GOD'S ACTION IN THE REAL WORLD[1]

by Arthur Peacocke

Abstract. The scientific and theological enterprises are regarded as interacting and mutually illuminating approaches to reality. The theological consequences of the transformation of the scientific worldview through twentieth-century physics and cosmology are considered with respect to notions of God's transcendence, time, continuous creation, determinism, and multiple universes. The theological implications of the worldview of biology are similarly assessed with respect to certain features of biological evolution: its continuity, its open-endedness, its mechanism, and the role of "chance" and law. The model of human agency for the agency of God in the hierarchy of natural systems is examined. The article concludes with some reflections on a science-informed understanding of God's relation to the world as transcendent, incarnate, and immanent.

Keywords: anthropic principle; biology; chance; cosmology; emergence; evolution; immanence; natural systems; physics; theology; transcendent.

I urged in the first chapter of my *Intimations of Reality* (1984) that the scientific and theological enterprises were interacting and mutually illuminating approaches to reality. I also suggested that the theological enterprise refers to the highest level in the hierarchy of the complexities that constitute reality, namely, the relation nature-man-and-God, and so some, at least, of the concepts, models, and metaphors appropriate to it may well not be reducible to those

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applicable to lower levels in the hierarchy of natural systems. There are in religious experience, and in the experience of the Christian community with which I am most concerned, concepts, models, and metaphors that have a life of their own, a history of their own, and an impact of their own within their own thought world. The terms of religious discourse are often very subtle and intricate in their relations with the many in the life of mankind, but because they refer to a total activity of human beings in community in their total relationships with the natural world, they must not be prematurely reduced to some lower level scientific description. What we must do is set these "religious" affirmations, their ways of depicting the world, their understandings of the world and of man in the world, *alongside* the changing perspective of man in the world that the sciences engender through studying the individual levels that the natural hierarchy of systems displays. Theology should be neither immune from the changing outlook of the sciences of man and nature nor should it be captive to them. Theology, I said, will have to listen to and adapt to, but not be subservient to, new understandings of the natural world afforded by the sciences, for both religion and science seek intelligibility within a framework of meaning. If my approach has proven acceptable, both are concerned with an understanding of reality inevitably articulated by means of model and metaphor.

Today, after more than three hundred years of the scientific revolution in our understanding of the natural world, including ourselves, it seems to me proper to inquire what effects this unparalleled expansion of knowledge and extension of consciousness should have on our way of modeling the relation of God, the ineffable, to the world as *so* known. Thus, any affirmations about God's relation to the world, any doctrine of creation, if it is not to become vacuous and sterile, must be about the relation of God to, the creation by God of, the world that the natural sciences describe. It seems to me that this is not a situation where Christian, or indeed *any,* theology has any choice—and, indeed, ought to expect to have any. For the scientific perspective on the world affords the most reliable available answers to questions men and women have always asked about it: What is there? What goes on? How does it change? Why does it change?

Any theological account of God's relation to the world is operating in an intellectual vacuum, not to say cultural ghetto, if it fails to relate its affirmations to the answers to these questions that the natural sciences have been able to develop. It is true that theology, the intellectual ordering of the religious experience, is concerned with wider and deeper questions of overall intelligibility and personal and social meaning than the natural sciences as such. But *these*

fundamental questions cannot be asked at all without directing them to the world as we best know and understand it—that is, as seen in the light of the sciences.

We shall now, therefore, consider certain features of the contemporary scientific perspective and then ask whether that perspective should influence, or at least allow us to choose between, models of the ways in which we may conceive of God's relation to and action in the real world.

I. The Transformation of the Scientific Worldview through Twentieth-Century Physics and Cosmology

By the end of the nineteenth century the "absolutes" of space, time, object, and determinism were apparently securely enthroned in an unmysterious, mechanically determined world, basically simple in structure at the atomic level and, statistically at least, unchanging in form. Yet within a few decades at the beginning of the twentieth century there was a "veritable Götterdämmerung" of these gods of absolute space, time, object, and determinism (Heim 1953, 24). What is the new worldview, then, that succeeds this Götterdämmerung?

Perhaps the most distinctive feature of the modern scientific worldview is the converging perspective of a number of quite different sciences on the world as being in *process of evolution.* The cosmologists and astrophysicists have shown us how, from a time of the order of 10 billion (10^{10}) years ago, a primeval, unimaginably condensed mass of fundamental particles could have been transformed, at the same time expanding into the present observable universe—with its 10^9 galaxies, each containing 10^8–10^{11} stars (plus associated planets)—of a size such that light only now is reaching our planet that set out before the Sun and the Earth were formed. We shall later take note of how there have emerged those complex organizations of matter that are living, including ourselves. "Cosmic evolution has been attended by a great increase in *the richness and diversity of forms.* . . . This is an inventive process and is one that is still continuing" (Denbigh 1975, 156). As matter has coalesced into more and more complex forms, new and very different kinds of behavior and properties have emerged. Time has been given new meaning as the "carrier or locus of innovative change" (Schilling 1973, 126), a role scarcely envisaged as a possibility within that Newtonian absolute time that flowed "equably without relation to anything external" (Newton 1956, 152).

A notable aspect of this picture is the seamless character of the web that has been spun on the loom of time; the process is continuous from beginning to end, and at no point does the modern natural scientist have to invoke any nonnatural causes to explain what he or she observes or infers about the past. Explanations are usually in terms of concepts, theories, and mechanisms which can be confirmed by, or inferred from, present-day experiments. The scientist's confidence is sufficiently well based that it would be extremely unwise for any proponent of theism to attempt to find any gaps to be closed by the intervention of some nonnatural agent, such as a god.

Looking back, we now see that the beginning of the twentieth century initiated a series of fundamental changes in the scientific perspective on the world. *Then*—that is, in the half century terminating at 1900—nature was regarded as simple in structure; *now* we know it is enormously complex, consisting of a hierarchy of levels of organization.

Then, as we saw earlier, the natural world was regarded as mechanically determined and predictable from any given state by means of laws of all-embracing scope; *now* the world is regarded rather as the scene of the interplay of chance and of statistical, as well as causal, uniformity in which there is indeterminacy at the *micro*-level and unpredictability at the *macro*-level, especially that of the biological.

Then, in spite of Darwinism, the natural world was still largely regarded as static in form: *now* it is discovered to be dynamic—always in process—a nexus of evolving forms, essentially incomplete, inexhaustible in its potential for change, and open to the future.

Then, the world seemed to be decomposable into simple subunits; *now,* a sense of mystery at the quality of the known and the quantity of the unknown has been engendered by the depths of reality encountered at the edges of experimental and theoretical inquiry.

It becomes clear that we have in our times witnessed an unparalleled leap in the expansion of human consciousness of the world. If the world were a closed system, we would expect an ultimate convergence in our knowledge as it accumulates, but nothing like this seems to be happening. Our awareness of our ignorance grows in parallel with, indeed faster than, the growth in our knowledge. Yet one is struck, as John Polkinghorne, an Anglican priest, formerly professor of mathematical physics at the University of Cambridge and now president of Queens' College, Cambridge, puts it, "by the fact . . . that mathematics, which essentially is the abstract free creation of the human mind, repeatedly provides the indispensable clue to the understanding of the physical world. This happening is so common

a process that most of the time we take it for granted. At root it creates the *possibility* of science, of our understanding the workings of the world" (Polkinghorne 1979, 125).

Our unity with the rest of the biological world should hardly need emphasizing in these days of ecological concern. But awareness of our dependence on and involvement in the cosmic processes is relatively recent. The values of the fundamental constants (velocity of light, electronic charge, etc.) determine the kind of physical world in which we live, and it turns out that if (for example) the proton-proton interaction were only slightly different, then all of the protons in the universe would have turned into inert helium in the early stages of expansion of the galaxies. As Sir Bernard Lovell put it, "No galaxies, no stars, no life would have emerged. It would be a universe forever unknowable by living creatures. The existence of a remarkable and intimate relationship between man, the fundamental constants of nature and the initial moments of space and time, seems to be an inescapable condition of our presence here" (Lovell 1975, 6).

The material units of the universe—the subatomic particles, the atoms, and the molecules they can form—are the fundamental entities constituted in their matter-energy-space-time relationships, and are such that they have built-in, as it were, the potentiality of becoming organized in that special kind of complex system we call living and, in particular, in the systems of the human brain in the human body which displays conscious activity. In humanity, the stuff of the universe has become cognizing and self-cognizing.

Briefly, because we have evolved to observe it, our universe is a *cognizable* one; this places restrictions on the kind of universe it could be, out of the range of all possible universes (the so-called anthropic principle) (cf. Carter 1974, 291–98; Carr and Rees 605–12; Gale 114–22). This simply expresses in a new way the old assertion that the universe in which we exist is contingent. Moreover, far from humanity's presence in the universe being a curious and inexplicable surd, we find we are remarkably and intimately related to it on the basis of this contemporary scientific evidence, which is "indicative of a far greater degree of man's total involvement with the universe" than ever before envisaged (Lovell 1975, 6).

This brings us to another major speculation of cosmologists. It is clear that in tracing the history of the universe back to the point ca. 10^{10} years ago, when all its mass is postulated as having been concentrated into a relatively small space (the size of a lecture room or less!), there comes a point beyond which the laws of physics, as we know them, cannot be applied. Even so, this does not exclude the possibility that there is another side to the "hot big bang," apart from

our own. Beyond this point, when the "universe is squeezed through a knot hole," all physical constants and entities might be different (Misner, Thorne, and Wheeler 1973, ch. 44). If so, we have to envisage the possibility that our universe is but one amongst a cycle of universes and just happens to be one in which the physical constants (and even the physical laws) are such that living matter, and thus human beings, could, in time, appear within it, and so be cognizable.

So it is that we come to stress the particular of our universe: there are certain basic given features—the fundamental constants, particles, and laws that limit what can eventually be realized through its evolutionary processes. Even though these limitations are not "necessary" in the sense of being features of all worlds that may have existed (or will do so), yet for us they constitute the givenness of our existence, of *its* "necessity." This givenness does not confine the open future in a universe in which dynamic processes lead to the emergence of new, complex entities of distinctive qualities and activities that include not only biological life but also the whole life of humanity. Moreover, it is the very *givenness* of the parameters of the milieu of human life that make human freedom and human perception possible. So in this more general sense, too, the cosmic order is a necessary prerequisite of conscious personal existence as we know it in human beings.

(The foregoing is not tied to the validity of the "hot big bang" account of the origin of the observable universe, but only to the empirically observed evolving, emergent character whereby its processes generate new complexities.)

Because we are *critical* realists, we must take this perspective on the world afforded by physics and cosmology seriously but not too literally. This means that in thinking how it might influence our models of God's relation to action in the world, it is only the broadest, general features, and these the most soundly established, that we must reckon with. But it will be *to* the world so described by these sciences that our theological questionings must refer, and it is *in* the world so described that we seek meaning. We must be clear from the outset that in saying that God is, and that God is Creator, we do not affirm that he/she is any ordinary "cause" in the physical nexus of the universe itself—otherwise God would be neither explanation nor possible meaning. He (to drop the feminine personal pronoun, at least for the moment) cannot be the old "God of the gaps." *Ex hypothesi,* God's uniqueness and distinction from the world ensures that nothing in the world itself, such as might "fill" one of its causal gaps, can ever be a totally satisfactory and true image of his all-embracing

Reality. The doctrine of creation affirms that any particular event or entity would not happen, or would not *be* at all, were it not for the sustaining creative will and activity of God. This fundamental "otherness" of God in his own inscrutable, unsurpassable, and ultimately incomprehensible Being is essential to what we mean by God. Referred to by the predicate *transcendent*, this is an inexpungible element of the Judeo-Christian (and Islamic) experience of God. Let us now look at some of the implications for our models of God-and-the-world that arise from the aspects of the scientific worldview I have just indicated.

a. The sense of God's *transcendence* is itself reinforced by the demonstration through physics and cosmology that vast tracts of matter-energy-space-time have existed, and probably will exist, without any human being to observe them—and this will be further compounded if it indeed turns out to be the case that this "present" observable universe is but one of a "run" of possible universes. The excessively anthropocentric cosmic outlook of medieval, and even of Newtonian, man is thereby healthily restored to that more sober assessment which characterizes the Psalms, the Wisdom literature, and some of the prophets. For when God finally answers Job out of the whirlwind (Job 38: 1-4 A.V.), it is not to justify God's actions with respect to him, but simply to point to the whole range of the created order and to ask Job if he, as man, took any part in the non-human processes of creation, both past and present.

b. Time, in modern relativistic physics, is an integral and basic aspect of nature: space and time have to be mutually defined in interlocking relationships, and both are related to definitions of mass and energy, themselves interconvertible. So matter-energy-space-time constitutes the *created* order. Hence, on any theistic view, time itself, really a *relation* between created aspects of the universe, has to be regarded as owing in some sense its existence to God, as Augustine perceived in addressing God thus:

> It is therefore true to say that when you had not made anything there was no time, because time itself was of your making. And no time is co-eternal with you, because you never change: whereas, if time never changed, it would not be time. . . . Let them (those who ask the question "What was God doing before he made heaven and earth?") see, then, that there cannot possibly be time without creation. . . . Let them understand that before all time began you are the eternal Creator of all time, and that no time and no created thing is co-eternal with you, even if any created thing is outside time (Augustine 1961, 263, 279).

It is this "owing its existence to God" that is the essential core of the idea of creation, which concerns the relationship of all the created

order, including time itself, to its Creator—its Sustainer and Preserver. Thus the fundamental "otherness" of God must include God's transcendence of time.

c. Nevertheless, there *is* an important feature that the scientific perspective inevitably reintroduces into this idea of creation. It is the realization, now made explicit, that the cosmos, which is sustained and held in being by God, is a cosmos that has always been in process of producing new emergent forms of matter—it is a *creatio continua,* as it has long been called in Christian theology. God creates continuously—"all the time," as we would say. The scientific perspective of a cosmos that manifests emergence of the new reemphasizes that dynamic element in our understanding of God's relation to the world, which was, even if obscured, always implicit in the Hebrew conception of a "living God."

The sciences now see no breaks in the causal and temporal nexus of the evolution of the cosmos, or of life on the Earth, and thus rule out any "God of the gaps" to fill out any current scientific lacunae. Thus we must conceive of God as creating *in* the whole process from beginning to end, through and through, or he cannot be involved at all. It is not so much a question of primary and secondary causes, as classically expounded, but rather that the natural, causal, creative nexus of events *is* itself God's creative action. It is this that the attribution of *immanence* to God in his world must now be taken to convey. God is not some kind of diffuse "spiritual" gas permeating everything (like the discarded ether of the nineteenth century), but all-that-is in its actual processes *is* God, manifest in his mode as continuous Creator. This also makes intelligible that striking rationality of the created order, referred to above, which makes it amenable to mathematical interpretation. For if God is at least fully personal, and so rational, his creation in its ultimate depths will be the embodiment of this aspect of his character. So a new stress is required on the *immanence* of God (the "sacrament of the present moment"? [Caussade 1981]) in the light of the scientific understanding of the world, and this demands to be reconciled with our profound and not-to-be-set-aside intuition of God's otherness in himself, his transcendence.

In order to bring together these two conceptions of transcendence over and immanence in creation, one can resort to a *spatial model,* the "space" of different kinds of distinction, as in a Venn diagram. Because there is no part of the world where God is not active and present in the events and processes themselves, and because there is infinitely more to God's being than the world, we could say that the world is *in God,* that there is nothing in the world *not* in God. This

understanding of God's relation to the world is sometimes called pan*en*theism, which has been defined as the belief that the Being of God includes and penetrates the whole universe, so that every part of it exists in him, but that his Being is more than, and is not exhausted by, the universe (*Oxford Dictionary of the Christian Church* 1970).

This spatial metaphor can be developed into what I think is a more fruitful *biological model,* based on human procreation. The concept of God as Creator has, in the past, been too much dominated by a stress on the externality of God's creative acts—he is regarded as creating something external to himself, just as the male fertilizes the ovum from outside. But mammalian females, at least, experience creation within themselves; the growing embryo resides within the female body. This is a proper corrective to the masculine picture—it is an analogy of God's creating the world within herself, we would have to say. This is yet another of the prices we pay for having in the past been more ready to predicate of God the active, powerful, external adjectives, conventionally and inaccurately associated with masculinity, rather than the more passive, responsive, internal adjectives, equally conventionally and inaccurately associated with femininity. God creates a world that is, in principle and in origin, other than "himself," but creates it, the world, within "herself."

d. The demise of determinism in its strict Laplacean form has not vitiated entirely the concept of causality. But we now have a picture of the world as possessing a more open-ended character, a world in which there is a much looser coupling between any two given events and in which science sees rather interlocking networks of statistical relationships, both at the subatomic level, because of the significance in that domain of the Heisenberg uncertainty principle, and in the macroscopic world of biology and the cosmos, because of the sheer complexity of structures and the multiplicity of operative factors. A certain openness, "looseness" even, is attributable to the structures and relational networks that constitute the natural world, and this entails limitations on predictability. There is a degree of openness about the future, especially in the realm of the living where separate organisms operate individualistically, most notably *Homo sapiens.* So the concept of God as the deterministic Lawgiver, prescribing *all* in advance, seems inadequate and even false, and instead we begin to search for metaphors associated with probing experimentation, exploration, and improvisation as representing more appropriately what God is up to in his continuous creative activity.

e. Finally, if we take the suggestion that this universe (cognizable by us) is only one amongst a possible "run" of such universes, must

we say it is by chance that it, and we, exist? We shall return to this question later, in connection with the so-called role of "chance" in biological evolution and its theological significance.

II. The Worldview of Biology

Some of the features of the world of living organisms that modern biology has discerned accord with some of those derived from physics and cosmology, but others are distinctive.

a. The *continuity* of the biological processes of evolution follows from that of the cosmological processes producing stars such as the Sun and its satellite planet, Earth. The continuities of biological evolution extend now to the molecular domain, where increasingly the principles that govern the emergence of self-reproducing macromolecular systems are understood both kinetically (Eigen and colleagues at Göttingen) and thermodynamically (Prigogine and colleagues at Brussels). I will not present here the overwhelming evidence for the interconnectedness through time of all living organisms, originating from one or a few primeval simple forms; I will take it for granted, as the agreed view of informed professional biologists of all creeds, in all kinds of society. (The *mechanism* of this evolutionary process is another matter, to which we shall shortly come.) Again, the "gaps" in this scientific account that scientists yesterday thought they detected continue to have the habit of being closed by the work of scientists today—and those of today will, no doubt, share the same fate tomorrow. The "gaps" into which any god may be inserted go on diminishing, for we see a world in process that is continuously capable, through its own inherent properties and natural character, of producing new living forms. In fact, evolution is the process *par excellence* of the manifestation of emergence. This is the in-built creative potentiality of all-that-is, which we have now to see *as* God at work, continuously creating in and through the stuff of the world he had endowed with those very potentialities. So again we find cause to stress God's immanence in the created order, or rather the creating order, and consequently to affirm pan*en*theism, to maintain his transcendence.

b. We referred to a certain "looseness" in the causal coupling that physics describes. This feature of the world of science becomes more noticeable in the *open-ended character of biological evolution.* In retrospect, each emergence of a new form of the organization of living matter is, in principle, intelligible to us now as the lawful consequence of a concatenation of random events. This involvement of randomness means that, although in retrospect the development is intelligible

(at least in principle) to modern science, yet in prospect the development would not have been strictly predictable. The development of the world as a whole has not unfolded a predetermined sequence of events, such as the development of a mammalian embryo from the fertilized ovum. As Dobzhansky put it: "The chief characteristic, or at any rate one of the characteristics, of progressive evolution, is its open-endedness. Conquest of new environments and acquisition of new ways of life create opportunities for further evolutionary developments" (Dobzhansky 1967, 129). As one goes up the scale of biological evolution, the open-ended character, unpredictability, and creativity of the process become more and more focused in the activity of the biological individual, for in the biological sequence the increase of complexity, which also occurs in the nonliving world of molecular systems, in the living becomes increasingly accompanied by an increase in consciousness, the power of language, and rationality. This aspect of the process reaches its apogee in human creativity and sense of freedom in taking responsibility for decisions. Such a perspective on evolution therefore still attributes a special significance to the emergence of human beings in and from the material universe, but recognizes that they have arrived by means of an open-ended, trial-and-error exploration of possibilities—an exploration devoid neither of false trails and dead ends nor, as consciousness emerges, immune from pain, suffering, and struggle.

If we were right tentatively to see God, as it were, exploring in creation, exploiting opportunities, then we begin to get here a hint of an involvement by God in his creation that involves putting his purposes at risk—an involvement that, in a human context, might well be described as suffering.

c. The mechanism of biological evolution can be interpreted to reinforce this hint or intuition. That mechanism of "natural selection" in its neo-Darwinian form, shaped by post-Darwinian genetics, is simply, as François Jacob, the French Nobel Prize-winning molecular biologist, has put it: "First, that all organisms, past, present, and future, descend from one or several rare living systems which arose spontaneously. Second, that species are derived from one another by natural selection of the best procreators" (Jacob 1974, 13). So the processes by which new species appear is a process of *new life through death of the old.* It involves a degree of competition and struggle in nature, which has often offended our moral and aesthetic sensibilities. It has taken modern biologists to restore the balance in our view of the organic world by reminding us, as Simpson puts it: "To generalise . . . that natural selection is over-all and even in a

figurative sense the outcome of struggle is quite unjustified under the modern understanding of the process. . . . Struggle is sometimes involved, but it usually is not. . . . Advantage in differential reproduction is usually a peaceful process in which the concept of struggle is really irrelevant" (Simpson 1971, 201).

The death of old organisms is a prerequisite for the appearance of new ones. There is indeed a kind of "structural logic" about all this, for we cannot conceive, in a lawful, nonmagical universe, of any way for new structural complexity to appear except by utilizing structures already existing, either by way of modification (as in the evolutionary process) or incorporation (as in feeding). Thus the law of "new life through death of the old" is inevitable in a world composed of common "building blocks," but in biological evolution this does not happen without pain and suffering, and both seem unavoidable, for death, pain, and the risk of suffering are intimately connected with the possibilities of new life in general and the emergence of conscious, and especially human, life, in particular. Moreover, the very order and impersonality of the physical cosmos, which makes pain and suffering inevitable for conscious and self-conscious creatures, is at the same time also the prerequisite of their exercise of freedom as persons. Again, its seems hard to avoid the paradox that "natural evil" is a necessary prerequisite for the emergence of free, self-conscious beings. But if it is necessary, and God is involved "in, with, and under" his creation, cannot we say again we have here a hint of *God suffering* with his creation to bring it to its fulfillment?

d. The role of chance in the processes of biological evolution has offended the sensibilities of some sufficiently to lead to atheistic conclusions. It has also baffled many Christian theists. The position is that we have to recognize that the process by which permanent changes (mutations) occur in the material (DNA) that carries the genetic instructions to succeeding generations of an organism is entirely random with respect to its need to survive long enough to procreate—the condition for the survival of the species. Yet it is the occurrence of such mutations that provides the variation on which "natural selection" by the environment favors some changes rather than others—and so produces new species with the accumulation of change (sometimes slowly, sometimes surprisingly rapidly). So "chance" seems to be at work here, in both its sense of an event resulting from so many multiple factors (e.g., the symmetry of a coin when tossed leading to a 50 percent chance of heads or tails) and in the other sense of the intersection of two independent causal chains. Both kinds of "chance" are involved in evolution: the former is

exemplified in this context by the mutational event in the DNA, the latter by the joint coincidence of mutational event and environmental situation, leading to a better-surviving form of the species. For Jacques Monod, this meant that "pure chance, absolutely free but blind," lies at the very base of the "stupendous edifice of evolution" (Monod 1972, 110). From it he deduced the hopelessness of finding any meaning in the universe, in general, and in the human presence in it, in particular.

However, this randomness of a molecular event in relation to biological consequence does not have to be raised to the level of a metaphysical principle for interpreting the universe. Indeed, in the behavior of matter on a larger scale many regularities, which have been raised to the level of "laws," arise from the combined effect of random microscopic events that constitute the macroscopic. So the involvement of chance at this level of mutation does not, of itself, preclude the possibility that these events manifest a lawlike behavior at the level of populations of organisms.

Instead of being daunted by the role of chance in genetic mutations, as the manifestation of irrationality in the universe, it would be as consistent with the observations to assert that the full gamut of the potentialities of living matter could only be explored through the agency of the rapid and frequent randomization that is possible at the molecular level of the DNA. Indeed, the role of "chance" is what one would expect if the universe were so constituted that all the potential forms of organization of matter (both living and nonliving) might be explored. Moreover, even if the present biological world *is* only one of an already large number of possibilities, the original primeval cloud of fundamental particles at the "hot big bang" must have had the *potentiality* of being to develop into the complex molecular forms we call modern biological life. It is this that I find significant about the emergence of life in the universe; the role of chance is simply what is required if all the potentialities of the universe are going to be elicited effectively. So I see no objection to conceiving of God as allowing the potentialities of his universe to be developed in all their ramifications through the operation of random events. It is as if chance is the search radar of God, sweeping through all the possible targets available to its probing—and these must be taken to include any "run" of possible universes that cosmologists have to postulate as having preceded our own. Chance can thus be seen as a creative agent, and we need not be daunted by the fact that the existence of life, and perhaps of our actual universe, is the result of its operation. The fact is that matter-energy has in space-time, in *this* universe, acquired the ability to adopt self-replicating living structures

that have acquired self-consciousness and the ability to *know* that they exist and how they evolved.

Since Monod made his contribution there have been other developments in theoretical biology that cast new light on the interrelation of chance and necessity in the origin and development of life. I refer to the investigations (Peacocke 1983) of Prigogine and Eigen and their collaborators, which show how subtle can be the interplay of chance and necessity, of randomness and law, in the processes that led to the emergence of living structures.[2] These studies demonstrate that the *mutual interplay of chance and law (necessity or determinism) is creative,* for it is the combination of the two that allows new forms to emerge and evolve.[3] Furthermore, the character of this interplay of chance and law appears now to be of a kind that makes it "inevitable" both that living structures should emerge and that they should evolve—given the physical and chemical properties of the atomic units (and presumably, therefore, of subatomic particles) in the universe we actually have. According to these analyses, although the emergence of living systems may be "inevitable," it is nevertheless "indeterminate," for it is impossible to trace back the precise historical route or to predict the exact course of future development, beyond certain time limits, because of the involvement of time-dependent random processes. It now appears that the universe has potentialities that are becoming actualized by the joint operation in time of random, time-dependent processes in a framework of lawlike properties—and that these potentialities include the possibility of biological, and so of human, life.

What can the assertion that there is a God who is Creator really mean in this new context? We need to rethink our models of God's action in the world. The potentialities of the stuff of this world, with its particular "given" properties—to elicit life (and so humanity)—are written into creation by the Creator himself, and they are unveiled by chance exploring their gamut (a musical term meaning "the whole scale, range or compass of a thing" [O.E.D.]).

Perhaps I may be allowed to press the musical analogy further. We might now see God as Creator as a composer who, beginning with an arrangement of notes in an apparently simple tune, elaborates and expands it into a fugue by a variety of devices. Thus does a J. S. Bach create a complex and interlocking harmonious fusion of his original material. The listener to such a fugue experiences, with the luxuriant and profuse growth that emanates from the original simple structure, whole new worlds of emotional experience that are the result of the interplay between an expectation based on past experience ("law") and an openness to the new ("chance," in the sense that the listener

cannot predict or control it). This is significant not only in the context of music itself—to those for whom music is entering into communion with the mind of the composer (and even of God)—but also, in our present context, in its modeling of God's creative work for those to whom the whole world is sacramental. As in the enrichment that comes from the unfolding and elaboration of a celebration of the Christian Eucharist from a few simple acts and their associated words, so contemplation of creation as sacramental engenders experience of and possession by God, who, as the Holy Spirit moved not only "on the face of the waters" at the beginning but moves through it now, transforming all into new forms, in and through the elaboration of the very stuff of the world.[4]

So might the Creator be imagined to unfold the potentialities of the universe, which he himself has given it, selecting and shaping by his redemptive and providential action those that are to come to fruition—an Improviser of unsurpassed ingenuity. One recalls in this connection that the music of creation has also been a constant theme of the religions of India—for example, the South Indian representations, in bronze, of the dancing Shiva, the Creator-Destroyer, as Lord of the Dance of creation.

Both images, the writing of a fugue and the execution of a dance, serve to express the idea of God enjoying, of playing in, creation. This is not an idea new to Christian thought. The Greek fathers, so Harvey Cox argues, contended that the creation of the world was a form of play. "God did it, they insisted, out of freedom, not because he had to, spontaneously and not in obedience to some inexorable law of necessity" (Cox 1969, 151).

The creative role of chance operating upon necessities which are themselves created has led us, then, to accept models of God's activity that express God's gratuitousness and joy in creation as a whole, and not in humanity alone. The created world is then seen as an expression of the overflow of the divine generosity.

III. The Hierarchy of Natural Systems: Man as Agent—God as Agent

I have described our scientific understanding of the world as that of a hierarchy of natural systems, each with its own science—and so language, concepts, and methods—appropriate to its elucidation and investigation. I argued that at least some of the concepts applicable to higher levels are autonomous, i.e., not logically reducible to those concepts applicable to levels lower in the scale of complexity, even though the "higher" (i.e., more complex) systems contained

processes involving lower-level entities. For example, to be an anti-reductionist biologist, vis-á-vis physics and chemistry, is not to be a vitalist postulating additional entities that constitute the "life" of matter in its living forms. What is true about this interface is also true at interfaces higher up in the scale of complexity, including human beings. That the language describing mental events is irreducible to that of cerebral physiological events is a proposition widely supported by philosophers of many different views on the mind-brain relation. The mental activity of "consciousness" does not have to be predicated of some new entity, the "mind," but is an activity of matter which emerges when its units have evolved a particular kind of organized complexity. Apart from any philosophical analysis, the evidence for the intimate relation between mental activity and the physiochemical state of the brain is, of course, enormously strong.

Are mental events identical with neurophysiological events? This question has been at the center of philosophical debates in recent decades, and from the stands, as it were, I note that many philosophers now accept that there is identity between mental states and brain states, but that they differ as to whether this is a contingent or a necessary identity. They also differ on whether or not mental events can be predicted. It appears that even materialist views of the body-mind relation often incorporate what other views are often designed to ensure, namely, the ability of the human brain in the human body to be a self-conscious free agent. I see no reason why Christian theology could not accept a body-mind identitist view that is qualified with respect to the "anomaly" of mental events and to their non-reducibility to the physical (cf. Davidson 1970), and that allows the autonomy of the human being as a free agent, as a "self." For the sense of the self as an agent remains a given fact of our experience of ourselves in relation to our bodies and to the world.

In reflecting on *human being as agent* we encounter a lacuna in our thinking: How can the mental events, which seem to be identical with the neurophysiological events, include a sense of selfhood and of agency with respect to the very body that is experiencing? I suggest that this problem of how the human sense of being an agent, of being a self, an "I," can be related to its action in the world of physical causality is of the same ilk as the relation of God to the world. How can God act in a world in which every event is tied to every other by regularities which the sciences explain with increasing competence? How can I, experiencing myself mentally as an agent, initiate processes within the chain of physical events constituting my body, processes that themselves *are* my intended action? I am not another

cause alongside my body but simply my body in reasoned and intended action. Nevertheless, in my experience of self as agent I transcend any particular action or group of actions, for any one physical action (e.g., raising my arm) can express many different intentions in various contexts. In my actions I am a transcendent causal agent, expressing myself in and through the physical structure of my body.

Can we not similarly conceive of *God as agent* in the world? God's transcendence over the world in which he is immanent implies that he expresses his intentions within the causal nexus of the natural world. God's transcendence must, of course, be of a higher order than that of the human self over the body, since God transcends the whole world process; but this could still be consistent with the world's being that realm of physical causality and regularity which the sciences show it to be—as consistent, that is, as the mental character of the experience of being a human agent with the implementation of such an agent's intentions within the causal nexus of his or her physical body.

The notion of God's relation to the world as at least analogous to the relation of the human mind to the human body (God : world:: mind : body) has a long history, but it was usually based on dualist assumptions about human beings and on interventionist assumptions about God's action in the world. Our new understanding of natural hierarchies, of the irreducibility of at least some higher-level concepts, and our new assessment of the relation between consciousness and the brain now transform the context within which such a model is developed.

We note, moreover, that the *meaning* of an action by a human agent is not to be found by scientific analysis of the processes going on in the agent's body, but by discovering his or her reasons and intentions. The model therefore suggests that if God is to be regarded as, in some sense, the agent of the nexus of physical events, then we should look for the meaning of these events in *his* reasons and intentions (i.e., his purposes). He is in all that goes on in nature and its processes—even if his purposes must be regarded as not always fully implemented in a world that has generated apparently free human agents within itself.

However much we may regard God as immanent in and expressing himself as agent through the world process, he is, ultimately, beyond all such describing and experiencing of him; he is the perpetual Creator of that process and never ceases to be such. So the transcendence of God, who is immanent, is of a higher order (or "power" in the mathematical sense) of transcendence than that of the

human agent over his or her own actions. Perhaps one should say that in one aspect, or mode, of his being God is transcendent Creator, but in another aspect he is, by analogy to human agency, transcendence-in-immanence, and in this latter mode he acts within persons, being immanent in the whole physical nexus. If we go on to say that this is eternally true of God's being, we come very close to the formulations of classical trinitarian doctrine.

To use person-as-agent as a tentative model of God-as-agent seems therefore to be suggestive and fruitful. It should however be noted that it is only the *functional* activity of person-as-agent that provides the model: it is not based ontologically on the kind of being that is human being. What people actually do and how they actually relate to the world, far from making intelligible the relation of God to the world (the doctrine of creation, if you like), generate only enigma and paradox. For in light of the enormous potentiality of human beings for creative good and for degradation and evil, destructive both of themselves and the rest of the created world, we may well ask: What does God think he was and is up to in evolving humanity, this "glory, jest, and riddle of the world"?

In humanity, biological evolution passes a critical point, for *these* evolved creatures can attempt to act independently of the intentions of the Creator. It follows that, in evolving human beings, God was taking a risk in giving them this hazardous, yet potentially creative, ability to be free. There must have been, as it were, a *cost* to God in his giving them this gift of the possibility of becoming more than their predecessors. In other words, God in creating human beings was acting with supreme magnanimity on behalf of the good of another existent—what in human life would be regarded as an expression of love. So it is meaningful to say that God's acts of creation are an expression of "love," an outgoing of his inner being on behalf of another, albeit created, person. God the Creator is the One of whom the First Epistle of John (4: 9, 16) says bluntly, "God is love."

Is it not reasonable to go further and to conclude that the creative loving action which operates in the universe, eventually bringing forth human beings, is not incorrectly described as that of a *suffering* Creator? For risking love on behalf of another, who remains free, always entails suffering in the human experience of love. It is, moreover, consistent with the processes of creation through evolution, themselves being characterized by eliciting new life through suffering, pain, and death. So our "model" of God as the personal agent of the creative process has to be amplified to include an awareness of him as the Creator who suffers in, with, and through his

creation as it brings into existence new and hazardous possibilities—most of all those implicit in the creation of human beings, self-determining persons.

IV. Our Understanding of God's Action in the Real World (in Light of the Knowledge of It Provided by the Sciences)

From the continuity and creativity of the processes of the natural world we inferred that God's creative relation to the world must be conceived of as a continuous, sustaining, creative action within these natural processes. This is what we meant by saying that the Creator is *immanent* in his creation, and that is why we look for his "meanings" *within* the world of which we are part.

But the natural processes of the world have led to the emergence, within it, of human beings who possess a sense of transcendence over their environment which serves to sharpen the quest for One who makes intelligible the fact that there is anything at all—the One who is ultimate Being and who gives being to all else. So we continue to postulate God the Creator as *transcendent* over all matter-energy-space-time, over all-that-is.

However, the concept of God the Creator as both immanent and transcendent was not entirely satisfactory when applied to One who is the Creator of that in which he is immanent. Of outstanding historical importance, of course, in relation to this problem are the Logos concept and that of God as Spirit. However, these two traditional "models" need supplementing today—in the light of our scientific knowledge of the world—by such models as that of *pan-entheism,* whereby the world is regarded as being, as it were, "within" God, but the being of God is regarded as not exhausted by, or subsumed within, the world. In this connection, a feminine image of God as Creator proves to be a useful corrective to purely masculine images by its ability to model God as creating a self-creative world *within* God's own Being.

We would also have to say, as a consequence of the created order's being continuously God in action, that although God is not more present at one time or place than at others (he is not a substance; everything is of God at all times), we nevertheless find that in some sequences of events in created nature and history God unveils his meaning to us more than in others. There are *meanings* of God to be unveiled, but not all are read: some events are and will be more revealing than others. Moreover, any meanings unveiled in the *various and distinctive levels* of the world must be complementary, and not all

have pertinence in the human search for meaning and intelligibility.

We have found that the processes of the world are *open-ended* and that there are *emergent* in space-time new organizations of matter-energy which often require epistemologically *nonreducible* language to expound their distinctiveness. Thus it was that I ventured the idea of God as "exploring" in creation, of actualizing all the potentialities of his creation, of improvising and unfolding fugally all the derivations and combinations inherently possible. The meanings of God unveiled to and for *humanity* will be the more partial, broken, and incomplete the more the level of creation being examined departs from the human and personal, in which the transcendence of the "I" is experienced as immanent in our bodies. The more personal and *self*-conscious the entity in which God is immanent, the more capable it is of expressing God's supra*personal* characteristics.

This stress on emergence is one-sided without a balancing emphasis on the *continuity* required by the scientific perception of natural processes. Thus any new meaning that God may express in a new emergent entity should not be discontinuous with meanings expressed in that from which it emerged. So it is that the transcendence-in-immanence of human experience raises the hope and conjecture that in *a* human person, adequate for the purpose, immanence might be able to display in a uniquely emergent mode a transcendent dimension to a degree that could *unveil,* without distortion, the transcendent *Creator*—which is what is meant by *incarnation.*

Furthermore, from a consideration of the character of the natural processes of suffering and death and from a recognition that God has put his own purposes at risk in creating free, self-conscious persons, we have tentatively recognized that *God suffers with creation and in the creative process*—that is, God *is* Love.

And so our two paths to reality, of science and religion, begin to converge as each points to a depth of reality beyond the power of model or metaphor, in which all that is created is embraced in the inner unity of the divine life of the Creator—transcendent, incarnate, and immanent. We can but echo Dante (1962) in his ultimate vision of the divine unity (in Canto 33, 25, of *Il Paradiso*):

> Thither my own wings could not carry me,
> But that a flash my understanding clove
> Whence its desire came to it suddenly.
> High phantasy lost power and here broke off;
> Yet, as a wheel moves smoothly, free from jars,
> My will and my desire were turned by love,
> The love that moves the sun and the other stars.

The rest is silence.

NOTES

1. This article, excerpted and adapted from *Intimations of Reality* by A. R. Peacocke (1984), represents the second Meldenhall Lecture, delivered at DePauw University, Greencastle, Indiana, on 26 October 1983. It summarizes some of the major themes in the author's book *Creation and the World of Science* (based on the 1978 Bampton Lectures at Oxford and published by Clarendon Press, Oxford, in 1979). This article refers to continuing concerns of the author's thought, much of which (especially the problem of the nature of God's interaction with the world) has been developed further in his book *Theology for a Scientific Age: Being and Becoming—Natural and Divine* (1990).

2. For a fuller exposition of the scientific principles see Peacocke (1983), especially chapters 2 and 3.

3. As beautifully exemplified, with reference to many contexts, in Eigen and Winkler (1981 and 1982).

4. I am indebted to Dr. Jean van Altena for this illuminating extension of the fugal image to the Christian Eucharist and for other phrases in these paragraphs.

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