

# SCIENCE AND GOD THE CREATOR

by Arthur Peacocke

*Abstract.* Variable judgments, both negative and positive, have been made by scientists (mainly physicists and astronomers) on the theological implications of their findings. It is urged that science and theology are most appropriately related through a critical-realist approach. On this basis some implications for our conceptions of God and our scientific perspectives on the created world are explored with respect to both divine Being and divine Becoming. A positive assessment of nature as created concludes the article.

*Keywords:* becoming; being; chance; creation; critical realism; emergence; omnipotence; omniscience; personal God; science; suffering; theology; time; vulnerability.

---

No one today needs reminding that theologians can be deeply divided both about how to go about their task and what can be—and has been—established as a result of their activities. They, and many others in our culture, assume that scientists exhibit the very opposite characteristics. Scientists certainly agree about their methodology, insofar as this is common to the different sciences (and there *are* strikingly distinct styles in the various sciences). They also seem to be capable of coming to agreement—across international and cultural barriers—about what can be regarded as reasonably established knowledge concerning the natural world. But as soon as one asks about the philosophical and theological significance of their (seemingly agreed) findings, the citadel of apparent monolithic assent collapses. We have rightly come to be as suspicious of authoritative pronouncements of the “Science says” kind, when

Arthur Peacocke is Warden-Emeritus of the Society of Ordained Scientists and a former Dean of Clare College, Cambridge, and Director of the Ian Ramsey Centre, Oxford. Mailing address: Exeter College, Oxford, OX1 3DP, U.K. He presented this paper at the Thirty-Eighth Annual Star Island Conference of the Institute on Religion in an Age of Science (IRAS), “The God Question in an Age of Science,” Star Island, New Hampshire, 27 July–3 August 1991. The article constitutes a summary of parts of *Theology for a Scientific Age: Being and Becoming—Natural and Divine* (Minneapolis: Augsburg-Fortress Press, 1993, and London: S.C.M. Press, 1993).

[*Zygon*, vol. 28, no. 4 (December 1993).]

© 1993 by the Joint Publication Board of *Zygon*. ISSN 0591-2385

what science is supposed to say has these wider connotations, as we have of the “The Bible says” and “The Church/tradition says” varieties.

Thus we find Paul Davies, a physicist, raising what he calls the “Big Four” questions of existence: Why are the laws of nature what they are? Why does the universe consist of the things it does? How did those things arise? How did the universe achieve its organization? We also find him affirming that physics is uniquely placed to answer them. He continues:

It may seem bizarre, but in my opinion science offers a surer path to God than religion. Right or wrong, the fact that science has actually advanced to the point where what were formerly religious questions can be seriously tackled, itself indicates the far-reaching consequences of the new physics. (Davies 1983, viii-ix)

He concludes the book with a reaffirmation of his

deep conviction that only by understanding the world in its many aspects—reductionist and holist, mathematical and poetical, through forces, fields, and particles as well as through good and evil—that we will come to understand ourselves and the meaning behind this universe, our home. (Davies 1983, 229)

However, this concluding sentence certainly contains nuances that could just be the swallows that herald the coming of a summer in which scientists turn to theologians. This, too, seems to be the implication of a much-quoted remark by the astronomer Robert Jastrow, who wrote:

For the scientist who has lived by his faith in the power of reason, the story [of the exploration of the beginning of the universe] ends like a bad dream. He has scaled the mountains of ignorance; he is about to conquer the highest peak; as he pulls himself over the final rock, he is greeted by a band of theologians who have been sitting there for centuries. (Jastrow 1978, 124-25)

So we have one physicist, Paul Davies, producing, no doubt, irritation in the “band of theologians,” yet displaying some small signs of grace; and another, Robert Jastrow, instilling in them a sense of complacency—with an admixture of unease that perhaps he thinks theologians are committed to believing in “creation” as an act of God *in time*, at 15,000 million B.C.?

These quotations illustrate only too well the need for examining more closely the epistemology and claimed ontology of both science and theology when one has in purview this no-man’s-land of the doctrine of creation across which, so one interpretation of this uneasy history has it, their battalions have fought inconclusively for

centuries. So, as a start, let me make an inevitably brief incursion into this territory.

#### SCIENCE AND THEOLOGY TODAY

“Critical” realism is the philosophy of science that I shall espouse here. It has the virtue of being the implicit, though often not articulated, working philosophy of practicing scientists who have the aim of depicting reality but know only too well their fallibility in doing so. The arguments for critical realism as a valid and coherent philosophy of science have been widely rehearsed elsewhere.<sup>1</sup> The position may be summarized thus, in the words of J. Leplin: “What realists do share in common are the convictions that scientific change is, on balance, progressive and that science makes possible knowledge of the world beyond its accessible, empirical manifestations.” (Leplin 1984, 2).

Science is aiming to depict reality. The basic claim made by such a critical scientific realism is that it is the long-term success of a scientific theory that warrants the belief that “something like the entities and structure postulated by the theory actually exists” (Mc Mullin 1984, 26). A formidable case for such a critical scientific realism (Mc Mullin 1984, 30) has, in my view, been mounted based on the histories of, for example, geology, cell biology, and chemistry, which during the last two centuries have progressively and continuously discovered hidden structures in the entities of the natural world that account causally for observed phenomena.

But critical realism recognizes that it is still only the *aim* of science to depict reality and that this allows gradations in acceptance of the “truth” of scientific theories. It is a *critical* realism about entities, structures, and processes which figure in scientific theories (the “terms” of the theories), rather than a critical realism about theories as such. Critical realism recognizes that it is the aim of science to depict reality as best it may—and since this can be only an aim, the critical realist has to accept that this purpose may well be achieved by scientists with but varying degrees of success. So such a critical realism might more correctly be regarded as a *program* for the natural sciences, and its success should be regarded as open to assessment in any particular case: science can often be confident of the existence of that to which its theories refer, but at the same time accept that its language and models concerning these claimed realities are always revisable and subject to change.

This reminds us of the use of models and metaphor in science: “A model in science is a systematic analogy postulated between a

phenomenon whose laws are already known and the one under investigation" (Barbour 1971, 158). The deeply and irrevocably metaphorical character of scientific language does not detract from the aim of such language to refer to realities and entails an acceptance of its revisability in seeking to explore a world only partially and imperfectly understood.

Theology also employs models that may be similarly classified (Soskice 1984, chap. 7; McFague 1987). I urge that a critical realism is also the most appropriate and adequate philosophy concerning religious language and theological proposition (see also Peacocke 1984, 1988; Van Huyssteen 1989, Banner 1990). Critical realism in theology would maintain that theological concepts and models should be regarded as partial and inadequate, but necessary and, indeed, the only ways of referring to the reality that is named "God" and to God's relation with humanity. Metaphor obviously plays an even wider role in religious language than in scientific. We have to distinguish between referring to God and describing God—this is crucial to a critical-realist stance in theology. The metaphors of the theological models that explicate religious experience can refer to and depict reality without at the same time being naively and unrevisably descriptive—and they share this character with scientific models of the natural world. We may reasonably hope to speak realistically of God through revisable metaphor and model.

How, in theology, that which—the One who—is encountered in any particular experience is to be identified with what the tradition has named "God" *should* be determined by attempting to infer to the best explanation. Thus, one applies the criteria of reasonableness that are generally used to assess ideas and, in particular, to appraise scientific models and theories. These are, namely: fit with the data; internal coherence; comprehensiveness; fruitfulness; and general cogency (see also Mitchell 1973; Pailin 1989; Banner 1990).

From a critical-realist perspective, both science and theology are engaging with realities that may be referred to and pointed at, but which are both beyond the range of any completely literal description. Within such a perspective, it is therefore entirely appropriate to ask how the respective claimed cognitive contents of science and theology might, or should be, related. The history of theology shows that its development is intimately related to the understanding of the natural, including the human, world that has prevailed at different periods. More pertinently, it behooves a critical-realist theology to take seriously the critical-realist perspective of the sciences on the natural world, for on that theology's own presuppositions, God's ownself has given the world the kind of being and becoming it has,

and it must in some respects (to be ascertained) be revelatory of God's nature and purposes. So theology should seek to be at least *consonant* with those scientific perspectives on the natural world that are well-established, as far as can be reasonably judged—for it is notorious that a theology which *marries* the science of today runs the risk of being a widow tomorrow!

### GOD AND THE CREATED WORLD

We come now to our main task; namely, to inquire into the extent to which these concepts, models, and images of God that have been winnowed and refined in the Judeo-Christian tradition and critically analyzed philosophically are illuminated by those impressive, at times intellectually vertiginous, perspectives on the world that the natural sciences now give us.

It is useful to express our scientific knowledge of the world in terms both of its being—what is there—and of its becoming—what is going on. Hence, it might also be helpful to examine how the scientific perspective on the world might provide evidence for our understanding of both the “being” of God and of God’s “becoming”—though fully recognizing, of course, that this distinction must be artificial, for the purposes of presentation only. Our concern, then, is with both divine being and becoming—with both static and dynamic metaphors. So we consider now some central strands in the concept of God and God’s relation to the world—that is, themes relevant to the concept of God as Creator—and how they might be illuminated by new perspectives generated by the natural sciences.

**DIVINE BEING.** *“Ground of Being.”* The current scientific perspective does not substantially alter the nature of the philosophical debate or the status of the theistic claim, but it does, it seems to me, highlight with greater intensity some of the issues at stake. Thus, what one might call the sheer apparent “givenness” of the world, with its cosmological, biological, and social history—its contingency—is enhanced by our newfound awareness of the regular lawfulness of its interconnectedness through space and time. Moreover, the quantum field (the quantum “vacuum”) in which those fluctuations are postulated as having occurred—at the start of the expansion of the present observed universe—is not, strictly speaking, simply “nothing at all.” *Its* existence still calls for explanation of some kind, in the sense that it is contingent and need not have existed at all with its particular properties; namely, those represented by quantum theory.

Now, the “Holy Grail” sought by the physicists is a “theory of everything” (T.O.E.). This T.O.E. would have to explain not only how our universe came into being, but also why there is only one set of physical laws. However, there is increasingly also a recognition<sup>2</sup> of the impossibility of answering the question of why the laws of nature (in particular, those of quantum physics) *are* what they are—that is, the impossibility of explaining the existence of the laws whereby the original quantum field should have had the property of generating matter through its fluctuations. As Russell Stannard has put it, “For these reasons the goal of a complete theory of everything is unattainable, and the claim to have disproved the need of a Creator is false” (Stannard 1989). Hence, the postulate of the existence of a *Ground of Being* continues to be plausible.

“*One.*” From a scientific perspective, the world exhibits an underlying unity beneath its remarkable diversity, fecundity, and complexity. The “best explanation” of such a world’s existence and character, if any is to be found at all, cannot but be grounded in *one* unifying source of creativity, multiple though its expression and outreach might be.

“*Of Unfathomable Richness.*” But this underlying unity in the world that the sciences perceive was and is capable of giving rise to immense diversity culminating in the enormously varied richness of human experience and societies. As the creative source of all that is, *God must be a Being of unfathomable richness* to be able to bring into existence a cosmos with such fecund potentialities.

“*Supremely Rational.*” Twentieth-century science reinforces this experience of the inherent, yet always challenging, intelligibility and putative comprehensibility of the world’s entities, structures, and processes. This cannot but render more probable than ever before inference to the existence of a supra-rational Being as Creator as the “best explanation” of such a world’s existence and character. The affirmation of the existence of *God as the supremely rational Creator* is strengthened and its truth rendered more, rather than less, probable by the increasing success of science in discovering the inherent, but in content ever-surprising, rationality of the cosmos.

“*Sustainer and Faithful Preserver.*” The natural sciences have led to such a revision of our concept of the nature of time that the relation of God to time needs to be reconsidered. First, we cannot now but

be aware, *inter alia*, that time is an aspect of the natural order, being closely integrated in relativity and quantum theory with space, matter, and energy; and so, for theists, time must be regarded as, in some sense, created. Second, the realization that time has a direction, in which there emerge new entities, structures, and processes, reinforces the idea that God is, as Creator, both the *Sustainer and faithful Preserver* through time of all-that-is and of all-that-is-becoming. If "God" is still to be their "best explanation," then God as Creator must be regarded as holding all in existence and maintaining the validity of all laws and relations throughout time. It should be noted that there is implied, if God is personal, a moral quality in the divine sustaining and preserving—that of faithfulness or "steadfast love," as the Old Testament calls it.

*"Continuous Creator."* What the scientific perspective of the world inexorably impresses upon us is a dynamic picture of the world of entities and structures involved in continuous and incessant change and in process without ceasing. The new entities, structures, and processes display genuinely emergent properties that are non-reducible in terms of what preceded them and so constitute new levels of reality (for the critical-realist). Hence, new realities come into being, and old ones often pass away, so that God's action as Creator is both past and present—it is continuous. Any notion of God as Creator must now take into account, more than ever before in the history of theology, that God is continuously creating, that God is *semper Creator*. Thus it is that the scientific perspective obliges us to take more seriously and concretely than hitherto in theology the notion of the immanence of God as Creator—that *God is the Immanent Creator creating in and through the processes of the natural order*.

*"Personal Creator of an Anthropoc Universe."* There are good general grounds for believing that God might be "personal," or "at least personal," or even, if one is more robust, "a person" (see Swinburne 1979, 8). This belief, indeed experience, is basic and fundamental to the Judeo-Christian religious tradition. From the scientific "anthropic principle," we can infer that the world does seem to be finely tuned with respect to many physical features in a way conducive to the emergence of living organisms and so of human beings. We can also give reasons why living organisms, through intelligible natural processes, might develop cognitive powers and consciousness as they increased in complexity and flexibility—and how the development of self-consciousness would involve awareness

of pain, suffering, and death. The presence of humanity in this universe, far from being an unintelligible surd, represents an inherent inbuilt potentiality of that physical universe in the sense that intelligent, self-conscious life was bound eventually to appear, although its *form* was not prescribed by those same fundamental parameters and relationships that made it all possible.

This now well-established “anthropic” feature of our universe has been interpreted in various and mutually inconsistent ways. For some (e.g., Atkins 1981) it renders any talk of a creator God more than ever unnecessary since we would not be likely to be able to observe a universe that did *not* have the right conditions for producing us. Others (e.g., Montefiore 1985; Polkinghorne 1988) have seen in it a new and more defensible “argument from design” for the existence of a creator God. The whole debate is philosophically a very subtle and puzzling one (cf. Leslie 1988, 297–311; 1989). It clearly depends on the presuppositions and interpretative framework that one brings to bear on any assessment of the a priori probability of all the constants—all the “fine tuning”—that result in the exact values that could lead to life and so to us.

This is the point at which the truly astonishing character of this emergence of personhood can be properly emphasized. For, we may well ask, why did the world, before the emergence of living organisms, and, a fortiori, of humanity, not just go on being an insentient, uncomprehending mechanism—“merely the hurrying of material, endlessly, meaninglessly” (Whitehead 1949, 56)? The fact is, it did not, and it is indeed almost highly significant, as John Durant has remarked (Durant 1988), that science, with all its impressive knowledge of the physical and biological worlds and of our human physical nature, can tell us nothing about why we have the experience of subjectivity. There is a huge gap between such experience and what mechanism, and even organicism, can predict, and any plausible explanation of the presence of persons in the universe eludes science as such. The concept, and so actual instantiation, of personhood is the most intrinsically irreducible of all emerging entities that we know.

It seems, therefore, that the universe has through its own inherent processes—and there is no need to depart from this well-warranted assumption—generated a part of itself (i.e., persons) which introduces a distinctively new kind of causality into itself; namely, that of personal agency. This scientific perspective makes the questions concerning the significance of the emergence of the personal more urgent. These questions could be summed up as follows: Does not the very intimacy of our relation to the fundamental features



of the physical world, its “anthropic” features, together with the distinctiveness of personhood, point us in the direction of looking for a “best explanation” of all-that-is (both nonpersonal and personal) in terms of some kind of causality that could *include* the personal in its consequences?

Since the personal is the highest category of entity we can name in the order of natural beings and since *God* is the name we give to this “best explanation,” we have good reason for saying that *God* is (at least) “personal,” or “suprapersonal” and for predicating personal qualities of God as less misleading and more appropriate than impersonal ones—even while recognizing, as always, that such predications must remain ultimately inadequate to that to which they refer, namely, God. It is of the nature of the personal not only to be capable of bearing static predicates, referring to stabler, settled characteristics, but also of predicates of a dynamic kind, since the flow of experience is quintessential to being a person.

For our models of God to be personal, they must be dynamic as well as static. So it is appropriate to develop our consideration of the creative actions and activity of a personal God also under the heading of “Divine Becoming.”

*Divine Becoming.* It is distinctive of free persons that they possess intentions and purposes and act so as to implement them. Hence it becomes proper to ask: Can we infer from what is going on in the natural world anything about what might properly be called the “purposes” of God as personal Creator acting in the created world? That is, can we discern the purposes of this personal God in any ways that are consistent with what we now know of the universe through the sciences? More broadly, is our understanding of God the personal Creator as the “best explanation” of all-that-is enriched by what science shows us concerning the natural world, including humanity?

*Joy and Delight in Creation.* The natural world is immensely variegated in its hierarchies of levels of entities, structures, and processes, in its “being”; it also abundantly diversifies with a cornucopian fecundity in its “becoming” in time. We can only conclude that, if there is personal Creator, then that Creator intended this rich multiformity of entities, structures, and processes in the natural world and, if so, that such a Creator God takes what, in the personal world of human experience, could only be called “delight” in the multiformity created. *God has joy and delight in creation.*

*Ground and Source of Law (“Necessity”) and “Chance.”* The interplay between “chance,” at the molecular level of the DNA, and “law” or “necessity” at the statistical level of the population of organisms tempted Jacques Monod, in his influential book *Chance and Necessity*, to elevate “chance” to the level almost of a metaphysical principle whereby the universe might be interpreted. He concluded that the “stupendous edifice of evolution” is, in this sense, rooted in “pure chance” and that *therefore* all inferences of direction or purpose in the development of the biological world in particular and of the universe in general must be false. In so arguing, he thereby mounted, in the name of science, one of the strongest and most influential attacks of the century on belief in a creator God.

But there is no reason why the randomness of molecular event in relation to biological consequence has to be given the significant metaphysical status that Monod attributed to it. This role of “chance,” or rather randomness (or “free experiment”), at the micro-level is what one would expect if the universe were so constituted that all the potential forms of organizations of matter (both living and nonliving) which it contains might be thoroughly explored.

The investigations of the Brussels school, under Ilya Prigogine, and of the Göttingen school, under Manfred Eigen, demonstrate that it is the interplay of chance and law that is in fact creative within time, for it is the combination of the two which allows new forms to emerge and evolve—so natural selection appears to be opportunistic.

The principles of natural selection involve the interplay and consequences of random processes (in relation to biological outcome) in the lawlike framework of the rules governing change in biological populations in complex environments. These rules are what they are because of the “givenness” of the properties of the physical environment and of the already evolved other living organisms with which the organism in question interacts. This givenness, for a theist, can only be regarded as an aspect of the God-endowed features of the world.

One might say that the potential of the “being” of the world is made manifest in the “becoming” that the operation of chance makes actual. *God is the ultimate ground and source of both law (“necessity”) and “chance”.*

On this view, God acts to create in the world *through* what we call chance operating within the created order, each stage of which constitutes the launching pad for the next. However, the actual course of this unfolding of the hidden potentialities of the world is not a once-for-all, predetermined path, for there are inherent

unpredictabilities in the actual systems and processes of the world (micro-events at the “Heisenberg” level and nonlinear dynamical complex systems).<sup>3</sup> There is an open-endedness in the course of the world’s “natural” history. We now have to conceive of God as involved in explorations of the many kinds of unfulfilled potentialities of the universe(s) God has created.

There are, as we saw, inbuilt propensities—a theist would say “built in by God”—in the natural, creating processes which, as it were, “load the dice” in favor of life and, once living organisms have appeared, also of increased complexity, awareness, consciousness, and sensitivity, with all their consequences.

It seems that we now have to take account of:

- this new perspective of God the Creator as acting through chance operating within the constraints of law; that is, of the God-given properties and propensities of the natural world;
- a renewed emphasis on the immanence of God in the processes of the creative and creating world; and
- our earlier recognition of the unpredictability of much of what goes on in the world.

These lead us to affirm that *God the Creator explores in creation.*

*Self-Limited Omnipotence and Omniscience.* Considerations such as these on the role of chance in creation impel us also to recognize more emphatically than ever before the constraints which God has imposed upon God’s own self in creation and to assert that *God has a “self-limited” omnipotence and omniscience.*

The attribution of “self-limitation” to God with respect to God’s omnipotence is meant to indicate that God has so made the world that there are certain areas over which God has chosen not to have power. Similarly, the attribution of self-limitation to God in regard to God’s omniscience is meant to denote that God may also have so made the world that, at any given time, there are certain systems whose future states cannot be known even to God, since they are in principle not knowable (for example, those in the “Heisenberg” range and certain nonlinear systems at the macroscopic level—and, traditionally of course, the operation of human free will). If there is no particular point in time of which it could truly be said of those systems “this will be its future state,” then it could not be known at any instant, by God or by us, what the future state of such systems will be. God’s “omniscience” has to be construed as God knowing at any time whatever it is logically possible that God know at that time.

These considerations do not, of course, preclude God from knowing the probabilities of the sequence of events in such systems

and so of knowing, and of influencing, the general direction of the history of natural events.

*The Vulnerability of God.* The conditions for the emergence of open-endedness in natural systems—and so, in due course, the experience of freedom of the human-brain-in-the-human-body—involve a subtle interweaving of chance and law, with consequences that are often not readily predictable in principle. If God willed the existence of self-conscious, intelligent, freely willing creatures as an end, God must, to be self-consistent, logically be presumed to have willed the means to achieving that end. This divine purpose must be taken to have been an overriding one, for it involves as a corollary an element of risk to God's purposes whereby God renders Godself vulnerable in a way that is only now becoming perceivable by us. This idea that *God took a risk in creation* is not new but is now, I am suggesting, reinforced and given a wider context by these biological considerations.

*A Suffering God.* If God is immanently present in and to natural processes, in particular those that generate conscious and self-conscious life, then we cannot but infer that *God suffers in, with, and under the creative processes of the world* with their costly, open-ended unfolding in time.

There has been an increasing assent to this idea that it is possible, as Paul Fiddes has put it, “to speak consistently of a *God who suffers eminently and yet is still God, and a God who suffers universally and yet is still present uniquely and decisively in the sufferings of Christ*” (Fiddes 1988, 3). He points out that among the factors that have promoted the view that God suffers are new assessments of “the meaning of love [especially, the love of God], the implications of the cross of Jesus, the problem of [human] suffering, and the *structure of the world*” (italics mine) (Fiddes 1988, 45; see also chap. 2). It is this last-mentioned—the “structure of the world”—on which the new perspectives of the sciences bear by showing how the world processes inevitably involve death, pain, and suffering if self-conscious, sentient creatures are to emerge in a physical universe. An immanent Creator cannot but be regarded as creating through such a process and so as suffering in, with, and under it, if the Creator is not to be regarded as a moral monster.

*God and Time.* The revived insight that God suffers in the processes of creation and, supremely, with suffering humanity, raises again the question of God's relation to time. For if God “suffers”

with creation in some sense analogous to that of human suffering, God must be conceived as being changed through this interaction with the world.

Analyses of the question of God's relation to time show that a number of important traditional attributes of God lose coherence and meaning if God is regarded as "timeless" in the sense of being "outside" time altogether. We have also had to recognize that, in some sense, God is also the Creator *of* the physical time which is so closely integrated with space, and so with energy, and so with matter, in the understanding that twentieth-century physics has given us.

If God *creates* time, does God not "transcend" it in the sense of viewing the whole course of "our" time from the mountain top, as it were, of another dimension—"above" or "outside" time so that our "before," "now" and "after" are spread out all for God to see? And does not our talk of unpredictability have to be taken to refer only to human and not divine foreknowledge? Yet, we had to recognize that many events (at the subatomic ["Heisenberg"] quantum micro-level, and possibly also the development of nonlinear dynamical systems) are unpredictable in principle. At best only the *range* of possible outcomes of such events is predictable in principle. This does not mean that God cannot have the most complete knowledge that is possible of the probabilities of the outcomes of these events, including the operation of our free will.

Our own sense of psychological time, the sense of succession of our conscious states, with which our own sense of personhood is so bound, is closely related to created physical time. For we move freely from one to the other even though they seem, often, to proceed at different rates while sharing many interactions and running in parallel. This relationship can perhaps at least make intelligible to us how God's own inherent self-awareness of successive states (which must be attributed to God if God is to be "personal" in any meaningful sense) might be closely linked to physical, created time, while yet remaining distinct from it.

On such a model, God would not be "timeless" and could be thought of as the Creator of every instant of physical time. Creation by God would be regarded as that activity whereby God gives existence to each instant of physical time, the "now" of the hand of the clock, and each instant has no existence prior to its being so created with all the entities, structures, and processes that fill it. On this interpretation, then, the future does not yet exist in any sense, not even for God—God creates each instant of physical time with its open, as yet not fully determined, outcomes, fecund with possibilities not yet actualized. If the future does not yet exist for God, any more

than it does for us, there is no question of God seeing ahead what the future is going to be, even though God can still have purposes to implement in that forthcoming future.

To summarize, we can affirm: *God is not "timeless"; God is temporal in the sense that the Divine life is successive in its relation to us—God is temporally related to us; God creates and is present to each instant of the (physical and, derivatively, psychological) time of the created world; God transcends past and present created time. God is eternal, in the sense that there is no time at which God did not exist nor will there be a future time at which God does not exist.*

*God and "Imaginary" Time.* The foregoing exposition has spoken of time as if it were meaningful to think of it as extrapolatable backwards, at least as far as the "point" in time, the singularity, from which the expansion of our known universe began (the "hot Big Bang"). However, we must also consider now the speculative proposal of J.B. Hartle and Stephen Hawking, who were led to the idea that the further one goes back along the ordinary "real" time scale, the more it has to be replaced by a new parameter which includes also a mathematically "imaginary" component (i.e., one involving  $i$ , the square root of *minus 1*). According to Hawking (Hawking 1988, 134–36), using this "time," involving an "imaginary" component, leads to the disappearance of the distinction between time and space. Furthermore, "space-time" (mathematical "imaginary" time unified with space) proved to be finite in extent and yet "have no singularities that formed a boundary or edge" (Hawking 1988, 135). According to this still highly controversial speculation:

There would be no singularities at which the laws of science broke down and no edge of space-time at which one would have to appeal to God or some new law to set the boundary conditions for space-time. . . . The universe would be completely self-contained and not affected by anything outside itself. It would neither be created or destroyed. It would just BE. (Hawking 1988, 136)

But the mystery-of-existence question still has to be pressed, for, as Hawking himself has put it:

Why does the universe go to all the bother of existing? Is the unified theory so compelling that it brings about its own existence? Or does it need a creator, and, if so, does he have any other effect on the universe? And who created him? (Hawking 1988, 174)

We seem to have come full circle, for here we have the author of the most recent best-selling book by a scientist raising the very question that the astronomer Robert Jastrow believed the theologians, whom

he anticipated the astronomers meeting at that mountain top, were answering. Yet Hawking raises this question only with considerable ambiguity, for, as we saw in the other quotation from *A Brief History of Time*, he toys with the possibility that the universe could “neither be created or destroyed. It would just *BE*.”

### CONCLUSION

The trumpets of the scientists, therefore, give an uncertain theological sound and play a number of different tunes. But this does not, indeed should not, preclude the theologian from listening to their deliverances qua scientists, rather than qua novices in philosophy and theology. For *what* they have and are discovering about the natural world affords late-twentieth-century human consciousness with a vista that completely transforms the context to which theology has continuously to return; namely, the world, including the human world, which it affirms owes its origin to the will and purpose of a Creator God. That vista is overwhelmingly evocative and dazzling to the mind and spirit and constitutes a challenge of far greater significance and consequence than did the rediscovery of Aristotle for the times of Saint Thomas Aquinas.

The sum effect, for me at least, of the cosmic panorama through space and time that the sciences now afford is to reinforce my conviction that, without a Creator God, all-that-is (the “world”) is without explanation both with respect to its very existence and with respect to the subtle, intricate, and ever-awesome rationality that it manifests increasingly as the sciences advance. These reflections also make even more urgent the need for a rebirth of images concerning the nature of God as Creator, the act of creation, and the continuing nature of God’s creative interaction with the world. There are, I believe, fruitful suggestions to be made with respect to all of these key matters—using especially the images of artistic creation, in general, and musical creation,<sup>4</sup> in particular. But that would be another exercise.

### NOTES

1. See Peacocke, 1984 and references therein; Peacocke 1988, 45–58. A helpful account of critical realism as a philosophy of science and an analysis of, and apologia for, its significance for systematic theology has been given by W. Van Huyssteen in *Theology and the Justification of Faith* 1989, ch. 9. See also Banner 1990, 22.

2. These laws are mathematical ones constituting a system if there is a TOE. Hence, like all such mathematical structures, a TOE would: (1) be based on axioms that could have been otherwise and cannot be proved to be consistent from within the system; and (2) not be complete. The mathematician Kurt Gödel proved that “from within the system it was impossible to prove the truth of all true statements contained in that system. This

inherent, unavoidable lack of completeness must reflect itself in whatever mathematical system models our universe. As creatures belonging to the physical world, we will be included as part of that model. It follows that we shall never be able to justify the choice of axioms in the model—and consequently the physical laws to which those axioms correspond. Nor shall we be able to account for all the true statements that can be made about the universe” (Stannard 1989).

3. Heisenberg systems are unpredictable in principle—and it now seems likely that this is also the case with nonlinear dynamical systems. (The unpredictability of these latter is beginning to make intelligible how the free will we experience might be grounded in neuronal networks.)

4. I originally propounded this idea in *Creation and the World of Science*, 1979, pp. 105–6; developed it in *Intimations of Reality*, 1984, p. 72; and expounded it more fully in *Theology for a Scientific Age*, 1990, chaps. 9, 3.

### REFERENCES

- Atkins, P. W. 1981. *The Creation*. Oxford and San Francisco: W. H. Freeman.
- Banner, M. 1990. *The Justification of Science and the Rationality of Religious Belief*. Oxford: Clarendon Press.
- Barbour, Ian. 1971. *Issues in Science and Religion*. New York: Harper and Row.
- Davies, Paul. 1983. *God and the New Biology*. London: Dent.
- Durant, John. 1988. “Is there a Role for Theology in an Age of Secular Science?” Enschede Lecture given at the Second European Conference on Science and Religion.
- Fiddes, Paul S. 1988. *The Creative Suffering of God*. Oxford: Clarendon Press.
- Hawking, Stephen W. 1988. *A Brief History of Time*. London: Bantam Press.
- Jastrow, Robert. 1978. *God and the Astronomers*. Lecture originally given to the American Association for the Advancement of Science, Washington, 14 February 1978. New York: Warner Books.
- Leplin, J. 1984. “Introduction.” *Scientific Realism*, ed. J. Leplin. Berkeley and Los Angeles: Univ. of California Press.
- Leslie, J. 1988. “How to Draw Conclusions from a Fine-Tuned Universe.” In *Physics, Philosophy and Theology: A Common Quest for Understanding*, ed. R. J. Russell, W. R. Stoeger, and G. V. Coyne. Vatican Observatory Publication, Vatican City State. Notre Dame, Ind.: Univ. of Notre Dame.
- . 1989. *Universes*. London: Routledge.
- McFague, Sallie. 1987. *Models of God*. London: SCM Press.
- Mc Mullin, Ernan. 1984. “The Case for Scientific Realism.” In *Scientific Realism*, ed. J. Leplin. Berkeley and Los Angeles: Univ. of California Press.
- Mitchell, B. G. 1973. *The Justification of Religious Belief*. London: Macmillan.
- Montefiore, H. 1985. *The Probability of God*. London: SCM Press.
- Pailin, D. 1989. *God and the Processes of Reality*. London: Routledge.
- Peacocke, Arthur. 1979. *Creation and the World of Science*. Oxford: Clarendon Press.
- . 1984. *Intimations of Reality: Critical Realism in Science and Religion*. Notre Dame, Ind.: Univ. of Notre Dame Press.
- . 1988. “Science and Theology Today: A Critical Realist Perspective.” *Religion and Intellectual Life* 5: 45–58.
- . 1990. *Theology for a Scientific Age*. Oxford: Basil Blackwell.
- Polkinghorne, John. 1988. *Science and Creation*. London: SPCK.
- Soskice, Janet Martin. 1984. *Metaphor and Religious Language*. Oxford: Clarendon Press.
- Stannard, Russell. 1989. “No Faith in the Grand Theory.” *The Times*, 13 November 1989.
- Swinburne, Richard. 1979. *The Existence of God*. New York: Oxford Univ. Press.
- Van Huyssteen, W. 1989. *Theology and the Justification of Faith*. Grand Rapids, Mich.: Eerdmans.
- Whitehead, A. N. 1949. *Science and the Modern World*. New York: Mentor Books.