

THEOLOGY AND SCIENCE WITHIN A LAKATOSIAN PROGRAM

by Nancey Murphy

Abstract. The writings of Ian Barbour and Arthur Peacocke can be construed as initial contributions to a Lakatosian research program on the relation between theology and science, the core theory of which is the thesis that theology belongs at the top of a nonreducible hierarchy of sciences. The positive heuristic of this program involves showing that theology and the sciences have enough in common epistemologically to be so related and arguing for nonreducibility. The author in this essay “rationally reconstructs” some of her philosophical work as a contribution to these tasks.

Keywords: Ian Barbour; Dennis Bielfeldt; Philip Clayton; George Ellis; Imre Lakatos; Arthur Peacocke; physicalism; reductionism; supervenience.

Replying to my three respondents, Dennis Bielfeldt, Philip Clayton, and George Ellis, has been an invigorating challenge. I proceed in my response as follows. Commenting on the fact that both he and I have used Imre Lakatos’s methodology of scientific research programs for understanding theological rationality, Clayton states that “many realized that specific theories for relating theology and the sciences could also be judged as research programs, for they too either help to explain results in theology and the sciences or fail to do so” (Clayton 1999, 610). I have to admit that I am not one of the “many” who thought along these lines. Ellis and I note in *On the Moral Nature of the Universe* (Murphy and Ellis 1996) that the synthesis we provide of theology, ethics, and the sciences might be considered as the beginning of a research program *in* theology and science, and in

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my first article in *Zygon*, "Acceptability Criteria for Work in Theology and Science" (Murphy 1987), I had drawn some conclusions for evaluating theology and science proposals from Lakatos's methodology. But it had never occurred to me that theories about *how* to relate theology and science could also become cores of research programs. Note the difference between theories *in* science and theology versus theories of the (proper) relationship *between* science and theology.

In light of Clayton's suggestion, I have been able to think in new ways about my own contributions to the field of theology and science. In this essay, then, I shall "rationally reconstruct" some of my work as a series of contributions to a program on the relation between science and theology that can be attributed largely to Ian Barbour and Arthur Peacocke. Then I shall respond more directly to comments by my respondents.

THE BARBOUR-PEACOCKE RESEARCH PROGRAM

The core of what I shall call the Barbour-Peacocke research program begins with the notion of a nonreducible hierarchy of sciences, or a hierarchy of complex systems, and asserts that theology belongs at the top of the hierarchy of the sciences. The hierarchical view of the sciences is not original with Barbour or Peacocke. Barbour has an excellent account of its role in the philosophy of biology earlier in this century: the "organicists" were opposed to both vitalism and mechanism in biology (Barbour 1966, chap. 11). The logical positivists of the 1920s and 1930s also made use of the hierarchical model, but their goal was reduction of all higher levels to physics.

The suggestion that religion be included in the hierarchy of complex systems precedes Barbour's *Issues in Science and Religion* (1966); I have found it already in the writings of Roy Wood Sellars, who labels the levels of complexity as the inorganic, the organic, the conscious or mental, the social, the moral, and the spiritual or religious. However, despite his championing of a nonreductive or emergentist account of the levels studied by the natural sciences, Sellars ultimately reduces religion to human values (Sellars 1970).

So far as I know, the notion of theology as the top science in a (thoroughly) nonreducible hierarchy originated implicitly in Barbour's and explicitly in Peacocke's writings. It is implicit in *Issues in Science and Religion* in Barbour's claim that "an interpretation of levels can contribute to a *view of man* which takes both the scientific and the biblical understanding into account" (Barbour 1966, 360; emphasis in original). Here it is implied that the religious perspective is an indispensable level of description of human life. This notion was explicit in Peacocke's work by the time he published *Creation and the World of Science* (Peacocke 1979). In an appendix he says:

It seems to me that no higher level of integration in the hierarchy of natural systems could be envisaged than [worship and other religious activities], and theology is about the conceptual schemes and theories that articulate the content of this activity. Theology therefore refers to the most integrating level we know in the hierarchy of natural relationships of systems and so it should not be surprising if the theories and concepts which are developed to explicate the nature of this activity . . . are uniquely specific to and characteristic of this level. . . . For this reason theories and concepts which the theologian may apply objectively to religion . . . have a right not to be prematurely reduced, without very careful proof, to the theories and concepts of other disciplines appropriate to the component units (society, man, nature, etc.), the unique integration of which in a total whole comprise the religious activity *par excellence*. (1979, 369)

I can recall immediately being drawn to Barbour's and Peacocke's proposals for two reasons. It was my first exposure to nonreductive accounts of the hierarchy of the sciences (I had been worried about how to reconcile human freedom with reductionism since I was a university student). Second, it offered fruitful guidelines for more detailed accounts of how the contents of theology and the various sciences might interrelate. In short, the relation of theology to a particular science should be analogous to the relation of any science in the hierarchy to its neighbors below. This seemed obviously better than assuming either that theology has no relation to the sciences or that it meets (and thus competes with) the sciences at their own level.

THE POSITIVE HEURISTIC. Cashing out the analogy of theology to science as higher science to lower is central to what, in Lakatos's terms, would be the "positive heuristic" of the Barbour-Peacocke program. It is a straightforward task to list some of the topics that need to be pursued:

1. Does theology in fact have enough in common epistemologically with the sciences such that it can be counted as a science and incorporated into the hierarchy?
2. What, precisely, is the relation among the (natural) sciences themselves?
3. In what sense(s) are higher-level sciences not reducible to lower, and how can this nonreducibility be explained and evidenced?

Much of my philosophical work can be seen as attempts to address exactly these issues. My earliest work in theology and science, already underway when I first read Barbour and Peacocke, provided an answer to the first question. I argued, using Lakatos's account of scientific method (Lakatos 1970), that theological reasoning could be enough like that in science to count theology as a science (Murphy 1990b). Both Peacocke and Barbour use the philosophical thesis of critical realism to address this same question. I have criticized this move, not in order to argue for a nonrealist view, but because I believe that the language of realism and antirealism is

not the best way to get at the issues (Murphy 1990a; 1997, chap. 2).

More recently I have addressed the second and third questions. If it is the case that the various sciences provide complementary descriptions of (roughly) the same reality, then how should we understand the relations between any two such descriptions? One possibility would be to argue that the different languages used at the different levels are mutually exclusive and cannot be related. The opposite approach is to argue that all higher-level descriptions can ultimately be translated into the language of physics. Neither of these accounts does justice to the actual relations among the sciences. I have argued that the concept of *supervenience*, used in philosophy of mind to relate the mental and the neurobiological, is a valuable resource for understanding relations among all the levels in the hierarchy, including theology (Murphy 1997, chap. 10). Supervenience is a technical term recently introduced by philosophers, and its proper definition is still a matter of debate. How one chooses to define the term will determine whether the concept is useful or not for answering question 3, regarding reductionism. More on this in my response to Bielfeldt.

Questions regarding reduction are of paramount importance not only for the theology-science dialogue but throughout the contemporary intellectual world. One difficulty with debates in this area is a lack of agreed-upon terminology. My preferred phrasing of the question is: How is it possible to reconcile a physicalist ontology with recognition of the causal efficacy of higher-order entities in the physical world, most important of which are human persons? Accepted terminology fails us here. As I pointed out in "Physicalism without Reductionism" (Murphy 1999a), we need terms to distinguish an "ontological reductionism" that maintains that only the entities at the bottom of the hierarchy are "really real" from one that means simply that no added metaphysical entities such as vital forces or souls are added as we go up the hierarchy. The latter countenances atoms and cells and organisms and human beings as equally "real" constituents of the universe, with all of their peculiar properties such as life and consciousness and morality. This latter is the position Barbour, Peacocke, and I advocate, and a current project is to show that it is consistent with the denial of causal reductionism (Murphy 1999b; Murphy and Brown forthcoming).

AUXILIARY HYPOTHESES. Two very important "auxiliary hypotheses" of the Barbour-Peacocke program are, first, an emergentist-monist or nonreductive-physicalist account of the human person and, second, (for Peacocke) an account of divine action as analogous to top-down causation within the hierarchy of complex systems.

My interest in a nonreductive physicalist account of the person stems directly from the works of Barbour and Peacocke. I am often surprised by the resistance I find to this idea; it occurs to me that one reason for the resistance is that, apart from the Barbour-Peacocke program's core assump-

tion of nonreducibility *throughout* the hierarchy, my denials of reductive intent appear disingenuous. That is, there are two radically different worldviews that share the concept of the hierarchy of the sciences. The reductive worldview is much more familiar outside of the theology and science dialogue. Against the background of these reductionist assumptions, some form of ontological dualism appears to be the only alternative to the denial of the intellectual, the moral, and the spiritual. My current project (in collaboration with Warren Brown) involves giving an account of mental causation and free will consistent with nonreductive physicalism.

The key to a (truly) nonreductive account of the human person is surely going to involve a better understanding of downward or top-down causation. I agree with Peacocke that top-down causation is also essential for understanding divine action (for example, insofar as humans carry out divine intentions they must be acting in the world in a top-down manner). Yet, I have become convinced that top-down causation will not solve the most critical problem: the “causal joint” between God and the world. Consequently I have advocated an account of divine action at the quantum level, based on the following simple argument: If God acts in all of God’s creation, as the Christian tradition maintains, then necessarily (logically) God acts in the smallest of created entities and processes. This we understand to be the quantum level (Murphy 1995). This is one position I have taken that I regularly consider repudiating, but (*pace* Ellis) I have not done so yet. I hope that the next in the series of conferences sponsored by the Vatican Observatory and the Center for Theology and the Natural Sciences will resolve some of the relevant issues.

Let me end this section on a personal note. In reflecting on the portion of my scholarly work that falls within the domain of theology and science, I am amazed to see how thoroughly the course of my intellectual life has been affected by the accident of being at the Graduate Theological Union at the same time Robert Russell arrived to found the Center for Theology and the Natural Sciences, and by the fact that in one of the first courses he taught I was introduced to his own thinking as well as to that of Peacocke and Barbour. Their nonreductive physicalist account of the whole of creation, along with the hierarchical relation they envisioned between theology and the sciences, has indeed been the “hard core” of my thinking about God and the world ever since. I shall be forever indebted to all three.

RESPONSES

I am also indebted to my three respondents, who have challenged my thinking in a number of ways.

GEORGE ELLIS. Ellis, in his gracious essay, is on target in identifying needs for further development in my work. He calls attention to three

areas: (1) justification of the claim for a two-way interaction between the natural sciences and theology; (2) further support in social science research of the viability of the kenotic ethic he and I argued for in *On the Moral Nature of the Universe* (Murphy and Ellis 1996); and (3) solving problems concerning free will and religious experience that arise from a physicalist account of the person.

It should be clear from what I have written above that I agree with Ellis on the need for clearer accounts of supervenience and of the relation between top-down and bottom-up causation; I now think that the latter issue is the more crucial one. I hope scholars in the social sciences will be inspired to pursue research guided by a kenotic vision of human life; Ellis himself is more qualified than I to develop these issues.

Ellis's essay raises the question whether one should expect theology to have any influence on the "hard" sciences. He and I have disagreed all along about the role of social construction in science, although our differences are only a matter of degree. Both of us agree on the underdetermination of theory by data, yet both of us are opposed to views that make the natural sciences out to be mere social fabrications. I take it that in weaving webs of scientific theories, inspiration can come from anywhere (including theology); the linguistic resources available for theorizing come from culture, but control of the choice of theories comes largely from considerations of consistency and empirical support. One reason for differences from one science to another in the extent of cultural influences is language. Sciences that are highly mathematical use a universal idiom, whereas theories expressed in natural languages (such as Darwin's) are more easily colored by local points of view. So regarded, physics and cosmology, biology, psychology, and the social sciences fall along a continuum. Yet, there are reasons for making a sharp distinction between the natural and the human sciences. Ellis and I have taken a strong stand on the value-ladenness of the human sciences (Murphy and Ellis 1996); if theology is, as we claim, an arbiter of values, then there is a role for theological input into the human sciences that has no corresponding place in the natural sciences. This is a point that I have not emphasized clearly enough before.

The one point with which I wish to take issue is Ellis's concern that I am offering an account of religious experience that reduces it to ordinary sensory input interpreted according to social context. I confess that in writing "Physicalism without Reductionism" I intentionally omitted mention of divine action at the quantum level, it being, as Ellis notes, a highly controversial position, and one likely to distract the reader from the points I intended to make in that essay. Chief among those points was the argument that rejection of dualism does not entail rejection of genuine religious experience. So my argument, in brief, is that religious experience requires nothing *on the human side* apart from our ordinary cognitive equipment. What makes it authentic religious experience is that it is (in some

way, cautiously not specified here) *caused by God*. The judgment whether or not a given experience is caused by God is not straightforward, but there are somewhat useful criteria for such judgments that come under the heading of “discernment” in the Christian spiritual tradition. These criteria include the context in which the experience occurs.

PHILIP CLAYTON. Clayton commends me for bringing the “clear, sharp light of [my] analytic mind to bear on previously murky issues” (1999, 616). Yet Clayton’s own essay shows how much further there is to go in this direction. I shall focus my response here on attempting to clarify the obscure.

I appreciate Clayton’s highlighting of arguments I have made regarding what I call Anglo-American postmodern philosophy (see especially Murphy 1997). But allow me to restate some of Clayton’s characterizations of my position. First, I am not sure what it would mean to take a “stand against modernity” (p. 610). Rather, philosophical problems and the resources we have to address them shift through history. I have joined my voice with those who believe that the resources most favored by modern philosophers have been pretty well exhausted, without solving many of the problems to which they have been applied. New resources are available in the works of Ludwig Wittgenstein, W. V. Quine, J. L. Austin, and, most recently, Alasdair MacIntyre that do not so much *solve* the intractable modern philosophical dilemmas as show us how to *dissolve* them.

One of the intractable problems of modernity has been to provide a formal and consistent theory of truth that works for all kinds of knowledge. The “common sense” view that Clayton expresses, that “at their core, truth claims are about the world, that things are this way and not that” (p. 612) has proved resistant to adequate philosophical explication. It is *not* the case that I have advocated an approach to theology and science that dispenses with questions of truth. In “Truth, Relativism, and Crossword Puzzles” (Murphy 1989) I used the analogy of a crossword puzzle to argue that we need elements of correspondence (fitting the facts, fitting the clues) but also the other modern workhorse, the coherence theory (fitting the words across one another) to make sense of a complex belief system. But this analogy does not take account of the intriguing question of what we are to say of competing truth claims expressed in different (and perhaps incommensurable) conceptual schemes. More recently I have advocated something like MacIntyre’s account of truth, designed to answer the question how one can make claims not only for the truth of particular beliefs within a tradition but also for the adequacy of that tradition’s conceptual scheme. I shall not attempt to summarize my summary of MacIntyre here but refer interested readers to my *Anglo-American Postmodernity* (1997, chap. 6) and to references therein to MacIntyre’s own writings.

“Separate but equal” does not strike me as the most apt motto for my

account of theology and science. I have argued that science and theology are (potentially) the same in their forms of reasoning (Murphy 1990b), but I hope I made it clear that the data for theology are much more questionable than those for the hard sciences, so I see the disciplines as strikingly similar in some respects but not equal in all. (So the “equal” in “separate but equal” is a half-apt description?)

I regret the fact that I have not been a more successful advocate of MacIntyre’s contributions to questions of truth and rationality. I have learned much from his extensive historico-philosophical analyses of Western intellectual history, but I have also learned that his subtle views do not condense well. When Clayton says that MacIntyre’s recognition of the tradition-dependence of all standards of rationality means that science cannot set standards for other intellectual endeavors such as theology, he is overlooking what I take to be MacIntyre’s greatest epistemological achievement—what I call his “fractal” account of how rational adjudication between competing large-scale traditions is sometimes possible (see Murphy 1997, chap. 3). Because I do not see science and theology as competing traditions, it is not immediately apparent what this contribution of MacIntyre’s has to say about relating standards of rationality within science to those within theology. However, it is certainly significant that MacIntyre developed his narrative-based account of justification as a corrective to Thomas Kuhn’s and Imre Lakatos’s philosophy of science (MacIntyre 1977) and then went on to apply it in his argument for the rational superiority of the Thomist tradition over Enlightenment rivals (MacIntyre 1988; 1990).

I have yet to be convinced of any substantive difference between emergent evolutionism and the nonreductive physicalism I advocate. Both are opposed to substance dualism. Clayton indicates that the difference is that he believes “*imago Dei* qualities” are real and that spiritual properties exist, while I do not. This is a verbal dispute. The physicalism I advocate is a denial of substance dualism. It is nonreductive in the sense indicated above: the complex entities, such as human persons, that emerge over time are just as real as the “sort of objects studied by the discipline of physics” (Clayton 1999, 615). Humans have properties that distinguish them from lower-level entities, such as consciousness, morality, and spirituality, and these properties make a real difference in the world. Note that I refrain from saying that spiritual properties *exist*, not because I deny their existence but because I take this to be an unnecessarily confusing way to make the point—we know what it means to say that properties are instantiated but not what it means to say that properties are real or that they exist.

Some readers may think that I am splitting hairs at this point, but it seems to me to make a great deal of difference when one speaks of the emergence of spirits, or even more, of Spirit (a Hegelian notion?), as opposed to the emergence of persons who have spiritual properties.

Emergentists and physicalists agree in denying that one needs a nonphysical substance in order to predicate spiritual properties.

These brief remarks will not have satisfied all of my readers, but rather than satisfy, I would hope that they whet the appetite for further investigations of physicalism (of a nonreductive sort) and postmodernism (of an Anglo-American sort).

DENNIS BIELFELDT. The challenge for me in responding to Bielfeldt's essay is to answer the question of how we can reach such sharply different conclusions when we agree on so much. I agree entirely with his perception of issues in my work that are in need of further development. These are to give adequate explication and defense of downward causation, of my minority account of supervenience, and of my account of divine action. These issues are intimately related. I shall give more attention to downward causation than to the other issues because, as I said above, I have come to think that defense of downward causation is more important than the concept of supervenience for blocking causal reductionism, and also because the problem of divine action is not going to get settled in this issue of *Zygon* in any case.

Supervenience. Definitions of supervenience are highly contested. Donald Davidson (who introduced the term in philosophy of mind) says that he believed he was using it in the same way as did R. M. Hare (who introduced it in ethics). Hare has complained that Davidson got the concept wrong and compared his version instead to Jaegwon Kim's "weak" supervenience. But Kim says that it is Davidson's version that comes closest to Kim's own (see Davidson 1995). Help!

I believe my version of supervenience is the only one of these that comes close to Hare's original use. However, the point is not who defines it how but whether there are states of affairs in the real world that satisfy one or more of the definitions. Bielfeldt is right that if the majority definition (in terms of co-variation of properties) is the only one that finds instantiation in the world, then causal reduction is guaranteed. Kim is also correct in arguing that any account of supervenience that is strong enough to maintain the dependence of the supervenient properties on the subvenient properties will result in causal reduction *unless one countenances downward causation* (Kim 1994). Since writing "Physicalism without Reductionism" I have come to agree with Bielfeldt: supervenience cannot be used to legitimate top-down causation. However, I believe, a satisfactory account of top-down causation will turn out to be consistent with my account of supervenience.

Downward Causation. It is understandable that philosophers such as Kim should be suspicious of downward causation as some have described

it. In his Gifford Lectures, Austin Farrer did not employ the term *downward causation* but spoke of molecular constituents being “caught up and as it were bewitched by larger patterns of action” (Farrer 1958, 57). Roger Sperry, who has probably done more than anyone to promote the concept of downward causation, speaks in some instances of the properties of higher-level entities or systems *overpowering* the causal forces of the component entities (Sperry 1983, 117). However, a much less mysterious account can be found in the writings of Donald Campbell (1974) and, more recently, Robert Van Gulick (1995), both of whom emphasize that downward causation is a process in which higher-level entities or systems affect which causal powers of their constituents are activated. The difference is between overpowering lower-level processes and selective activation of lower-level causal processes.¹

My own thinking on these matters is still in progress, but I believe there are several steps we can take toward a more adequate account of causation in general that will help us understand downward causation. First, it has become common to think of causation as a relation obtaining between *events*. This has led philosophers of mind to pose questions regarding causation in terms of the causal powers of *properties* of events. I find this unhelpful. Instead, I believe, we need to enrich our resources for understanding causation by countenancing the causal role of properties of entities or objects, along with the causal role of events. That is, I think I know what it means for events to cause events and for the properties of objects to have causal roles, but I do not know what it means for the properties of *events* to have a causal role. The value of incorporating the causal role of entities has already been recognized implicitly by Sperry. He argues that the behavior of higher-level entities cannot be understood entirely on the basis of lower-level laws because one also has to take into account the spatio-temporal patterning of physical masses. Such physical patterns exert causal influences in and of themselves. “This space-time causality, or *pattern factor*, prevents reduction, as a rule, of macro to lower level phenomena” (Sperry 1993, 880; emphasis in original).

Second, a term often used to highlight the causal role of structures is the “boundary conditions” of a causal process. Fred Dretske has proposed terminology that I find more enlightening. He distinguishes between triggering causes and structuring causes, as illustrated by the following example: the design of the computer hardware and the programming of the machine are structuring causes that make it the case that a triggering cause, such as striking a key on the computer keyboard, will have the effect it does (Dretske 1995, 122–23). So, for many purposes, it is an oversimplification to represent a causal sequence as a single series of events: $E \rightarrow E \rightarrow E$. Instead, we need to think of two series of events: those leading up to the triggering of the effect as well as those leading up to the condition

under which T is able to cause E, and this condition will be something like Sperry's pattern factor.

Third, Alwyn Scott points out that we need to take into account the peculiar causal role of nonlinear dynamic systems (Scott 1995). These are self-maintaining systems in which matter and energy are not conserved and in which the causal effect of the whole is not equal to the sum of the causal effects of the parts.

These three insights are all exemplified in brain processes. The simplest example is a nerve impulse. Scott says that "the nerve impulse emerges as a well defined dynamic entity. On a particular fiber, it has a characteristic shape and speed. It is a *thing* and asks to be treated as such" (Scott 1995, 51). Nerve impulses are pulses of electrical charge traveling along the axon of a nerve cell. The voltage in one region of the cell changes rapidly from a resting state of -65 millivolts to +55 and back again. This process, once begun at one end of the neuron, travels down the length of the cell much as a flame travels along a wick or fuse. The micromechanism that produces the change in voltage is the transfer of positively charged sodium ions through the cell membrane. So the nerve impulse depends on fairly simple electrical processes, comparable to those operating in a battery. Yet the laws governing the behavior of nerve impulses cannot be predicted from the laws of physics, because the timing of the diffusion of sodium ions across the membrane depends on the detailed organization of the intrinsic proteins and the geometric structures of the nerve fibers (Scott 1995, 52). We have here an illustration of Sperry's point that space-time patterns of physical masses exert causal influence in and of themselves. So, to understand what happens in a physical system, one needs to know not only the laws governing causal relations among events but also about the effects of the structures in which those events take place.

Dretske's distinction between triggering and structuring causes is also exemplified. The nerve impulse is the result of the movement of a large number of ions in and out through the nerve membrane; its triggering cause will be a stimulus at one of its synapses, but the passage along the nerve fiber is a result of local changes in the structure of the membrane itself. A complicating feature is that the nerve impulse is the result of a dynamic process in which the existence of the positive charge at point A on the axon affects the condition of the cell membrane at point B. Thus, the structuring cause at B is itself an effect of the triggering of the ion flow at A.

This *interaction* between triggering and structuring causes completes the steps necessary to understand downward causation. The nerve impulse interacts with the structure that makes it possible, the nerve-cell membrane; as the voltage inside the membrane changes from negative to less negative the membrane allows sodium ions to pass through. Since the sodium ions are positively charged, this makes the neighboring region less

negative and permits more sodium to flow in. This is a self-supporting dynamic process of positive feedback. The influx of positive ions is a bottom-up cause of the nerve impulse, but, once triggered, the nerve impulse becomes a self-sustaining entity that exerts downward causal influence on the ions themselves by altering the permeability of the cell membrane—by *selective* absorption and release of ions with their intrinsic causal powers.

The foregoing represents my more recent thinking about top-down causation (see also Murphy 1999b and Murphy forthcoming). While more needs to be said, I find this sketch satisfying in that it begins to get at the stunning complexity of the causal interactions that science has revealed, yet without invoking anything mysterious. I believe it can be used to give an equally nonmysterious account of mental causation, so long as the mental is understood as supervenient in the sense in which I define it. However, I do not believe this account of downward causation solves the central problem of divine action.

Divine Action. I would say that the description of an event as an act of God (“God led Israel across the Sea of Reeds”) supervenes on a historical description (“Israel crossed the Sea of Reeds”) only under the *circumstance* that God was actually involved in the event. I need my account of supervenience with its emphasis on the co-determination of the supervenient by both the supervenience base and the circumstances, rather than the standard account, in order *not* to have the result Bielfeldt claims—making God the all-determined reality. I believe that Bielfeldt himself comes closer to such a position (Bielfeldt 1995), so I was surprised to receive this criticism from him, given that he is well aware of the difference in our views of the meaning of supervenience. But supervenience does not solve the problem of divine action. It only gives us another resource for talking about it.

I have, sadly, come to conclude that top-down causation does not solve the problem of divine action either. Sadly, because it would have been so neat to use it throughout for a nonreductive account of the hierarchy of complex systems (taking Peacocke’s position that God-and-the-universe is the most complex system possible). However, if downward causation is, as I have argued, merely a matter of selectively activating lower-level causal entities, then we are back where we started when we ask *how* God selectively activates the lower-level causal entities that make up the natural world. So, as unsatisfying as it is, I feel driven to start with a bottom-up account of divine action, relying on the theological claim that God is immanent and active in all things, however small. I have to leave it to the physicists to argue over the relations between the micro and macro levels.

There are two serious problems concerning divine action. One is the modern problem of how God can act in the natural world without violat-

ing the laws of nature. The other is the ancient problem of why, if God can act in the world, we see so little evidence of God's action to prevent suffering at the hands of nature. Consideration of these two questions together has led me to reaffirm that divine action would better be thought of in terms of God's cooperation with and respect for created entities rather than cooperation with and respect for laws of nature. It may turn out that the modern concern about God's relations to the laws of nature has been a red herring. God's withholding of power out of respect for creatures rather than respect for abstract laws fits better, somehow, with the Christian account of a God who is characterized first by love rather than by rationality. I recognize that these scattered thoughts are not an adequate response to Bielfeldt's critique of my account of divine action, which problem I see as the outstanding unresolved issue for theology-science dialogue.

NOTE

1. Arthur Peacocke, of course, is largely responsible for introducing the concept of top-down causation into the theology and science dialogue. However, I believe that his move to speak in terms of "whole-part constraint" is less precise and therefore perhaps less helpful than Van Gulick's account of top-down causation.

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