account of what causal features chemicals and providence share in common can we make sense of Jewish, Christian and Muslim claims for divine action in the world.

The problem of divine agency therefore stands on center court for theists today. Christians and Muslims, in particular, have traditionally been committed to a robust account of the actions of Allah or God within the natural order. But how can we attribute events to the causal activity of God when science appears to fully explain each event that occurs within the natural world? What conceptual resources might allow believers to acknowledge the power of science without reducing the divine to a "God of the [few remaining] gaps"? I assume — as one can hardly deny — that science has been massively successful in explaining events in the natural world. We cannot give just any account about what causes chemical and physical events; well-attested scientific explanations are not just "one story among the rest." This is not to deny that scientific theories have a preliminary status, that they are open to change and some of them will be falsified. Still, the fact that a given theory will possibly be revised in the future does not mean that it stands on the same level as any other account of the phenomena in the present.¹

The Determinist Challenge

¹ On the presumption of naturalism, see chapter 7 in Clayton, *God and Contemporary Science*, (Edinburgh: Edinburgh University Press and Grand Rapids: Eerdmans, 1997).

The problem is not just that science has a preference for non-divine causes. Far more serious, physical science presupposes the principle of *causal closure*. A physical system must be closed if physical calculation and prediction are to be possible. A core principle of physics is the principle of the *conservation of energy*. If we cannot assume that the total energy of a system remains constant — or at least know the exact quantity of energy that is added at a given time — we can have little or no knowledge of the system.

Put together these various requirements and you have the principle of causal or physical determinism. As William James notes, determinism “professes that those parts of the universe already laid down absolutely appoint and decree what other parts shall be. The future has no ambiguous possibilities hidden in its womb: the part we call the present is compatible with only one totality.”² This determinism of physical causes involves the claim that the physical state of the world at a given time determines the physical state of the world for all future times. It is thus a *modal* notion, since it denies that it is *physically possible* that the present state of the world should give rise to more than one future state of affairs.³

Physical determinism is fundamentally a claim about causality — the claim, namely, that all that happens is a necessary effect of antecedent causes. It entails that the causal chain is all of a piece; no one cause stands out from the others as more fundamental. For example, neither genes in the biological sphere nor intentions in the realm of psychological can be taken as the “real” determining factors without reference to *their* causal antecedents. At the same time, it claims that all physical occurrences are lawful: the universe is such that a given set of physical events can give rise to only one successor set.

All versions of determinism accept the *ontological* thesis that the state of the universe up to and including the present time *t* determines the universe’s state in subsequent moments. But the challenge for theists is compounded by the fact that the ontological thesis usually begets an *epistemological* thesis: that future states could be predicted if one had enough knowledge of the past and present. Its most famous version is expressed by Laplace’s thesis that all future and past events could be predicted from a complete knowledge of the present: “An intelligence which knows at a given instant all forces acting in nature, as well as the momentary positions of all things of which the universe consists, would be able to comprehend the motions of the largest bodies of the world and those of the smallest atoms in one single formula, provided it were powerful enough to subject all data to analysis. To it, nothing would be uncertain; both future

² William James, *The Will to Believe and Other Essays in Popular Philosophy* (New York: Longmans, Green, and Co., 1905).

³ See C. Brighouse, “Determinism and Modality,” *British Journal for the Philosophy of Science* 48 (1997): 465-81.

and past would be present before its eyes.”⁴

By (often tacit) appeal to what I just called the epistemological thesis, debates about determinism often turn into debates about what is physically possible. In a broad sense of the term, it is physically possible that a divine agent exists — a being with no body who is utterly separate from this world. But, it seems, the actions of this agent could not be scientifically discerned, since all the observer would detect would be anomalies in causal sequences in the physical world. Under a stricter interpretation, however, the existence of a divine being might be viewed as physically impossible, since it is not a physical thing. If this interpretation is correct, theism and physical determinism would be incompatible. To be honest, one must admit that modern science has presupposed one of these two interpretations; and by and large it has been the stricter view that has predominated.⁵

It is on these grounds, for example, that the “new synthesis” in evolutionary biology represents a serious challenge to theism. Evolution requires that no outside causal force be responsible for the development of more complex systems and life forms; random genetic variation and selective retention through the environment are the only allowable causal determinants of the evolutionary process. For its part, theism requires that the development be intended by God, so that God is in some sense responsible for the outcome. Some Christian biologists, most notably Arthur Peacocke, have argued that God could have initiated a process of cosmic evolution that God knew would lead to the development of conscious life without any further role being required on God’s part.⁶ But this viewpoint faces a serious dilemma: either the development of life would have to be a necessary consequence of the Big Bang (which does not seem likely given the quantum uncertainties involved), or God would have had to be ready to intervene, and perhaps actually *have* intervened, in order to bring about conscious life (which

⁴ Henry Margenau, *Scientific Indeterminism and Human Freedom* (Latrobe, PA: Archabby Press, 1968), 3. In popular writings it is sometimes assumed that scientists, who are *not* omniscient, will be able to predict the future if determinism is true. But chaos theory, the physics of systems far from thermodynamic equilibrium, now suggests that prediction will be impossible even in fully deterministic systems when they are “chaotic.”

⁵ Among many excellent works see especially John Earman, *A Primer on Determinism* (Norwell, MA: Reidell Publishing Co., 1986); Ted Honderich, *A Theory of Determinism: the Mind, neuroscience, and life hopes, II* (New York: Oxford University Press, 1988); Hook, Sidney (Hg.), *Determinism and Freedom in the Age of Modern Science* (New York: 1st Collier Books, 1961); Keith Lehrer (Hg.), *Freedom and Determinism* (New York: Random House, 1966); Viggo Mortensen; Robert Sorenson u.a. (Hgg.), *Free Will and Determinism: Papers From and Interdisciplinary Research Conference, 1986* (Chicago, Ill.: Aarhus University Press, 1987); M. Targett, “Determinism, Indeterminism, and Explanatory Bias,” *Progress in Neurobiology* 53 (1997): 533-45; ⁵R. Taylor, *Action and Purpose* (New York: Humanities Press, 1973) [add ref.]; Roy Weatherford, *The Implications of Determinism* (New York: Routledge Press, 1991); G.H. von Wright, *Causality and Determinism* (New York: Columbia University Press, 1974)

⁶ Arthur Peacocke, "Science and the Future of Theology: Critical Issues," *Zygon*, 35. (2000)

would contradict the “hands-off” position). At first blush, at least, it looks like a stand-off, such that evolution is incompatible with theism and divine providence or action in the world is incompatible with evolution.

Needed: A New Theory of Causation

The challenge we have been exploring requires theologians to do some fundamental rethinking on the topic of divine action, since the inherited tools and concepts are no longer adequate to make sense of divine action in an age of science. To put it bluntly, the theologian seems to be faced with a forced choice between two alternatives: either God acts as the Divine Architect only, creating a finely tuned machine and leaving it to function in a consistent manner expressive of its Designer; or God becomes the Divine Repairman, whose imperfect building of the machine in the first place requires him, like a refrigerator repairman, to return from time to time to fix up errors he made the first time around. Though perhaps not impossible, it is certainly difficult to develop an alternative perspective that allows one to speak of a “different but equal” causal system, alongside the network of scientific explanations, that is equally constitutive of physical events in the world.

Many attempts have been made to respond to this challenge. Some have found an opening in quantum indeterminacy. Perhaps, they argue, the physical world is fully lawlike, and even physically closed (i.e., the total amount of energy remains constant). But quantum physics, at least on the Copenhagen interpretation, reveals a world that is both law-governed and essentially indeterminate: unobserved subatomic events do not have a precise location and momentum, and probabilistic laws leave some room for chance. Now it does seem significant that quantum mechanics allows for multiple outcomes given the same initial conditions, since it leaves room for top-down influences (more on this below). Still, “stochastic” or probabilistic laws are still laws: they may not determine the individual case but they do reflect a physical determinism of the overall pattern. Also, the laws say nothing about agents and agents’ freedom; hence they do not provide the stronger sense of counterfactual free action that theists appear to need to make their case.

This lack has led some to set strongly dualist notions of mental causation over against the world of physical causes. Among these non-physical types of causation are the “agent causation” of Richard Taylor and the ubiquitous divine causation (“double agency”) of Austin Farrer. Such approaches posit mental or divine causes that affect outcomes without introducing new energy into the physical world. Certainly views of this sort leave room for full human and divine agency. Unfortunately, they do not integrate easily with physical science as we now know it, and some versions actually contradict physical descriptions of the world.

But what of human agency? Do humans not have a freedom of the will: “A staff moves a

stone, and is moved by a hand, which is moved by a man.”⁷ Theists have often argued that since humans are free, God could act in the world. After all, if humans can break the chain of physical causality, couldn’t God do so all the more? But free will may be less of a trump card than it appears. The dominant view within philosophy has been *compatibilism*, the view that physical determinism is compatible with human agency and moral responsibility.⁸ The American legal system, for example, holds individuals responsible if they will and then carry out an illegal action (say, murder), *even if* the willing was determined by prior causes. According to compatibilism, agents’ actions express their character traits; it is thus irrelevant whether these traits, and thus the actions themselves, are determined by antecedent causes. Perhaps the “sense” of being free is mistaken, since even a fully determined will could still (falsely) imagine itself to be free. Finally, many scientists argue that neuroscience presupposes (or more radically: has already proven) that the only causal agency is physical; aside from brain states and the body’s responses, there *is* no “actor” to be found.

Clearly, it is an urgent task for the theologian to provide a clear account of what she means by asserting that God continues to be active in the world. To succeed at this task we need nothing less than a new theory of causation. This paper offers a first sketch of such a theory. The argument divides into three main parts:

(1) I first concede that the threat of equivocation cannot be overcome as long as one’s theory of causality includes only physical and divine causes; the gap is just too wide. By contrast, if we find evidence within the natural world of vastly different types of causes we can perhaps extend the line to include super-natural causal influences as well. And in fact the study of the natural world *does* reveal rather different types of causal action, from classical Newtonian causality to gravity to the influence of quantum fields to the “holistic constraints” of integrated systems — and on to the pervasive role of mental causes in human life, as in your comprehension of the sentence, “Please stop reading this sentence!”

(2) The objection arises: Are not all these causal forces ultimately explainable in terms of the laws of the underlying physical reality — unlike divine causes, which are said to issue from a transcendent and free source? In the following sections I marshal the diverse evidence and arguments that point beyond classical notions of physical causality. Taken together, they

⁷ Aristotle, *Physica*, 256a. See also Timothy O’Connor, ed., *Agents, Causes, and Events: Essays on Indeterminism and Free Will* (New York: Oxford University Press, 1995).

⁸ Hud Hudson, *Kant’s Compatibilism* (Ithaca: Cornell University Press, 1994). Indeterminists, of course, deny this claim, arguing instead for “genuine” or counter-factual freedom: you did this action now, but you might have done something different even in identical circumstances. As Jean-Paul Sartre puts it in a classic phrase, “the indispensable and fundamental condition of all action is the freedom of the acting being” J.P. Sartre, *Being and Nothingness* Translated by Hazel E. Barnes, (New York: Citadel Press, 1956.)

now encourage us to accept (as the medieval Islamic philosophers also urged) that the genus “cause” includes types of influences other than mechanistic ones.

(3) The last section then draws together the results of the earlier sections in the direction of a systematic theory of divine action. Emergent causal levels, reflecting the hierarchical structure of the natural world, help to elucidate the nature of divine action, though they are not identical to it. The differences between natural and super-natural causation that remain do represent a continuing burden to Muslim and Christian thinkers in an age of science. Given an adequately broad theory of causation, however, the burden may be bearable.

This is a high-stakes question for Islam and Christianity. Traditional formulations remain attractive, but they face conceptual objections that some fear are insuperable. Can a scientifically acceptable concept of emergence be developed that will “re-enchant” the world, allowing us to speak of it again as the ongoing handiwork of God? If so, what might this “theology in a new key” look like? Can we again find the divine in “the light of setting suns, / And the round ocean and the living air, / And the blue sky, and in the mind of man” (Wordsworth)?

The Framework of Emergence

For simplicity’s sake one could speak of four major transitions in the natural world that evidence the phenomenon of emergence⁹: (1) fundamental physics to physical systems and chemistry; (2) biochemistry to complex biological organisms and ecosystems, including the evolution of life; (3) the brain and central nervous system to the phenomena of consciousness or “mind”; and (4) the emergence of spirit within the natural order, including the question of its ultimate nature and origin. We will only be able to understand the emergence of life, mind and spirit if we develop a broader notion of causal influence based on emergent levels in the natural world. If we are successful, this notion may be broad enough to at least make sense of the idea of God’s causal activity in the world.

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Before we can proceed to a constructive theory of causality, we must first review the history of the concept of emergence in the disciplines in which it first arose. In the history of Western philosophy the concept goes back at least as far as Aristotle. Aristotle’s biological research led him to posit a principle of growth within organisms that was responsible for the qualities or form that would later emerge. Aristotle called this principle the *entelechy*, the internal principle of growth and perfection that directed the organism to actualize the qualities that it contained in a

9 In a new book the biologist Harold Morowitz finds no less than 28 levels of emergence in the natural order; see his *Emergences: Twenty-Eight Steps from Matter to Spirit* (forthcoming).

merely potential state. In this sense the adult form of the human or animal *emerges out of* its youthful form. Aristotle also introduced several kinds of cause to explain this emergence: “material” causes, or the ways that the matter of a thing affect it; “formal” causes, which operate through the form internal to the organism; “efficient” causes, which work from outside to move it or to cause change; and “final” causes, which pull the organism (so to speak) toward its final telos or perfection.

Aristotle’s influence on Hellenistic, Islam and Western medieval philosophy cannot be overstated. Through Thomas Aquinas, who directly adopted his theory of the four causes¹⁰, Aristotle was brought into the center of Roman Catholic theology, a place he continues to occupy among conscious and unconscious Thomists to the present day. Thus Aquinas insisted that every event involved not only the efficient cause (what physicists would speak of today as *the* cause of an occurrence), but also the formal and material causes, that is, the influence of the matter and the form on the outcome. Baptizing Aristotle’s theory of “final causes,” he introduced the notion of the overall purpose of God as one of the causal forces in every event, thereby making divine causal action a component in every action. Aristotle — or, more generally, Greek natural philosophy — also remained surprisingly dominant in early modern medicine, biology and geology. In fact, biology was in many respects still under the influence of something very like this paradigm when Darwin began his work.

It is true that some contemporary theologians have attempted to preserve something like this “final” type of causality. One of the most sophisticated representatives is Wolfhart Pannenberg. In chapter 4 of *Theology and the Kingdom of God*, he adopts something like Aristotelian final causality, speaking of the power of the future as a causal constituent in every event.¹¹ A similar adaptation or version of final causality is visible in Lewis Ford’s “lure of the future,” a notion that he adapts from Whitehead. Thomistic overtones can also be heard in theories of divine action that distinguish between primary and secondary causality -- indirectly in the work of Austin Farrer, and more directly in the writings of David Burrell.¹² Such defenses of “future causality” in one

¹⁰ see especially Q 44, A 1-4, which argues that God is all four causes.

¹¹ See Clayton, “The God of History and the Presence of the Future,” *The Journal of Religion* 65 (1985): 98-108, and “Being and One Theologian,” *The Thomist* 50 (1988): 645-671.

¹² See Austin Farrer, *Faith and Speculation*, (New York: New York University Press, 1967). Cf. also David Burrell, *Knowing the Unknowable God* (Notre Dame: University of Notre Dame Press, 1986), as well as Burrell, “Divine Practical Knowing: How an Eternal God Acts in Time,” in Brian Hebblethwaite and Edward Henderson, eds., *Divine Action: Studies Inspired by the Philosophical Theology of Austin Farrer* (Edinburgh: T. & T. Clark, 1990), pp. 93-102.

guise or another cannot be quickly dismissed as metaphysical non-starters.¹³ Nonetheless, they have not won broad acceptance, presumably because final or future causes are not among the causal forces accepted by the ruling scientific worldview.

(Note that there are other ways to include divine causal influence than the Aristotelian-Thomist strategy, for example theologies of process and theologies of emanation. The doctrine of emanation, at least in its most famous (Neoplatonic) form, defends the emergence of the entire hierarchy of being out of the One and the movement of finite beings back up the ladder of derivation to their ultimate source. This Neoplatonist model, of which orthodox theologians were always skeptical, allowed both for a *downward* movement of differentiation and causality and an *upward* movement of increasing perfection. Ultimately, diminishing distance from the Source would lead (in principle) to a final mystical (re)unification with the One. Unlike static models of the world, emanation models allowed for a fluid movement downward and upward through the various species, as well as between the physical, psychological and intellectual spheres. In those cases in which the emanation was understood in a temporal sense, as with Plotinus, the emanation doctrine provided an important antecedent to doctrines of biological or universal evolution.)

When science was still natural philosophy, emergence played a productive heuristic role. After about 1850, however, emergence theories were several times imposed unscientifically as a metaphysical framework in ways that blocked empirical work. Key examples include the neo-vitalists (e.g., H. Driesch's theory of entelechies) and neo-idealist theories of the interconnections of all living things (e.g., Bradley's theory of internal relations) around the turn of the century, as well as the speculations of the British Emergentists in the 1920's concerning the origin of mind. From these mistakes we can derive certain cautionary conclusions and criteria for the use of emergence. Above all, speculation must never *replace* empirical science; it *supplements* it when broader questions are being raised. The concept of emergence is useful not as a metaphysic *imposed* on the sciences from the outside but as an inductive result that emerges out of a careful study of the sciences themselves.

Building the Case: Quantum Mechanics and the Question of Causation

It is often said that the development of quantum mechanics has transformed our understanding of the causal connections in the world. In one sense this is true: quantum physics countenances types of causal influence utterly foreign to Newtonian physics. In another sense, as we will see, quantum physics does not genuinely move beyond the framework of physical causes in a way that

¹³ Thus my critique of Pannenberg's future ontology as "counterintuitive" in "Anticipation and Theological Method," in Carl Braaten and Philip Clayton, eds., *The Theology of Wolfhart Pannenberg: Twelve American Critiques*, (Minneapolis: Augsburg, 1988), must be taken as over-hasty. I offer a fuller and more nuanced critique in the article, "Being and One Theologian," cited above.

helps to solve the puzzle of God's causal action — at least not until it is supplemented by a broader theory of emergence.

Consider, for example, the position of Werner Heisenberg, who explained the Copenhagen interpretation by taking a fundamentally Aristotelian view of quantum mechanics.¹⁴ Heisenberg believed that quantum indeterminacy was like the world of Aristotle's metaphysics, in which (actually existing) potentials strive to become actual. Under this interpretation of quantum mechanics, the subject acts as a sort of final cause, pulling a certain potential state into actual existence. Note that this view reverses the stance of classical (Newtonian) physics, which requires that the subject ultimately be explained in terms of physical laws.

For the Copenhagen theorists in general, when a definite measurement is made of a quantum state, the resulting macrophysical state results from combining a quantum-physical probability distribution and the scientist's decision of what, when and how to measure. Indeed, on this view the subject's role is in one sense the primary one: the "world" is merely potential until the moment of observation, when the conscious observer resolves it into an actual state. The most extreme form of this position — the form propounded for instance by John Wheeler — holds that the entire universe may have existed in a state of quantum potentiality until the moment when the first observer emerged, at which point the universe was *retroactively* resolved into macro-physical structures such as stars, planets, and the like. At one point Wheeler even applied this logic backwards as far as the creation of the universe:

Is the very mechanism for the universe to come into being meaningless or unworkable or both unless the universe is guaranteed to produce life, consciousness and observership somewhere and for some little time in its history-to-be? The quantum principle shows that there is a sense in which what the observer will do in the future defines what happens in the past – even in a past so remote that life did not then exist, and shows even more, that "observership" is a prerequisite for any useful version of "reality."¹⁵

The debate between the various interpretations of quantum mechanics has not yet been resolved, and there is reason to wonder whether it even could be resolved physically. It's therefore at present a philosophical debate, and one which, as I hope to show, is deeply influenced by metaphysical assumptions about causality. At the risk of oversimplification, we might state the basic opposition in this way: if you take it to be crucial that the explanation of the world be given ultimately in terms of physical causes, then you will be justified in rejecting interpretations that

¹⁴ See Werner Heisenberg, *Physics and Philosophy: The revolution in Modern Science*, (New York: Harper & Row, 1962).

¹⁵ John Wheeler, quoted in P. C. W Davies, *Other Worlds: A Portrait of Nature in Rebellion, Space, Superspace, and the Quantum Universe* (New York: Simon and Schuster, 1980), p. 126.

depend essentially on the causal activity of a subject — even at the cost of an incredible loss of parsimony. It may *seem* like ontological exuberance (or over-kill) of the worst sort to assert, with DeWitt, that “our universe must be viewed as constantly splitting into a stupendous number of branches” and that “every quantum transition taking place on every star, in every galaxy, in every remote corner of the universe is splitting our local world into myriads of copies of itself. Here is schizophrenia with a vengeance!”¹⁶ But if one holds, as many many-worlds theorists have, that this is the only viable *scientific* interpretation that interprets quantum mechanics in terms of physical causes alone, and if one has a strong enough commitment to avoiding any appeal to subject- or intention-based causes (e.g., final causes), then it may be a cost one is willing to pay.¹⁷

But what if you believe that subjects do play an irreducible part in the causal chain? In this case your metaphysical belief will incline you to see quantum mechanics as *evidence* for a causal role for the subject – as a number of its leading theorists have in fact maintained. Instead of multiplying worlds unnecessarily, you’ll argue, one should see quantum mechanics as a (the?) point at which the explanatory story begins to require non-physical, or even mental, causes. Thus the quantum physicist Carl Friedrich von Weizsäcker argued in *Zum Weltbild der Physik* (1949) that quantum physics was the vindication of Kant’s dualism, his sharp separation between the kingdom of causes and the kingdom of means and ends. This was also the view taken by Eugene Wigner and his followers. Wigner used the quantum revolution to argue that “the minds of sentient beings occupy a central role in the laws of nature and in the organization of the universe, for it is precisely when the information about an observation enters the consciousness of an observer that the superposition of waves actually collapses into reality.”¹⁸ Interestingly, one of Roger Penrose’s arguments against many-worlds theories also appeals to subject-based considerations. He calls them “zombie theories of the world” because “the continual branching of the world and the threading of my own consciousness through it would seem to result in my becoming separated from the tracks of consciousness of all my friends” (Penrose 1979). Penrose insists that one needs an adequate theory of consciousness *before* one can make sense of the many-worlds view as an interpretation of quantum mechanics.

Now there are also serious objections to the subject-based interpretation of quantum

¹⁶ See De Witt, quoted in Davies, *Other Worlds*, p. 136. See also Bryce DeWitt and Neill Graham, *The Many Worlds Interpretation of Quantum Mechanics* (Princeton, Princeton University Press, 1973)

¹⁷ Put more strongly, one can sometimes see no stronger motivation for some of these views than the sense that Copenhagen or subjectivity-based views are methodologically opposed to the interconnections among the sciences which alone could yield completed science.

¹⁸ Eugene Wigner, quoted in Davies, *Other Worlds*, pp. 132f.

mechanics, objections which draw out its counterintuitive nature.¹⁹ But the fact is that during the last 75 years major physicists have found themselves needing to experiment with the idea of essentially non-physical causes in order to explain the anomalies of the quantum world. Indeed, quantum physics has recently challenged classical notions of causality in yet another way. “Entangled particles” are particles emitted from a common source that preserve certain symmetries even when widely separated in space. For example, measuring the spin of one entangled particle will instantaneously cause the other to exhibit the corresponding spin — even if the two particles are 10 km. apart at the instant of measurement. Because no causal influence can be propagated faster than the speed of light, these results suggest a radically new type of influence or connection. So-called entanglement phenomena have been cited, for example, as evidence for holistic conclusions. Even mainline physicists such as Henry Stapp find in them signs of an overarching interconnection of all things:

The principle of local causes asserts that what happens in one spacetime region is approximately independent of variables subject to the control of an experimenter in a far-away spacelike-separated region....The statistical predictions from which this result follow...have been experimentally tested and confirmed.

Bell’s theorem shows that no theory of reality compatible with quantum theory can allow the spatially separated parts of reality to be independent.²⁰

In a more extreme vein, Stapp’s comments have led Ken Wilber to claim that entanglement experiments provide increased justification for the holism of the Eastern traditions:

It is common among the “new-paradigm” thinkers to claim that the basic problem with science is that, under the “Newtonian-Cartesian” worldview, the universe is viewed as atomistic, mechanistic, divided, and fragmented, whereas the new sciences (quantum/relativistic and systems/complexity theory) have shown that the world is not a collection of atomistic fragments but an inseparable web of relations. This “web-of-life” view, they claim, is compatible with traditional spiritual worldviews, and thus this “new paradigm” will usher in

¹⁹ For example, one objection imagines that a meter is set up to permanently register whether the radioactive particle has decayed at the end of a minute (assume an experimental set-up in which there is a 50% probability of this occurring). Two photographs are then automatically taken of the meter reading, first photo A and then photo B. The photographs are developed but no one looks at them. Imagine that ten years are allowed to pass during which no subject observes either the meter or the photos. At the end of that time a subject looks at photo B, and suppose that she observes the meter to register a radioactive decay. On Wigner’s view, at that moment but not before the superposition of states will be collapsed, the particle will (retroactively) have decayed, the meter will (retroactively) register its decay, and photo A (which no one has yet looked at) will suddenly show a picture of the meter in its “on” position. Before that moment photo A was still indeterminate; the observation of photo B makes A determinate – despite the fact that A was taken *before* B.

²⁰ Stapp, “Theory of Reality,” *Foundations of Physics* 7 (1977): 313-23.

the new quantum self and quantum society, a holistic and healing worldview disclosed by science itself. ... The problem, in other words, was not that the scientific worldview was atomistic instead of holistic, because it was basically and generally holistic from the start. No, the problem was that it was a thoroughly *flatland holism*. It was not a holism that actually included all of the interior realms of the I and the WE (including the eye of contemplation).²¹

Admittedly, these reflections are highly speculative and go beyond what most physicists would be willing to conclude. Still, the founders of quantum mechanics were the first to stress that whatever ontology will finally express the quantum physical results and theories will be radically different from the everyday ontologies that we are used to in the macrophysical world and in traditional philosophical theories. Clearly quantum physics requires some radical rethinking of our notions of causality.

Psychological Causes

Classical physics (and non-Copenhagen interpretations of quantum mechanics) hold that all causal forces are ultimately explainable in terms of the laws of the underlying physical reality. If this view were true, it would raise insuperable problems for any appeals to divine causes, since they are said to issue from a transcendent and free source. But there is another area of science, in addition to the one just presented, that suggests the inadequacy of this view. If there are genuinely psychological causes, then there is at least one type of causality that stretches beyond physical causality. If so, it would appear that the genus “cause” can include types of influences other than mechanistic ones.

I have already noted the four major transitions in the natural world that evidence the phenomenon of emergence. In the case of the emergence of consciousness through the human

²¹ Ken Wilber. *The Marriage of Sense and Soul: Integrating Science and Religion* (New York: Random House, 1998), pp. 38, 57. When concepts such as these are fleshed out into the full form of the more radical Eastern mystics, the results can be startling: “The reason is that in quantum physics the elements are not physical themselves; they do not exist as objects. Their very existence depends on the idea of their existence beforehand. They are treated as ‘tendencies to exist’ rather than as already existing possibilities like the sides of a flipped coin. In the quantum world the quantum coin’s sides do not appear unless someone calls for them to appear” (Fred Alan Wolf, *Star Wave: Mind, Consciousness, and Quantum Physics* [New York: Macmillan, 1984, p. 17]). And “Thus we conclude that the ‘new physics’ introduces the element of consciousness into the material world. This consciousness will not arise from the molecule itself, as seen as a material unit, but will arise as a ‘risk-taking’ psyche - that is, one that chooses. These choices cannot be made willy-nilly. ‘Reason’ must begin to make its appearance, which surpasses the simple mechanism of cause and effect. We know that atoms do not follow the laws of cause and effect except statistically or on the average. To explain the evolution of learning, associative memory, and possibly even the more primitive forms of memory called habituation and sensitization, we must face the quantum. State of consciousness, feelings, emotional states, and psychology as a science may depend on recognition of mind, the consciousness of the universe, arises through quantum physics (Wolf, *Star Wave*, pp.18-19).

brain and central nervous system the evidence for another type of cause is perhaps the clearest. Noticably more than even ten years ago, the natural sciences of the human person — neurobiology, primatology, cognitive science, evolutionary psychology — are today acknowledging the realm of the mental as an emergent phenomenon. The difficulty no longer lies in showing the irreducibility of mind, but rather in demonstrating that mind can have “downward” causal effects on the body and the world (which will be necessary if one is to speak of God’s effects on the world).

What is it precisely emerges? What emerges in the human case is a particular psycho-somatic unity, an organism that can do things both mentally and physically. Although mental functions supervene upon a physiological basis²², the two sets of attributes are interconnected and exhibit causal influences in both directions. To say that human persons are *psycho-somatic unities* is to say that we are complexly patterned entities within the world who evidence diverse sets of properties and causes operating at different levels of complexity. A living body and a functioning brain are *necessary* conditions for personhood, yet the wide discrepancy in the vocabularies of neuroscience and psychology suggests that they are not *sufficient* conditions. Personhood is not fully translatable into “lower-level” terms; persons evidence causal and phenomenological properties (*qualia*) that are uniquely personal.

Studies of the human person must be multi-dimensional because persons are the result of causal influences that operate at the physical, biological, psychological and (I believe also) spiritual levels — and because these levels, though interdependent, are not mutually reducible. In particular, psychology does not need to be at war with the experience of every human actor in the world on the question of mental causation: there are genuine mental causes that are not themselves the product of physical causes. The causal history of the mental thus cannot be told in physical terms, and the outcome of mental events is not determined by phenomena at the physical level alone. Talk about the subjective experience of being in love or the sense of self-awareness is irreducibly mental; such phenomena exercise a type of causal influence of their own.

Now the critic may object that talk of mental causes is like returning to occult causes in the physical world or “vitalist” causes in the biological world. But science stopped appealing to such causes because of the recognition that the realms of physics and biology operate in a fully law-like manner *based on explanatory successes in the relevant sciences*. Is it true that human persons are analogous to rocks and cells, that their behaviors can be exhaustively predicted and explained in a “bottom-up” manner? I have argued that we have good evidence to think not. Indeed, the hierarchy of the sciences itself offers evidence of principles that are increasingly divergent from

²² For an emergentist theory of supervenience see Clayton, “Neuroscience, the Person and God: An Emergentist Account,” *Zygon* (Sept. 2000).

“bottom-up” physical causality.²³ Functionalist causal explanations play a role in the biological sciences (from cell structures through neural systems to ecosystem studies) that is different from causal explanations in fundamental physics, just as explanations appealing to intentions as causes play a role in explaining human behavior that is without analogy at lower levels.²⁴ As one moves up the hierarchy of emergence, one finds an increasing role for top-down causal action. Thus, for example, DNA embodies in its very structure the top-down action of the environment on the molecular biology of the human body. In intentional explanations it is even more clear that the goal for which the agent acts, and the broader context within which she understands her actions, causally influence her particular thoughts and behaviors.

Note the theological implications of this view. It is easier to maintain that God influenced the convert to bring him to his new religion than it is to argue that God fixed the broken plumbing system in one’s house (unless one has *also* had a plumber come to do the repairs!). The reason for the difference is that we do not now possess, and may never possess, laws of human behavior. In contrast to natural scientists, social scientists can at most ascertain broad patterns of human response, and even these evidence a virtually unlimited number of personal and cultural exceptions. Within the human realm, it seems, uniqueness and idiosyncrasy are the norm. No laws are broken when we speak of an individual action in a non-standard way — indeed, this is almost what we *mean* by an individual action! “Psychological miracles” — God’s causal influence on the thought, will and emotions of an individual person — could therefore be frequent occurrences; God could bring about changes in one’s subjective dispositions without causing an affront to natural scientific knowledge of the world.²⁵

Double Agency and Divine Persuasion

But what kind of causal influence would this be? The great British philosophical theologian Austin Farrer developed a sophisticated account of divine action which he called the “double agency”

²³ I cannot review the entire argument here. It is powerfully laid out in Arthur Peacocke, *Theology for a Scientific Age: Being and Becoming — Natural, Divine, and Human* (Minneapolis: Fortress Press, 1993).

²⁴ These emerging orders of explanation may also involve an increasing role for top-down explanations. In intentional explanations it is even more clear that the goal for which the agent acts, or the broader context within which she understands her actions, influences the particular behaviors or thoughts.

²⁵ Perhaps this is why one finds so little resistance to purely “psychological” accounts of Jesus’ resurrection. I recall, for example, listening to various conversations within the Jesus Seminar -- a group famous for its resistance to supernatural miracles in the New Testament documents -- in which the reawakened faith and hope on the part of the disciples was gladly designated as “the resurrection of the Christ.” Christian theologians across the liberal/conservative spectrum are willing to speak of the presence of God in individuals’ personal experience and of God’s providential role in guiding them “toward all truth.” (John 16:13).

view.²⁶ On this view, every action in the world includes a causal role for one or more agents or objects in the world (the “secondary” causes) and a role for God as the “primary” cause of what occurs. Kathryn Tanner summarizes and defends something like Farrer’s position:

The theologian talks of an ordered nexus of created causes and effects in a relation of total and immediate dependence upon divine agency. Two different orders of efficacy become evident: along a “horizontal” plane, an order of created causes and effects; along a “vertical” plane, the order whereby God founds the former. Predicates applied to created beings ... can be understood to hold simply within the horizontal plane of relations among created beings.²⁷

Such a view of action implies that God’s action in the world should be understood as something more like divine persuasion. Responding to Tanner, Tom Tracy concludes:

There are, therefore, important respects in which the free acts of creatures can be regarded as God’s acts. If we deny that God is the *sufficient cause* of the creature’s free acts, we can immediately go on to affirm that God acts with the infinite resources of omnipotence to *guide* those choices by shaping the orienting conditions under which they are made. In untraceably many, varied, and subtle ways, God continuously brings to bear the pressure of the divine purpose for us without simply displacing our purposes for ourselves. God’s action goes before our own, preparing us (in spite of ourselves) for the unsurpassably great good that God has promised us.²⁸

This theory does alter how God’s causal agency is said to contribute to human actions in the world, at least in comparison to classical views of divine action. On most classical views, God’s decision to bring about an effect in the world was taken to be sufficient for that effect to occur; it did not require the concurrence of any finite person or object. On this view, by contrast, God must persuade the agent in question to act in a particular way for the event to occur. Hence, again, the special role for the human psyche: a mind can be convinced or persuaded, whereas (as far as we know) a rock cannot be persuaded to act on its own, no matter how good the arguments. Though it limits the efficacy of the divine will in the world, I nonetheless believe that Tracy’s position is

²⁶ Add refs: Austin Farrer, *Finite and Infinite*, 2nd ed. (London: Dacre Press, 1959); and F. Michael McLain and W. Mark Richardson, eds., *Human and Divine Agency: Anglican, Catholic, and Lutheran Perspectives* (Lanham, MD: University Press of America, 1999).

²⁷ See Kathryn Tanner, *God and Creation in Christian Theology: Tyranny or Empowerment?* (Oxford: Basil Blackwell, 1988), p. 89, also cited in Tracy, “Divine Action, Created Causes, and Human Freedom,” in Thomas F. Tracy, ed., *The God Who Acts: Philosophical and Theological Explorations* (University Park, Pa.: Pennsylvania State University Press, 1994) p. 86. Tracy modifies: Under this [his] view, only if I am the cause of my action is my responsibility preserved.

²⁸ See Tracy’s own article in Tracy, ed., *The God Who Acts*, pp. 101f.

sufficient for the theological needs of theists today.²⁹

Viewed in this way, God's role becomes that of one who prepares and persuades, rather than the one who "brings about" human actions by divine fiat alone. This view is also conceptually much neater than the alternatives, since it also attributes basic actions to humans. Like the theist traditions, however, it does continue to ascribe to God a crucial causal role in "luring" humanity and encouraging certain types of actions. Further, according to this model there must be genuine openness in history. The theologian Wolfhart Pannenberg, among others, has made clear that the result is that one cannot *know* in advance that God will bring about the ends that he desires to accomplish.³⁰ Nonetheless, one *can* know that, if God is God, these ends will in the end be achieved, such that the final state of affairs will be consistent with God's nature.

Evolution as a Test Case

Consider evolution as a particularly difficult test case for this theory of divine causal influence. (I take contemporary evolutionary theory as the starting point: there is no point in "lowering the bar" at the outset in order to make things easier for theists.) On the one hand, the standard model requires that the evolution of life be a product of a process of random genetic mutation, where the environment selects for the fittest individuals. On the other hand, any theist who wishes to avoid deism must assert that God in some way guides the process of evolution to bring about the effects he intends (conscious life, persons, salvation history).

In most of biological evolution God cannot influence conscious beings, so the type of causality defended in the previous section cannot be employed, at least not directly. But the recent synthesis of biology and information theory does open the door to an at least analogous type of causal influence. The dimension of information became central in biology following the discovery of the genetic code responsible for the in-forming of the cell and organism as a whole. Recent work has interpreted biological structures (morphology) and the organism's interaction with its environment as processes involving the storage, use and exchange of information — think of it as a cybernetic or semantic version of Aristotle's formal causes. Even nutrition has been construed as the ingestion of highly structured (informationally rich) matter with low-information energy as a byproduct.³¹

²⁹ It remains *metaphysically* possible, of course, that a God who created the universe could bring about any effect within that universe that he might choose to accomplish. The position seeks merely to describe the standard mode of divine influence in the world.

³⁰ See e.g. Pannenberg "Der Gott der Geschichte," in *Grundfragen systematischer Theologie: Gesammelte Aufsätze*, vol. 2 (Göttingen: Vandenhoeck und Ruprecht, 1980), pp.112-128.

³¹ See Puddefoot's article in Mark Richardson and Wesley Wildman, eds., *Religion and Science* (New York: Routledge, 1996).

The informational approach clearly suggests parallels with information processing in the sphere of mental activity. As we saw above, no physical laws are broken if there is an exchange of information between a divine source and conscious human agents. The key to reconciling evolution and theism is the recognition that the process of information transfer at the conscious level is anticipated at other points within the biosphere. In particular, the introduction of goals — and especially the goal of increasing complexity — can be held out to evolving life forms as a possibility for their development without contradicting the mechanisms of evolution. Morphological possibilities (formal causes) can be presented as a type of information that helps pull the evolutionary process toward the goal of increasing complexity (final cause).

This position has several advantages. For example, it helps resolve the question of how complex organs, which come to have survival value only when they are fully developed and functional, could emerge gradually over many, many generations through a combination of genetic (bottom-up) and environmental (top-down) influences. It is also consistent with the recent emphasis on epigenetic effects — “top-down” causal influences — in cytology (the study of cells). The data now show that a two-way interaction occurs between the DNA of a cell and the cell as a whole. Since particular proteins in the cell function selectively to cause particular segments of the genome (i.e., particular elements of genetic information) to be expressed, the determining influences are not only “from below.” In a similar manner, social behavioral studies in primatology show how the broader environment pervasively influences the development of the organism without superseding genetic mechanisms. The effects of broader systems or wholes are therefore already standard parts of the overall biological explanation. Thus Steven J. Gould writes, “Minor adjustment within populations may be sequential and adaptive. ... Evolutionary trends may represent a kind of higher-level selection upon essentially static species themselves, not the slow and steady alteration of a single large population through untold ages.”³²

My suggestion is that the framework of information theory in biology will help establish enough parallels with psychological causes that we can make sense of a divine causal influence on this process. It is a matter of extending the spheres of causal influence “upward” through cell, organ, organism and environment. The information model allows for divine causal constraint in a way that remains consistent with the hierarchical structure of the natural world as we know it. If I am right, theists can now speak of the sort of divine influence required by the doctrine of divine providence, while conceiving this influence in a way that does not require the addition of new causes or new energy into the system. A direct divine intervention to change the chemistry of a cell would be a miracle in a way that the chemical effects produced by one’s shifting one’s attention would not be. An information-based “lure” on the evolutionary process construes the divine influence in a fashion much more similar to the latter than to the former.

³² Stephen J. Gould, *The Panda’s Thumb: More Reflections in Natural History* (New York: W. W. Norton, 1980), p. 15.

Toward a Theory of Emergent Causality

Let us now attempt to put these various resources together into a single theory of emergent causality. We have agreed to accept modern natural science as a source of justified explanations of the natural world, and we have conceded that these explanations depend primarily on efficient causation. It certainly does not follow from the fact that pre-modern philosophers utilized three other types of causality that we can simply reintroduce them alongside efficient causality. Critics would rightly point out that the success of modern science seems to have been based on its insistence on explanations in terms of traceable and reconstructable series of (efficient) causal histories in the natural world.

The challenge that we philosophers and theologians are faced with is nothing less than to sketch a new theory of causation. I have suggested that the resources for this new theory lie in concepts already employed by scientists in various fields: entanglement phenomena in quantum mechanics, mental causes in psychology, information theory and epigenesis in biology, and the structure of emergence that appears again and again as one climbs the ladder of complexity in the natural world.

Causal relations *up* the emergent hierarchy are uncontroversial, since they rely on efficient causality. The slogan of modern science might be expressed as “explanation, and therefore ontology, reduces downward; causes propagate upward.” The standard model in scientific explanation is to explain complex behaviors (or the behavior of complex bodies) in terms of fundamental forces acting on their constituent parts. It might look mysterious that a cell can divide and divide again, suggesting to vitalists the need for a higher and more mysterious “life principle” to explain these actions. But when one has understood the biochemistry of cell division, the catalytic effect of enzymes, and the basic genetic architecture and functioning of the cell, no mysterious forces remain. The compilation of these myriad physical particles and forces, combined with the effects of chemical properties, tell the whole causal story. With this bottom-up account in place, no other causal story is necessary. Or so it seemed.

But emergence has shown that upward propagation of causes is *not* the whole story. The state of the whole — the whole physical system within which particles interact, the whole cell, the whole organism, the whole ecosystem — affects the behavior of the particles and the causal interactions that they have (though these interactions, once so affected, do propagate upwards). Now admittedly some are arguing that no actual causal forces are involved. Arthur Peacocke leans in this direction when he speaks of “whole-part constraint” rather than of downward causation.³³ Likewise, certain branches of complexity theory, including complexity theorists such as John

³³ See (originally) Arthur Peacocke, *Creation and the World of Science*, the Bampton Lectures 1978 (Oxford: Clarendon, 1979).

Holland who use the word emergence, also allow only upward causation, although they do grant that something new and unpredictable (at least in lower-level terms) emerges. By contrast, I shall argue that the phenomena allow for, and may actually require, the notion of a downwardly propagating causal influence. How can this be understood?

In this paper I started with the most compelling area, the relationship of the mental to the physical. To make the position as little controversial as possible, I have not posited a separately existing substance called soul or mind, but only the existence of mental predicates. Physicalists who reject emergence understand these to be mental properties of a physical object, in this case the brain. But I suggested that the strength of our experience of mental causation — the ability of our ideas and thoughts to cause bodily movements such as speaking, walking or raising an arm — is so great that real mental causation must be taken as the default position. The onus is thus on those who would deny any causal efficacy to ideas or wishes.

I then turned to the question of evolution. At first blush it looked like a stand-off: evolution is incompatible with theism, and divine providence or action in the world is incompatible with evolution. What does one do when encountering a problem that cannot be solved either from the bottom alone (i.e., through genetics and biochemistry), or from the top alone (i.e., by negating biology and imposing a theological answer)? One looks for a way to place several different disciplines together to solve the problem — not as identical (which is false) or as incompatible (which is inadvisable), but in a dialectical relationship. Specifically, I suggested, the contradiction is overcome if what evolution demands and what theology requires are not contradictory but complementary. This turned out to be the case: evolution forbids internal purposes or causal influences from outside, whereas theism requires only that the product of the evolutionary process reflect the divine intention to create rational, moral creatures who can be in conscious relationship with the divine. This might have occurred by God's initiating a process that he knew in advance would necessarily produce such creatures without any further guidance on his part. But in the case of evolution it proved possible to find an analog to the downward causation that we experience in conscious volition. Because of the analog God could guide the process of emergence through the introduction of new information (formal causality) and by holding out an ideal or image that could influence development without altering the mechanical mechanisms of evolution or adding energy from outside (final causality).

Of course certain caveats and limitations must be expressed. The framework of guided emergence does not amount to the sort of control of the evolutionary process often conceived by theists. The explanations of biological phenomena are indeed given in terms of evolutionary biology, and the conclusions and constraints of that discipline are not short-circuited by this response. Guidance by possibility and by information is not a form of efficient causation; it comes closest to the luring nature of "formal causes" associated with Aristotelian philosophy. But it is sufficient to provide the sort of structure traditionally implied by a doctrine of providence. The

notion of “purposiveness” I am employing admittedly has a quasi-“as if” status: the biological world develops *as if* it were being guided by a divine hand. Elsewhere I have called this, following Kant, *purposiveness without purpose*. Still, all the conceptual framework needs to accomplish is to show that science does not require one to speak of this guidance as a mere fiction, and this it successfully does.

Agenda for the Future³⁴

It has been said that we today lack what the medieval Islamic and Christian philosophers had: a unitary theory of causation. The required theory must be comprehensive enough to do justice to the strength of scientific causal explanations *and* be able to integrate them, together with mental and divine causation, into a single causal account of the world. I have sought to outline such a theory in these pages.

As both Aristotle and the medieval Islamic philosophers saw, an adequate theory of causation must finally be integrated with an ontology. The doctrine of “efficient causes alone” was a natural expression of the physicalist ontology of Newtonian mechanics, according to which all that exists are bodies and forces within absolute space and time. This view held from the foundations of modern physics in Galileo and Newton to the advent of the Copenhagen interpretation of quantum mechanics in the 1920s. Similarly, Aristotle’s theory of four causes was fully integrated into a metaphysics in which things were not mere point-masses but actualities that resulted from the striving of prior possibilities to reach their natural *telos*.

The ontology presupposed in this paper is an ontology of emergence, which I have elsewhere called *emergentist monism*.³⁵ On this view there is only one natural world (hence dualism is false). But as this one “stuff” becomes organized in more and more complicated ways, new properties emerge. Although their manifestation is dependent on the properties of the underlying particles, and thus ultimately on the laws of physics, their behavior is irreducible to any of the underlying levels. Hence the natural world evidences the emergence of genuinely new properties. At each level of emergence, new structures obtain and new causal forces are at work. We can extend the structure of emergence downward to address questions of fundamental physical law, and we can extend it upwards to come to a better understanding of conscious, and ultimately spiritual,

³⁴ The options, summarized from ch 7 of GCS: *1. God’s Action as “Top down” Causality* (John Polkinghorne); *2. Does Chaos Theory Provide an Opening for Divine Action?*; *3. A Theory of Divine Action based on Quantum Indeterminacy*; *5. A Panentheistic Theory of Divine Action*

³⁵ See the article in Robert Russell et al., eds., *The Neuroscience of the Person* (Berkeley, Center for Theology and Natural Sciences, 1999). The theory of *emergentist monism* has been developed in collaboration with Arthur Peacocke, whose influence on the outcome I happily acknowledge. See Peacocke’s article in the same volume “The Sound of Sheer Silence: How Does God Communicate with Humanity,” p. 215.

properties. I have therefore argued that emergent causal levels reflect the hierarchical structure of the natural world and may help to elucidate the nature of divine action (though they are not identical to it). The differences between natural and super-natural causation that remain do represent a continuing burden to Muslim and Christian thinkers in an age of science. Given an adequately broad theory of causation, however, the burden is bearable.

This is truly theology in a new key. We may shy away from magical interventions into the physical world and yet still find that world “re-enchanted” as the field of action of the divine. The beauties of our planet and the richness of its life forms are not distant expressions of the providence of God; they continue to manifest the divine presence. We can again look to the structures (and contents!) of individual consciousness, and to the growth and development of culture, for signs of divine guidance and creativity. Think for example of the cultural means by which individuals who are open to the divine lure can influence other individuals. An idea of genius (Einstein’s special relativity, Kant’s critical philosophy, Ghandi’s non-violent resistance) or an artistic genre (classical harmony, the Sufi poets) — which might reflect the divine causal influence — can spread like wildfire through a large number of minds or through human experience in general. Individual minds integrate into groups of minds; individual actions influence other actions.

Of course, one cannot *demonstrate* that a given idea is God-breathed or that either religious groups, or human culture as a whole, is progressing toward greater harmony with the divine will; the previous centuries offer too painful a picture of regress in the other direction for such melioristic optimism to be convincing. Still, the “upwardly open” nature of human consciousness, infused as it is with intimations of immortality, offers a powerful model of the integration of mind and spirit. Just as the neurophysiological structure of the higher primates is “upwardly open” to the emergence and causal power of the mental, so the mental or cultural world is upwardly open to the influence of the Creator Spirit.