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Cosmic Purpose and the Contingency of Human Evolution*

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In their joint work, Theism, Atheism, and Big Bang Cosmology, Quentin Smith and William Craig debate the consequences of the new cosmology for belief in God. Smith claims that Big Bang cosmology effectively disproves the existence of a Creator. One of his arguments runs like this. According to Big Bang theory, the universe began from a singularity. Such singularities are inherently chaotic and unpredictable. No physical laws connect them to later states; in fact, the form taken by later physical laws, the relative magnitude of the four fundamental forces, for instance, is not determined by the initial singularity and is, in principle therefore, a random outcome. Thus, "God has no basis on which to compute what will emerge from the singularity."[1] God (if there is a God) could not, then, have had as purpose that the created universe should contain animate creatures, since a universe in which such creatures could never appear could equally well have developed from the initial singularity (indeed, according to recent "anthropic" arguments would have been far more likely to do so). This, therefore, according to Smith, constitutes an argument against the sort of Creator that religious people normally believe in, namely one whose purposes in creating the universe included the bringing to be of the human race.[2]

Smith assumes, reasonably enough, that for an action to count as purposive, the agent must have some degree of knowledge of the likely outcome of the action. But if the physical processes involved are such that the agent cannot tell in advance how to act in order to achieve the desired end, then purposive action is effectively blocked. Extending this plausible premise from human agency to the agency of a Creator may not, however, be as simple a matter as Smith is assuming. Does God anticipate the future by extrapolating from a knowledge of the present, as

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we do? Does God have to rely on the predictability of a particular physical process in order to make use of that process to achieve a Divine end? Is God's relationship to past, present, and future sufficiently like ours for these analogies to go through?

This is the topic I want to address, not in the context of early-universe cosmology where the processes involved in the first primitive stages of the universe's expansion are barely understood, but rather in the context of evolutionary accounts of human origins where the fortuitous character of the outcome has been debated since Darwin first proposed his theory of natural selection a century and a half ago. The role played by chance in that theory seemed from the beginning to call in question the teleological character of the overall evolutionary process. Yet if this be so, how is one to reconcile it with the traditional Biblical understanding of human origins? Even if one were to interpret the Genesis account of the Creator's breathing of life into the dust of the earth to mean that God relied on the natural processes of the created world to form the first humans, could these processes really be as contingent in their working as the new theory seemed to make them and still serve as the agencies of God's purpose in ensuring the appearance of beings made in God's own image?

One possible response is to point to the overall directionality of the evolutionary process, its apparent tendency to lead to greater and greater degrees of complexity, however that elusive term be defined. Even if the multitude of individual mutations and crossings of causal lines that compose evolutionary process were to be inescapably random in nature, the long-term direction of the process itself could then be relied on to lead to the sort of superior adaptability associated with intelligence. And so evolution could once again be construed as God's instrument in achieving a definite end: the appearance of human beings somewhere in the cosmic vastness. Christians sympathetic to Darwin were inclined to orthogenetic interpretations of evolutionary process of this sort in which chance was in the end overcome by something like necessity.[3]

This essay falls into three main parts. First, I want to sketch two opposing trends in the understanding of evolutionary process, one which represents it as more or less predictable, and the other which stresses its contingency. In recent years, thanks in particular to the writings of Stephen J. Gould, the latter trend has attained considerable prominence. In the second part, I will first analyze, and then make use of, the notion of teleological explanation in order to see how far one can go in attributing purpose to evolutionary process on scientific grounds. In the third part, finally, I will explore the implications of the traditional religious view of the cosmos as the work of a Creator for whom the existence of human beings could be construed as in some appropriate sense fulfilling Divine purpose. One way in which the contingency of the evolutionary account of natural selection might be countered from the scientific point of view would be to suppose that God acted in some sort of "special" way to bring about the appearance of humanity. And this has, indeed, been a fairly standard response on the part of Christian writers. But there is another alternative. If the Creator escapes from the limits imposed on the creature by temporality, as indeed the traditional Augustinian account supposes, might not the effect of contingency be blunted since the Creator would no longer be dependent on a knowledge of the present for an anticipation of the future?

1. Predicting evolution

A common view of biological evolution is that, given the right environment, it will necessarily occur and in the course of time necessarily give rise to intelligence. Textbook presentations of Darwinian theory often make a progressive process of this sort seem like a simple consequence of natural selection in operation. Heritable variations that favor differential survival of descendants will necessarily tend to spread in the population. There may be additional complications involving geographical isolation, environmental change and the like, but the impression is of a gradual but steady drift towards greater complexity. Organic structures become more complex as new organs develop and old ones find new uses. Intelligence itself, with the enormous advantage it confers in terms of survival and propagation, may then seem an almost inevitable development, if the time-scale be generous enough.

This "upward and onward" view of the action of evolution finds some support in the text of The Origin of Species itself:

> Natural selection acts, as we have seen, exclusively by the presentation and accumulation of variations which are beneficial under the organic and inorganic conditions of life to which each creature is at each successive period exposed. The ultimate result will be that each creature will tend to become more and more improved in relation to its conditions of life. This improvement will, I think, inevitably lead to the gradual advancement of the organization of the greater number of living beings throughout the world.[4]

Elsewhere, it should be said, Darwin sometimes shows himself much less confident about the inevitability of this sort of progress.

One recent strong supporter of the inevitability thesis is Nobel-prize biochemist, Christian de Duve. In his book, Vital Dust (1995), he argues that as we have come to understand the complex processes of the living cell, we have been able to give a more and more satisfactory account of the developments that could have led up to the appearance of the first cell. He maintains that: "Most of the steps involved must have had a very high likelihood of taking place under the prevailing conditions."[5] The universe, he concludes, "is pregnant with life":

> In this organic cloud, which pervades the universe, life is almost bound to arise, in a molecular form not very different from its form on Earth, wherever physical conditions are similar to those that prevailed on our planet some four billion years ago. This conclusion seems to me inescapable. Those who claim that life is a highly improbable event, possibly unique, have not looked closely enough at the chemical realities underlying the origin of life. Life is either a reproducible, almost commonplace manifestation of matter, given certain conditions, or a

> miracle. Too many steps are involved to allow for something in between.[6]

And he extends this argument from the development of the first cell to the appearance on earth of intelligence; he "sees at work throughout animal evolution a strong selective pressure favoring the creation of neuronal networks of increasing complexity."[7] And again: "The drive toward larger brains and, therefore, toward more consciousness, intelligence, and communication ability dominates the animal limb of the tree of life on earth."[8] His conclusion is directed specifically against Stephen Gould: "The history of life on earth allows less leeway to contingency and unpredictability than current fashion claims."[9]

It was among philosophers, perhaps, that the progressivist view of the development of life found warmest welcome originally, especially among those who regarded evolution as the key to their cosmology and to their philosophy generally. Herbert Spencer formulated a "law" of evolution that would, he believed, hold not only for living things but for the physical world generally. Organic structure, he claimed, tends to become more and more differentiated over time, with new forms of integration constantly appearing. Following Lamarck, he maintained that the use or disuse of an organ could lead to hereditable changes of function. Later philosophers like Lloyd Morgan, Samuel Alexander, and Henri Bergson, proposed theories of evolution that departed even more from the Darwinian norm than did Spencer's, while agreeing that evolution is a relatively steady and progressive process.

It is notable that those philosophers who have represented evolution in strongly progressivist terms have as a rule (Spencer would be an obvious exception) seen evolution as God's mode of action in the world. This conjunction finds its most striking expression, perhaps, in the work of Pierre Teilhard de Chardin. He sought an explanation for the steady "complexification" he found in the fossil record of life, in a "psychic" or "radial" energy that operated directively, unlike the "tangential" energies treated in physics and chemistry. Though he allows for a degree of "groping" along the way, evolution is for him "a grand orthogenesis of everything living toward a higher degree of immanent spontaneity," "a spiral which springs upwards as it turns. From one zoological layer to another, <u>something is carried over: it grows,</u>

jerkily, but ceaselessly and in a constant direction."[10] So steady, indeed, in his view has the upward curve been that he felt entitled to extend it into the far future to an Omega Point where consciousness will finally be fully realized, a Final Cause in which an explanation will be found for the entire course of evolution that inexorably led in its direction.

Few other evolutionary philosophers were quite so confidently orthogenetic in their understanding of the evolutionary process. But philosophers have been on the whole more likely than biologists to see the operation of evolution in terms of law, of a force analogous to Newtonian gravity that relentlessly alters the composition of the gene-pool to create more and more complex organisms.

In recent years, the "progressivist" view of evolution is even more likely to be found among physical scientists, especially those who speculate about the existence of intelligent life elsewhere in the cosmos. If one is to devote expensive resources to SETI, as the search for extraterrestrial intelligence has been dubbed, it is important to have at least some sort of estimate of the likelihood of success. Frank Drake, a highly-regarded radio-astronomer eager to direct his Arecibo radio-telescope to the search, in 1961 formulated an "extraterrestrial civilization equation" involving seven factors that should yield such an estimate if the magnitude of each factor could be roughly estimated. The number of extraterrestrial civilizations in our galaxy with both the capacity for, and an interest in, interstellar communication would be given by the product of these factors, two of them intended to specify the likely number of planetary systems in the galaxy, the others dependent on the likelihoods of various outcomes: how likely it would be for a planetary system to be hospitable to life, how likely it would be that life would actually develop in such a case, how likely it would be that such life would evolve into intelligence, how likely it would be that intelligent life would develop the means for interstellar communication, and how long a civilization with these capacities would be likely to last.[11]

There is much one could say about the hazards of venturing even the roughest guesses in such a context; undeterred by such hazards, Carl Sagan ventured 10^6 as a reasonable estimate of the number of potential partners in an intra-galactic dialogue. My interest here lies in Sagan's understanding of biological evolution (one shared with the great majority of those who favor SETI expectations) that given the "right" planetary environment and enough time, biological evolution will necessarily occur, and

that in the course of time this evolution will necessarily progress towards higher and higher levels of intelligence. Darwinian natural selection is taken to operate in a steady way, favoring the spread of hereditable variations that promote differential survival of descendants. Though the potential role of environmental factors and physiological constraints in inhibiting this process is not denied, the tendency is to minimize these other aspects of neo-Darwinian theory, and to regard the central role of natural selection as warranting a confidently progressive outcome, "given sufficient time." Thus evolutionary theory becomes a predictive resource, and not just an explanation for the radiation of living forms in times past.

2. The contingency of evolution

Those who shaped the "new synthesis" in evolutionary biology over the past half century were never comfortable with the predictive uses of evolutionary theory by exobiologists and others, and were flatly opposed to orthogenesis in any shape or form. Ernst Mayr and Theodosius Dobzhansky were among those who expressed their skepticism about this way of understanding evolutionary modes of explanation. The most outspoken critic was, perhaps, George Gaylord Simpson who in This View of Life developed an extended polemic against the assumptions underlying the predictivist account. He emphasized, in particular, the fundamental differences between such non-historical natural sciences as physics and chemistry and the historical sciences: geology, paleontology, and evolutionary biology. The latter deal with unique events for which the notions of law applicable in physics, on which people like Drake and Sagan draw, simply do not work. The complexity of the interactions between environment and gene-change is so great that any attempt to abstract "trends" or "tendencies" is bound to fail. "There is direction, but it wavers, and apparently random effects also occur."[12]

In Chance and Necessity (1971), Jacques Monod celebrated the decisive role of chance in evolution. Since mutations in DNA:

> constitute the only possible source of modifications in the genetic text, itself the sole repository of the organism's hereditary structures, it necessarily follows that chance alone is at the source of every

> innovation, of all creation in the biosphere. Pure chance, absolutely free but blind, at the very root of the stupendous edifice of evolution: this central concept of modern biology is no longer one among other possible or even conceivable hypotheses. It is today the sole conceivable hypothesis.[13]

Mutations are "chance" events for him in two different senses. First, they represent the convergence of previously unrelated causal chains: second, they are quantum events and hence essentially unpredictable. The course of evolution is thus itself unpredictable in detail. Yet despite the far-reaching consequences that Monod draws from the primacy of chance in the story of evolution (losing our "necessary place in nature's scheme" condemns us to "a frozen universe of solitude")[14], he is still willing to allow that evolution follows a "generally progressive course," that its general direction is "upward," that an initial commitment in particular groups to a certain kind of behavior "commits the species irrevocably in the direction of a continuous perfecting of the structures and performances this behavior needs for its support."[15] So the operation of natural selection seems to restore a fair degree of directionality, and even of progress, to the course of evolution after all.

Stephen Jay Gould takes a much stronger line regarding the contingency of evolutionary change. He will have no truck with "upward courses" or "trends," or with predictability of even the most modest kind. And his emphasis is not on the randomness either of the mutations that afford the material for natural selection nor of the genetic drift in founder populations. Rather, it is on the lack, in general, of connection between the multiple lines of causality that affect singular historical events, such as changes in the gene-composition of a population.

In his popular essays, he returns over and again to the flexibility of the evolutionary process that makes it something other than simple selectionist accounts would lead one to expect. In the title essay of Eight Little Piggies, he argues that the pentadactyl limb we share with so many other mammalian species "just happens to be." It ought not necessarily be taken to testify to some intrinsic adaptive advantage of five, as against some other number, of digits; the earliest tetrapods, in fact, had seven or eight digits. Rather, the number may derive from:

> the complex, unrepeatable, and unpredictable events of history. We are trained to think that the "hard science" models of quantification, experimentation, and replication are inherently superior and exclusively canonical, so that any other set of techniques can pale by comparison. But historical science proceeds by reconstructing a set of contingent events, explaining in retrospect what could not have been predicted beforehand.... Contingency is rich and fascinating; it embodies an exquisite tension between the power of individuals to modify history and the intelligible limits set by laws of nature. The details of individual and species' lives are not mere frills, without power to shape the large-scale course of events, but particulars that can alter entire futures, profoundly and forever.[16]

The nature of history and of historical science is the theme around which Wonderful Life, his lively account of the successive and conflicting interpretations of the Cambrian fauna found in the Burgess shale, is organized. He has long been a critic of the gradualism of the traditional Darwinian account of the operation of natural selection, urging instead a "punctuated equilibrium" in which long periods of stasis, when species remain more or less unchanged, are interspersed with moments of relatively sudden speciation.[17] In this ambitious work, he reconstructs the extraordinary original flowering of the major phyla of nearly all modern animal groups within a geologically (and biologically) brief interval of a few million years during the Cambrian period, beginning around 570 million years ago. What excites Gould most about the "Cambrian explosion," as it has been called, is not just the fact that the phyla appeared over such a relatively brief time nor that no new phyla have appeared since, but that the vast majority of the arthropod "ground-plans" found in the Burgess shale have no modern representatives.

Put in another way, of the twenty-five or so diverse anatomical designs found in the shale, any one of which could, in Gould's view, have served as ancestor for a distinct phylum, only four survived the Cambrian period and gave rise to the modern animal phyla. It is this decimation of phylum-

candidates, this "lottery" as he terms it, that Gould sees as testimony to the effects of historical contingency. The conventional response, of course, would be that the four surviving phyla were in some way better adapted for changing environmental conditions. Gould regards this as implausible. But even if this were to have been the case, under a different environmental scenario the list of survivors (he claims) would have been quite different. And everything that came later would then have taken a quite different direction.

Gould's emphasis on extinctions, particularly the great extinctions of life that marked the end of the Permian period, when up to 96% of marine species died off, and of the Cretaceous, when the dinosaurs vanished, is in some ways reminiscent of the catastrophism that enlivened geological debate two centuries ago. His claim is that in such episodes natural selection of the usual sort would cease to operate; it would in large measure be a matter of luck which among all the existing species would survive to propagate themselves in a depopulated world. Furthermore, the causes of such massive extinctions are a matter of chance, relative to the prior history of the affected populations. And so he concludes:

> Since dinosaurs were not moving toward markedly larger brains, and since such a prospect may lie outside the capabilities of reptilian design, we must assume that consciousness would not have evolved on our planet if a cosmic catastrophe had not claimed the dinosaurs as victims.[18]

The strength of Gould's case lies in his insistence on the importance of the web of necessary conditions in any explanation of a complex historical event, conditions, that is, in whose absence the outcome would have been different, perhaps altogether different. One specific source of contingency to which he often returns is the constraint set on possible adaptive lines of development in a particular population by the availability in some corner of that population, for quite other reasons, of the appropriate anatomical framework for that development. Thus, one obscure group (lungfish/coelocanth) belonging to the vast domain of fish species in the Devonian period happened to have the sort of skeleton that would permit the development of limbs, thus allowing locomotion on land.

Had those species not been present, as they might well not have been, Gould remarks, amphibians could not have invaded the land, which in that event might still be inhabited by insects only.[19]

Few have pushed the theme of contingency as far as Gould has; others have found his emphasis much overdone.[20] He is, of course, right about the overall contingency of the evolutionary path actually followed. But "contingency" is ambiguous in this context: it may refer to the chance character of the particular outcome, or to the unlikelihood of an outcome of this general sort. Accepting the first by no means commits one to the second. The question remains: how does one know what would have happened if life had taken a different fork along the way? Or more exactly: how likely was it that life on land would not have developed if lungfish had not been around at the right time? Or that consciousness would not have developed if an asteroid had not hit or if climate change had covered Africa in forest three or four million years ago? The massive evidence for parallel evolution of such organs as the eye or of physiologically very similar species ought to give one pause in making such claims of unlikelihood. It seems as though contingency has in many instances been overridden by strong selective advantage.

There appears, then, to be a considerable risk involved in adopting either of the extremes above, the appeal to laws or tendencies that would allow one assert that life on land or the advent of consciousness on this planet would assuredly have come about anyway, or the emphasis on radical contingency that allows Gould conclude that Homo sapiens is a "tiny twig on an improbable branch of a contingent limb on a fortunate tree." "Replay the tape a million times from a Burgess beginning," he remarks," and I doubt that anything like Homo sapiens would ever evolve again."[21] How can we be so sure either of the inevitability or the improbability of the advent of consciousness?

Most evolutionary biologists and philosophers of biology seem to adopt a middle course somewhere between these extremes, but this still allows for a lot of latitude. Dobzhansky, for example, disagrees with what he regards as an overemphasis on chance on the part of Monod. On the contrary, he remarks: "Viewing evolution of the living world as a whole, from the hypothetical primeval self-reproducing substance to higher plants, animals, and man, one cannot avoid the recognition that progress or advancement, or rise, or ennoblement, has occurred."[22] Though chance predominates in mutation and recombination, he goes on, natural selection serves to counterbalance this as an "anti-

chance" factor. Thus, though the course of evolution cannot be predicted, "it does not follow that the human species arose by a lucky throw of some evolutionary or celestial dice."[23] In a recent assessment of the issue, Elliott Sober is more cautious. He is skeptical of the suggestion that the evolutionary process has in the past displayed progress or even direction. Though there may have been directional trends within specific lineages, all that the theory of natural selection allows one to conclude is that such trends are possible. It does not, however, allow one to anticipate them in advance; the multiple sources of contingency exclude this.[24]

What may we conclude from this rapid survey? Macro-evolution is an irregular process, admitting of breaks, reversals, large-scale extinctions. Its course can, in principle at least, be explained after the fact, but it cannot be anticipated by us. The last billion years has seen an enormous growth in the variety and number of species. There has been a concomitant growth in the complexity of organisms that, (according to some) can be construed as a form of progress; it has, however, proved difficult in practice to find an agreed definition of what 'complexity' and 'progress' should be taken to mean in this context.[25] Nevertheless, as the palaeontological and geological records come under closer scrutiny and genetic mechanisms come to be better understood, the fragile character of the causal skein leading up to the first appearance of humans becomes ever more evident.

What are the theological implications of this emphasis on contingency, whether at the evolutionary or the cosmological levels? Belief in a Creator has usually gone hand in hand with a conviction that the human race has a special role to play in the story of the Creation: fashioned in the Creator's image, the only creatures so far known to us that are able freely to offer or to deny the Creator their love. Jews, Christians, and Moslems would be at one in supposing that insofar as we can speak of God's plans at all, we can assume that humans have a significant part in at least one corner of them. It would seem to follow, then, that the appearance of the human species would not, as it were, have been left to chance. If it was part of the Creator's purpose that humans should eventually make their entrance on planet Earth after a fifteen-billion year preparation, can the story of that long prelude be as shot through with contingency as it seems to be? Conversely, if the contingency thesis be accepted, even if not in as radical a form as Gould or Smith propose, does this not cast doubt on the

belief that the Creator intended the cosmos to bring forth human beings? And if it does, would it not also call in question the whole notion of an omnipotent Creator whose purposes give meaning to a universe that would otherwise be pointless?

The frank anthropocentrism of the line of inquiry these questions open up runs counter, of course, to the instincts of scientists who sometimes call on a "Copernican principle" to justify their refusal to grant any form of privilege to humans. But Western theology is of its nature anthropocentric; it is concerned centrally with human destiny. When theologians hurdle the eons of evolutionary time in order to concentrate on the relationship between human beings and God, the form their inquiry takes will necessarily appear alien to scientists who look on humans as one node, admittedly a particularly intricate node, in a vast network of living kinds. But if scientists ought to be careful not to rush too rapidly to judgment when their theological colleagues focus on human destiny, theologians have to take seriously what the sciences have to say about how human beings came to be on this planet in the first place.

3. Teleological explanation

Can evolution in general, and human evolution in particular, be viewed as in any sense the working out of purpose? Before turning to the issue of Divine purpose, it will be helpful to turn to this more general, and more familiar, question first. The explanation of living process in terms of goals and purposes is a theme that goes all the way back to Aristotle, who made teleological explanation the most fundamental of the four complementary ways of explaining nature. Has teleology been discredited in the biological sciences? David Hull speaks, I suspect, for a great many historians and philosophers of biology when he claims that Darwin, to all intents and purposes, did away with teleology or at the very least brought about its "final trivialization."[26] Yet some leading biologists seem to disagree, insisting that teleology, properly understood, not only has a place, but even a central place, in contemporary biological discourse. What are we to make of this?

The trouble lies, to begin with, in very different understandings of the key term, 'teleology,' and of its associated terms 'goal,' 'purpose,' 'design.' I will follow the example of Ernst Mayr and Francisco Ayala, two major figures in modern evolutionary theory, and begin from Aristotle who, after all has

some rights in regard to the disputed term, 'telos,' since it was he who first made technical use of it in this context[27] In his studies of the living world, Aristotle noted that the organs and tissues in living things serve specific functions in the economy of the organisms of which they are a part. The phrase "that for the sake of which" (hou heneka) recurs constantly in explanations of the structures of living things. Horns are for the sake of defense; the fat that surrounds kidneys is for the sake of warmth, and so on. The natural operation of the liver necessarily brings about "concoction" and this is for the good of, indeed is necessary to, the flourishing of the individual organism.[28]

Aristotle's De Partibus Animalium contains scores of examples of this sort. The paradigm of goal-directed process for him, of course, is found in ontogeny, the normal development from embryo to the adult form. The "telic" aspect of natural process, its tendency to promote the larger good of the whole served by the organ or the process, is not confined, Aristotle asserts, to the living world only. The goal of the natural motion of the elements is the recovery of natural place, not just in the factual sense that this is where the motion terminates, but that this is for the good of the body in question and of the cosmic order generally. At the core of Aristotle's notion of telos, then is the idea of a good, a mode of flourishing, which is served by the structure or process in question and which thus serves to explain that structure or process in a distinctive way.[29]

The first thing to note about this mode of explanation is that mind or conscious purpose plays no part in it. The goal is immanent in the process itself; insofar as one would speak here of purpose, it would be in propositions like "the purpose of the liver is...," "the purpose of the stone's falling motion is...." This is not conscious purpose; there is no suggestion that livers or stones are animated by a conscious striving, though critics of Aristotle from the seventeenth century onwards have constantly misrepresented him in this regard. Aristotle draws a very clear distinction between the living and the non-living worlds. The fact that teleological explanation applies, in his view, equally to the natural motions of living and of non-living things[30] is sufficient of itself to refute any suggestion that the striving towards the good that characterizes all natural action is a conscious one, bearing the mark of intelligence or intentionality.

Aristotle takes the ordered character of the physical world for granted. Unlike most of his predecessors, he did not ask about origins. His listing of the canonical types of explanation stops at four; there is no entry for genetic explanation, for queries as to how particular kinds or particular forms of order came to be in the first place. In an eternal universe, he seems to say, things must work together for the good, and there is nothing more to say. Contrast this with Plato's quest in the Timaeus for the source of cosmic order. His concern is first and foremost with agent cause, not final cause. His aim is to show that everywhere in the sensible order, notably in the realm of planetary motions and in the structures of the human body, there are the traces of the shaping Reason that must have fashioned them.[31] He seeks for evidences of design, for features whose intelligibility requires that they be the work of intelligence. About the Demiurge, the Shaper, he has little to say. Plato scholars, I may add, have long since made up the deficit!

The explanation he offers is clearly not teleological in form; it does not point to goals or purposes, within the cosmic order as explainers but as features to be explained. What complicates matters, however, is that showing a shaping intelligence to be the agent cause in bringing order to what would otherwise be chaos opens a further question as to why the intelligence itself acted in this way. And this is a teleological question. Plato does not concern himself directly with this question, though one can infer that he would answer it in ethical terms, involving the Good as motivation for the Demiurge's shaping actions. At this point, a second and quite different sense of 'teleology' is slipping into view. Though Plato himself never addressed the second-order question as to the logical species of the kind of explanation he is offering in the Timaeus, proposing a shaping Intelligence to account for evidences of apparent design in the natural order came to be characterized as "teleological." Indeed, modern Plato scholars routinely speak in this sense of Plato's "teleology" and of his cosmology as "teleological" in form.[32]

When Thomas Aquinas looked for ways to turn Aristotelian natural philosophy, up till that time suspect among Christian theologians, to good account as testifying to a Creator, he asked the Platonic question that Aristotle had not asked: why does the natural world lend itself to teleological explanation in the first place? His famous answer:

> The fifth way is taken from the governance of the world. We see that things which lack knowledge, such as natural bodies, act for an end, and this is evident from their acting always, or nearly always, in the same way so as to obtain the best result. Hence it is plain that they achieve their end, not fortuitously but designedly. Now whatever lacks knowledge cannot move towards an end, unless it be directed by some being endowed with knowledge and intelligence, as the arrow is directed by the archer. Therefore some intelligent being exists by whom all natural things are directed to their end; and this being we call God.[33]

Teleology in the original sense has now become evidence for teleology in the later and looser sense. The explanation that Aquinas offers for the goal-seeking behavior of natural bodies is an agent-cause, God. There is no reference to God's purposes in creating; the explanation is clearly not teleological in the strict sense. Still, because teleological behavior is the starting-point of the argument and since intelligent action is ultimately purpose-guided, it came to be characterized as the "teleological" argument for God's existence. It should be clear by now that the confusion as to whether contemporary biology has or has not a place for "teleological" reasoning had its origin a long time ago.

But back for a moment more to history. When Descartes rejected appeal to final causes as inappropriate to natural science, it was appeal to the Creator's purposes that he had in mind. In the Christian perspective of creation, it was easy to convert immanent Aristotelian goals ("the liver is for the sake of...") into the goals of the Agent who created organisms to be that way. Appeals to the likely purposes of the Creator had become popular in the Aristotelian natural philosophy of Descartes' day, despite their distinctly non-Aristotelian flavor. Descartes objects: "We should not take any reasons for natural things from the ends which God or Nature proposed for themselves in making them, since we should not glorify ourselves to such an extent that we think we are privy to their counsel."[34]

But his objections cut even more deeply than this. In his Discourse on Method (as in his earlier unpublished Le Monde), he proposed that the complexities of the natural world, not only of stars, planets, minerals, and the like, but also of all living organisms, could in principle be genetically explained

by the continued operation of purely mechanical laws on an original chaos of particles in motion. This would be to eliminate in a single stroke the Platonic arguments from the evidence of design to the need for a Designer. If all physical structures had their origin in purely chance interactions, there would be no genuine evidence of design from which arguments of either the original Platonic or the later Thomistic sort could begin.

Reactions to this proposal were on the whole strongly negative. The most vigorous ones came from naturalists like Robert Boyle and John Ray who found such an abundance of evidence in the living world of intricate adaptation of means to end that they could argue effectively that chance alone could never suffice as explanation. There was still need of a Designer to effect so complex a set of adjustments. The resulting argument from design, and the natural theology built around it, became for growing numbers of Christians a firm reassurance of the consonance of the new sciences and their own religious beliefs, for some, indeed, their primary motive for belief in a Creator.

Darwin's theory of natural selection provided an alternative explanation of the sort of evidence that had led the founders of natural theology to invoke the intelligence of a Designer as agent-cause, and dealt what would eventually be a mortal blow to design arguments rooted in the teleological features of the living world. Darwin did not deny the existence of these features; he simply offered a different explanation for them, one that did not require the shaping action of a Designer. He left Aristotelian teleology untouched, indeed made the adaptations that are still best described in the Aristotelian language of "that for the sake of which" the evidential foundation for his theory. But he rejected Platonic "teleology," that is, the appeal to a shaping intelligence, whether of a transcendent or an immanent kind, as agent-causal explanation of how the intricate adaptations of the living world came (and still come) to be.

When Hull and Dennett and other chroniclers of evolutionary theory claim that Darwin banished teleology from natural science, it is this latter derivative sense of the term that they have in mind. They mean that the causal mechanisms built into the synthetic theory of evolution, the modern-day descendant of Darwin's brainchild, are sufficient of themselves to make any appeal to an active agency of intelligence, whether shaping from the outside or directing from the inside,[35] unnecessary in accounting

not only for the adaptive features of organisms but for the origin of living species themselves. Their antipathy to the mere mention of teleology has, no doubt, complex roots; for most, it is primarily the challenge that claims of design offer to the Darwinian mode of explanation; for some, perhaps, it is the historical association between such claims and theistic belief.

Yet teleological explanation in the original Aristotelian sense of the term is still quite evidently at home in contemporary biology. To meet this situation, some biologists have proposed a new term, 'teleonomy,' that retains the telic thrust of the original but lacks the negative associations that 'teleology' now has for so many evolutionary biologists.[36] Mayr introduces the term by remarking:

> Goal directed behavior (in the widest sense of this word) is extremely widespread in the organic world; for instance, most activity connected with migration, food-getting, courtship, ontogeny, and all phases of reproduction is characterized by such goal-orientation. The occurrence of goal-directed behavior is perhaps the most characteristic feature of the world of living organisms.[37]

In his usage, 'teleonomic' refers specifically to goal-directed, lawlike processes, to processes, that is, that lend themselves to teleological explanation in the Aristotelian sense.[38] G. G. Simpson takes a rather different tack. He applies the term to those features of the organism, whether structures or behaviors, that are the product of natural selection:

> The teleonomic, or apparently teleological or purposive, characteristics of organisms are adaptations.... Teleonomic adaptations arise in the course of evolution, and the factor governing their origin is natural selection.[39]

Some, however, prefer to retain the older term, 'teleology,' despite its drawbacks. Ayala, as already noted, maintains that teleological explanation is fundamental to modern biology. He sees this sort of explanation at work at two different levels. At the first level are the familiar functional roles played by the parts of the organism. At the second level there is explanation in terms of the goal of reproductive fitness. Natural selection itself, "the ultimate source of explanation in biology," is thus for

him a teleological process both because it is directed to the goal of increasing reproductive efficiency and because it produces the goal-directed organs and processes of the first level.[40]

To "explain" natural selection as teleological is to characterize it as goal-directed. But to explain the organs and processes by means of natural selection is to show how and why they originated. Thus explanation by means of natural selection is not itself teleological but genetic and agent-causal; that is, it explains how a particular feature of the organism could have come to be because of its contribution to reproductive fitness, and it does so by invoking agent-causal processes. This complicated mingling of teleological and genetic explanation is reminiscent of the relation between Aristotelian and Platonic teleology, except that the agency in this case is not intelligence but natural selection operating on chance variations in an independently varying environment.[41]

Mayr disapproves of this extension of teleological (or, as he would prefer, teleonomic) language to natural selection. If such language means anything, he says, it means goal-directed:

> Yet natural selection is strictly an a posteriori process which rewards current success but never sets up future goals.... Natural selection rewards past events, that is, the production of successful recombination of genes, but it does not plan for the future. This is, precisely, what gives evolution by natural selection its flexibility. With the environment changing incessantly, natural selection—in contradistinction to orthogenesis—never commits itself to a future goal. Natural selection is never goal oriented. It is misleading and quite inadmissible to designate such broadly generalized concepts as survival or reproductive success as definite and specified goals.[42]

I suspect that there is a misunderstanding here of what Ayala had in mind. The latter emphasizes that he does not mean that natural selection tends towards the production of specific kinds of organisms or that evolution as a whole proceeds towards preconceived goals. Natural selection does not "plan for the future," but it is not just a way of explaining the past either, as Mayr suggests. It is also future-oriented, but because of the multiple contingencies of the larger evolutionary process of which

natural selection is the only non-random aspect, it cannot guarantee that future. Maintaining that natural selection has a goal does not imply that the goal will always be achieved. Natural selection is predictive only in a quite limited sense: given a suitable environment, a hereditable genetic variation favoring reproductive fitness will gradually spread in a population.

Where Ayala is perhaps incautious is in holding that the evolutionary process itself (and not just natural selection) can be regarded as teleological in character, in the sense of being directed to the improvement of "the reproductive fitness of a population in the environments in which it lives," as well as having the "potentiality of producing end-directed DNA codes of information."[43] Mayr is right to object that this makes evolution sound more directional, more purposive, than it should. It is sufficient to hold that one causal component of the overall evolutionary process, natural selection, is goal-directed; it is this that gives evolution its often directional-seeming appearance. But the overall process is so beset by contingency that the use of the term 'teleological' in its regard is almost inevitably going to lead to misunderstanding.

What are the implications of the revival of teleological language in biology for the issue from which we began? It does validate the use of the language of purpose in specific biological contexts relating to the economy of the organism as a whole or in part, where functional explanation would also apply: "the purpose (function) of the protein, cytochrome C, is to aid in cell respiration." At the second level, that of evolutionary development, the language of purpose is more problematic. Is natural selection goal-directed? Ayala and Mayr disagree, as we have seen, and their disagreement would be mirrored in the biological community generally. It is one thing to say that the liver has a purpose, a function;[44] it is not so obvious that one can say the same thing of natural selection. 'Goal' comes more readily to mind here, since the process of selection serves in some sense the "good" of the species. But because natural selection is only one aspect of a process fraught with contingency, it seems strained to use the language of purpose in its regard. And as far as evolution as an overall/process is concerned, teleological language seems simply inappropriate. Evolutionary explanation is retrospective, agent-causal, concerned to establish origins. Even though the features of the living world that it explains are,

many of them, teleological in character, the explanation it offers is itself in no real sense teleological, does not invoke a purpose.

Even less does it involve design. From Plato to Aquinas to the natural theology of the seventeenth century, 'design' connoted evidence for conscious purpose, for an active Intelligence responsible for the origins of the feature in question. To see something as embodying "design" was to allow inference to a Designer as the only possible genetic cause. This is why I regard it as misleading for some writers on evolution to speak of "design without a designer," to recognize two possible sources of design: "one in the intentions of agents and one in the action of natural selection."[45] Implying that the action of natural selection is a form of "designing," so that the human eye, for example, would be an instance of "design," seems almost inevitably to lead to misunderstanding.

Richard Dawkins' book, The Blind Watchmaker, offers a striking example of the confusion that this looser use of the term can lead to. On the one hand, the sub-title of the book reads: "Why the evidence of evolution reveals a universe without design," and the argument of the book itself is said to show how natural selection can give "the illusion of design."[46] But in the only definition he offers of the elusive term, he writes: "We may say that a living body is well-designed if it has attributes that an intelligent and knowledgeable engineer might have built into it in order to achieve some sensible purpose."[47] The remainder of that chapter is devoted to showing how various organisms embody what he calls "good design." But attributing design to an organic structure because it only appears to be designed is surely to court confusion.

To summarize, then, the term 'design' is to be avoided in describing either the teleological aspects of organisms or the work of natural selection. 'Purpose' and 'goal' can be freely used in the former context; they are problematic ('goal' less so) in the latter. They are not to be used of the overall evolutionary process from the scientific standpoint.

Does this, then, answer the question from which this essay began: given the contingency of the evolutionary process as a whole, and specifically of the process that led to the appearance of human beings on this planet, can one meaningfully speak of the outcome of these latter processes as being the product of purpose? Not in the scientific sense, evidently. That is, the evolutionary explanation of

human origins does not require the postulation of an active (Platonic) shaping purpose at work or even of an immanent (Aristotelian) goal-directedness. Indeed, if anything, it seems rather to rule both of these out. If purpose is to be attributed to the evolutionary sequence leading to the human, support for it will have to come from a different quarter.

4. Contingency and cosmic purpose

G. G. Simpson has this to say:

> Adaptation is real, and it is achieved by a progressive and directed process. The process is wholly natural in its operation. This natural process achieves the aspect of purpose without the intervention of a purposer; and it has produced a vast plan without the concurrent action of a planner. It may be that the initiation of the process and the physical laws under which it functions had a purpose and that this mechanistic way of achieving a plan is the instrument of a Planner—of this still deeper problem the scientist, as scientist, cannot speak.[48]

Though natural selection is a "directive" and "creative" "pseudo-purposive" factor back of adaptation, it is "not always the decisive factor in evolution and it never acts alone."[49] Even though evolution is "a deterministic process to a high degree," the factors that have determined the appearance of human beings on earth are so intricate and so special that though "human origins were indeed inevitable under the precise conditions of our actual history, that makes the more nearly impossible such an occurrence anywhere else."[50] Inevitable, then, in one sense that it may have been given all the factors involved, no finality could be attributed to it: "If evolution is God's plan of creation—a proposition that a scientist should neither affirm nor deny—then god is not a finalist."[51] A plan, somehow or other, but one not dependent on finality, on teleology. How is that to be understood? Simpson does not say.

Gould, in passing, has a suggestion to offer. He is, as we have seen, more insistent than anyone else on the fragility of the evolutionary line leading to the human. But he recalls a tentative solution that Darwin once offered to the difficulty that weighed so heavily with him in his later life: how could a good

God permit the suffering that is everywhere evident in the living world? Perhaps, Darwin suggested, one might say that, while the details of the operation of nature are a matter of chance, God is responsible for the laws that underlie this operation.[52] There can be no doubt, Gould remarks, that the advent of Homo sapiens was "a wildly improbable evolutionary event," a "contingent detail" of cosmic history that could not possibly be attributed to purpose; nevertheless, we "may yet hope for purpose, or at least neutrality, from the universe in general."[53]

The admittedly rather half-hearted suggestion on the part of both authors is, then, that there may be enough lawlikeness, despite the prevalence of contingency in individual evolutionary lines, to sustain some sort of claim for cosmic purpose. Aristotelian or Platonic? That is, is it the immanent "purpose" of a goal-directed behavior at the cosmic level or is it the conscious "purpose" of a shaping Agent? They leave it open. What about the former? It would require something analogous to a "good" at the cosmic level; a lawlike process like the cosmic expansion of itself would not be sufficient. The speculative Gaia hypothesis—that the earth tends to maintain itself in a sort of homeostatic equilibrium—would be a teleological explanation of that sort, the "good" here being the preservation of the Earth's "balance," however the latter might itself be defined. It is difficult to envision an analogue of this sort of "good" at the level of the universe of expanding galaxies. Might it be longevity?—in which case the instant of inflation in the first moments of the cosmic expansion that may have prevented quick collapse or runaway expansion could be a candidate. But an "Aristotelian" teleology itself, as we have seen, leads one to ask for a "Platonic" agent-causal explanation: how and why did this goal-directedness come to be? So this brings us back to the second sort of purpose, the conscious purpose of a creative Agent. And in this context we still face the challenge that the radical contingency of the evolutionary process poses to the achievement of conscious purpose.

This is not, it should be noted, a matter of discerning purpose in the evolutionary sequence and inferring from this to a Purposer. That would resemble the traditional Design argument, and we have already seen that, from the standpoint of the synthetic theory of evolution, evidence of design, of the work of conscious purpose, is not to be found in evolutionary process. Rather, what we are asking here is the more oblique question: might not this process, despite its contingency, still be consonant with

the achievement of purpose on the part of a creative Agent?[54] Within the religious traditions of the West, the assumption has always been that human beings play a special role in the creation. Surely their appearance, then, must be more than a cosmic accident from the standpoint of the Creator?

It is true that some Christian theologians have been developing the relatively non-traditional view that God's efficacy is limited in regard to the achievement of ends within the created order. W. H. Vanstone bases his argument on the nature of loving relationship:

> The activity of God in creation must be precarious. It must proceed by no assured programme. Its progress, like every progress of love, must be an angular progress—in which each step is a precarious step into the unknown...If the creation is the work of love, then its shape cannot be predetermined by the Creator, nor its triumph foreknown.[55]

Keith Ward offers a nuanced argument, drawn in part from metaphysics, in part from Biblical theology. "God's omniscience is the capacity to know everything that becomes actual, whenever it does so."[56] God's knowledge of the future is thus of the possible only and changes as the set of actual existents changes. "What is possible is determined by God, but what becomes actual may be determined by creatures."[57] Ward challenges the traditional view of God as atemporal: "That which is wholly necessary can only produce that which is necessary. A contingent universe can only be accounted for if one makes free creativity a characteristic of the First Mover, which entails placing change and contingency within the First Mover itself."[58] A Creator whose knowledge of the future is only of the possible could presumably see his purposes defeated by the contingency of the creation itself.

John Polkinghorne agrees with Ward in holding that God is temporal. But he maintains that limitations on God's knowledge and power are <u>freely</u> chosen on God's part, a <u>kenosis</u>, or emptying, freely undergone, akin to the <u>kenosis</u> that Christians already find in the doctrine of the Incarnation: "God has permitted a kenosis of his omniscience, parallel to the kenosis of his omnipotence. Even he does not know the unformed future, and that is no imperfection in the divine nature, for that future is not yet there to be known."[59]

The vulnerability that these authors, and others who hold similar views, speak of bears to a large extent on God's relationship with creatures who can exercise free choice. They do not ask whether the existence of such creatures was in the first place defeasible. Ward remarks that God causally determines "those outcomes which are necessary to the fulfillment of the dynamic purpose."[60] Presumably the advent of human beings would qualify as one of those outcomes. But how does God causally determine the outcome of evolution? This brings us right back to the question from which we began. Those who maintain that God's purposes are limited by God's own nature or the nature of God's relationship with the world might still be persuaded to allow that the advent of human beings was something God knew from the beginning would happen. We would not have to suppose, then, that the Creator uttered a metaphorical sigh of relief when human beings finally made it!

That still leaves us groping for a means by which the real contingency of the evolutionary process might be overcome by the Creator. Several possibilities suggest themselves. The most obvious, perhaps, might be introduced by recalling an objection posed by Simplicio, the Aristotelian, to Salviati, Galileo's spokesman, in the Dialogue Concerning Two Chief World Systems (1632). If Copernicus was right about the earth's motion round the sun, a parallax shift ought to be noticeable in the relative positions of the stars. Yet none is seen. The alternative is that the stars are at an enormous distance from us. But then, Simplicio asks, to what purpose are these great spaces? Are they not "superfluous and vain"? To which Salviati replies that God may well have other plans in mind besides the care of the human race. And in any event: "it is brash for our feebleness to attempt to judge the reasons for God's actions."[61] Good advice still!

But suppose we were to put this objection again today. Our universe, as we now know, is far, far greater than Copernicus could ever have dreamed; space and time stretch out to the limits of human imagination. Does this not strengthen Simplicio's objection? Perhaps not. Might it not be said that such great spaces, populated by billions of galaxies that have developed over billions of years, may have been needed in order that in a natural way the cosmos might give birth somewhere within it to human life, one or maybe a multiplicity of times? The contingency of the single evolutionary line might thus be overcome by the immensity of the cosmic scale. Evolutionary biologists are divided, as we have seen,

as to whether, on general evolutionary grounds, life of a broadly human type, would be bound to originate somewhere in all those myriad planetary systems. But assuming for the moment a positive answer to this question, the enormous space of evolutionary possibilities would then make it possible to maintain that there could be a cosmic purpose at work here on the part of a Creator, a purpose that the contingency of a particular evolutionary line like ours would not defeat. If God be conceived as a time-bound Creator whose knowledge of the future depends on a knowledge of the present, this way of swamping contingency in order to achieve a distant end might seem plausible. Such a universe could, of course, give rise not just to one evolutionary line but to many, something that those Christians who emphasize the uniqueness of Christ's Incarnation on earth might find unwelcome. More seriously, it could, in principle, give rise to none at all, or so it would seem. Could a time-bound Creator rely on this as a way of achieving purpose?

Before we look for other ways than this that the Creator might relate to contingency in the evolutionary process, it may be helpful to look in somewhat more detail than we have done so far at the main sources of contingency that writers on evolution have claimed. The first of these is the interweaving of independent causal lines, the source of "chance" (tuché), as Aristotle defines it in Physics II, the sort that defeats teleology, in his definition of that term. (Pig eats acorn which never, in consequence, develops into an oak.) These causal lines may be separately deterministic, so that a comprehensive knowledge of the situation would allow its possessor to anticipate the "chance" outcome. (Meteor hits earth, altering the course of evolution.) It is lack of knowledge that leads us to regard such an outcome as chance. (For Aristotle, it would, rather, be the lack of teleological explanation.) Were the universe to be entirely deterministic, a time-bound Creator, knowing only past and present, could still anticipate the future with absolute assurance. When Gould points to catastrophe as a major, perhaps the major, source of evolutionary contingency, it is chance in the Aristotelian sense that he has in mind, that is, the crossing of causal lines whose intrinsic teleologies are unrelated to one another. But some sort of causal indeterminism might also intrude.

What kind of indeterminism? The most obvious candidates are quantum indeterminism and the indeterminateness (not indeterminism, strictly speaking) associated with human choice. The latter can be

left aside as irrelevant to the process leading to the first appearance of humanity. Peter van Inwagen points to the challenge of physical indeterminism:

> Since the actual physical world seems, in fact, to be indeterministic, it is plausible to suppose that there are a great many states of affairs that are not part of God's plan and which, moreover, cannot be traced to the free decisions of created beings. I very much doubt that when the universe was (say) 10^{-45} seconds old, it was then physically inevitable that the earth, or even the Milky Way Galaxy, should exist. Thus, these objects, so important from the human point of view, are no part of God's plan—or at least not unless their creation was due to God's miraculous intervention into the course of development of the physical world at a relatively late stage.[62]

In his view, then, for something to be part of God's plan, it would have to be either "physically inevitable" or else the product of a "special" action on God's part. Given the contingency of the evolutionary record, van Inwagen concludes: "I see no reason as a theist, or as a Christian, to believe that the existence of human beings [i.e. our terrestrial human race] is part of God's plan.'[63]

If physical inevitability is lacking, only a "special" action of some sort on God's part would ensure the realization of long-term purpose. (We are assuming, remember, that God is time-bound.) Christians have a name for such special action: 'miracle.'[64] However, those who call on miracle in the context of explaining human origins are no admirers of the theory of evolution as a rule. The defenders of so-called "creation science" see this theory as a rival to their own preferred account of cosmic origins, which is derived from a more or less literal reading of the first chapters of Genesis. A more nuanced view defended by some Christian philosophers of religion is prompted not so much by the Genesis story, literally or partly literally taken, as by an intense irritation with evolutionists like Richard Dawkins whose dogmatic-seeming confidence in the all-sufficiency of evolutionary explanation ultimately depends (they charge) on presupposing an atheism that would make evolution the only possible explanation of origins.

Alvin Plantinga, the main proponent of this view, argues for the insufficiency of current evolutionary theory to account for various stages in the development of life, beginning from the appearance of the first life, and progressing through the appearance in the Cambrian period of the main phyla.[65] He concludes to the greater likelihood from the Christian standpoint (as the scientific evidence currently stands) of a special creation of a straightforwardly miraculous sort to account for these transitions. Since he is prepared to invoke miracle in these gaps, as he sees them, in the orthodox evolutionary reconstruction of the history of life, he would presumably be willing to deal in the same way with the factor of contingency in those parts of the evolutionary account that he accepts. Since he holds God to be a temporal being, the reconciliation of contingency at the microlevel with Divine purpose is a topic he has then to address. The solution, miracle, has the merit of simplicity. My hesitations in its regard I have laid out elsewhere.[66]

"Special action" is, however, a capacious category, and some scientist-theologians have recently been exploring its limits.[67] Arthur Peacocke and John Polkinghorne are in agreement that invoking miracle to accomplish what might be called God's "basic" purposes in nature is unacceptable. They agree, further, that a deterministic universe of the sort described by Newton's physics would leave no room for any sort of "special" action on God's part, miracle aside. But because Newtonian determinism has been multiply challenged by twentieth-century physics (the candidates here are quantum mechanics, non-linear dynamics and chaos theory), there are now points of entrance, as it were, for the Creator's "special" action, without in any way compromising the integrity of the laws that the Creator has implanted in Nature.

Some such action on God's part is called for because of another consequence of this sort of cosmic indeterminism. Since God is a temporal being (another point of agreement between the protagonists of this line of argument) such "looseness" in cosmic process not only severely limits God's knowledge of the future but also threatens the realization of the Divine purposes. However, if God can somehow "influence" cosmic process within the limits set by the natural indeterminism of the physical order, the ends of Providence may still be achieved. When it comes to the detail of how exactly this is

to be done, the two authors diverge, as they struggle to formulate the elusive notion of an "influence" which is something other than an "intervention."[68]

Each sets great store by the model offered by "top-down" causality, the action of the whole upon its parts. Polkinghorne looks to chaotic behavior for inspiration in that regard favoring Prigogine's controversial suggestion that such behavior may be at bottom indeterministic.[69] For God to influence such a system, leading it to take one among a number of energy-equivalent paths, would be to communicate "information" in a "top-down" way, he suggests, but not to affect the energy of the system, and hence not to "intervene," or overrule the laws of nature. God's action would thus be permanently "cloaked from view"[70] Earlier proponents of the theological implications of the breakdown of Newtonian determinism, like Arthur Compton and William Pollard, had relied on quantum indeterminism as their mainstay. Polkinghorne is skeptical: "It does not seem that the proponents of divine action through quantum events have been able to articulate a clear account of how this could actually be conceived as the effective locus of providential interaction."[71]

Polkinghorne's ingenious deployment of chaos theory in the interests of Christian theology faces a number of challenges. For example, is chaos theory really indeterministic? Can "information" be imparted without exchange of energy?[72] I do not propose to deal with these here. But Polkinghorne's exclusion of quantum indeterminism from the scope of his solution is significant for the issue of evolutionary contingency. This latter usually is held to be due, to a significant extent, to quantum contingency at the level of mutation and possibly recombination. If the "special" action envisaged by Polkinghorne does not bear on this sort of process, it appears that it may not be of much help in explaining how the Creator's purpose might still prevail at the micro-level.

The line of argument followed by Peacocke is quite different. Though he emphasizes the importance to the issue of God's action in the world of the breakdown of Newtonian assumptions about predictability and determinism, he views these not as facilitating "special" action on God's part but as presenting, if anything, a barrier to it. If the future behavior of a physical system is in principle unpredictable, then God, a temporal being, <u>cannot</u> know how it will behave. Its "manipulation by God would then be impossible."[73] God can only will what God can foresee.[74] (Peacocke excludes the

alternative that God might simply intervene to make the system go one "open" way rather than another; this would still in his view be to overrule nature.) How, then, in a universe where unpredictability everywhere looms,[75] are the Divine purposes to be accomplished?

To this he offers two quite different answers. First is that the Creator has implanted in the world certain propensities, notably the propensity for increase in complexity which is continually manifested in the evolutionary process:

> So that, although we have had to infer that God cannot predict in detail the outcome of in-principle unpredictable situations, this does not derogate from his having purposes which are being implemented through the inbuilt propensities that load, as it were, the dice the throws of which shape the course of natural events.[76]

One would want to know more about how those propensities "load the dice," that is, overcome the contingency that to others seem such a challenge...

But there is a second line of defense. Drawing heavily on the notion of top-down causality, he suggests that God acts upon the "world-as-a-whole" which in turn constrains what happens at all lower physical levels, including that of quantum interaction. The exemplar he most relies on here is the causal relation of brain/mind and the bodily states it directs, including the myriad quantum processes that power organic life. Since the world-as-a-whole "may be regarded as in God, though ontologically distinct from God," God may be presumed to interact with it in its totality. Thus:

> God, by affecting the state of the world-as-a-whole, could, on the model of whole-part constraint relationships in complex systems, be envisaged as able to exercise constraints upon events in the myriad sub-levels of existence that constitute that "world" without abrogating the laws and regularities that specifically pertain to them—and this without "intervening" within the unpredictabilities we have noted.[77]

Peacocke has, at this point, two daunting hurdles to clear, corresponding to the two stages of his top-down descent. First, how is God supposed to "interact" with the world-as-a-whole? The world

is not God's body, as Peacocke agrees. But if it is not, how is the top-down metaphor to work, exactly? If God and the world are, as he says, ontologically distinct, does not interaction reduce to the forbidden sort of intervention? Second, is it really the case that the world-as-a-whole has a top-down relationship to everything below it, after the model of brain and body? If, as Peacocke emphasizes, quantum indeterminism is an absolute barrier to God's knowledge of the future, how exactly does God's action on the world-as-a-whole succeed in overcoming that barrier in order to achieve the Divine purposes?[78]

5. Atemporality and teleology

It will not have escaped the reader that the authors we have been discussing hold in common the view that the Creator is a temporal being, facing something, at least, of the limitations and vicissitudes that beset the creature. Nor will the reader have missed the fact that it is in consequence of this limitation that the contingency of the evolutionary process becomes such a challenge to the strongly-held religious belief that this process fulfilled the Creator's purpose when it gave rise to rational free creatures. This leads to a fairly obvious question: might there not be something awry about the starting-point? What if we were to suppose that God is not, after all, a temporal being?

This would not be a radical departure. The belief that the Creator stands outside temporal process entirely has, indeed, been the dominant one within the Christian tradition from Augustine's day onwards. It is true that it has been strongly challenged in recent times, not least by scientist-theologians who seek a closer affinity between Creator and creature than the traditional account admits. First, then, a quick, and necessarily superficial outline of this view.[79]

Augustine saw God not as a Demiurge shaping an independently existing matter nor as a First Mover responsible for the motions of a world whose natures were not of the Mover's fashioning, but as a Creator in the fullest sense, a Being from whom the existence of all things derives. Such a Being cannot be operating under constraints, as the God of Greek philosophers did. Temporality is the first and most obvious constraint of the created world, a mark of its dependent status. A temporal being exists only in the present moment, without secure access either to its past or its future. Its past is no longer; its future is not yet. So even though both past and future are somehow constitutive of what "it" is, in a real sense, they do not in the temporal sense exist. Such a being is evidently lacking, incomplete.

The Creator on whom the universe depends for its existence cannot be limited in this way. Time is a condition of the creature, an evident sign of dependence. It is created with the creature; by bringing a changing world to be, God brings time, the condition of change, to be. The act of creation is a single one, in which what is past, present, or future from the perspective of the creature issues as a single whole from the Creator.[80] God is not part of the temporal sequence that the act of creation brings to be; God is not one more temporal thing among other things. The Creator is "outside" time created,

though the metaphor is an imperfect one. Calling God "eternal" is not a way of saying that God is without beginning or end, like Aristotle's universe.[81] 'Eternal,' as applied to God, does not mean unending duration; it means that temporal notions simply do not apply to the Creator as Creator. "Atemporal' might be less misleading.[82] Nor is God static, frozen, as nineteenth-century critics charged. In a famous formula, Boethius expressed the doctrine in lapidary terms: "Eternity is the whole, simultaneous, and perfect possession of boundless life.'[83] God's life transcends the sort of dispersal that is the first characteristic of the creature; it is not subject to the kind of division that time-marking would require.

Creation and conservation blend together in this view, as do transcendence and immanence. Creation was not just a moment of cosmic origination a long time in the past, though we often speak of it that way, since the first moment seems to call in a special way for a transcendent cause. Creation continues at every moment, and each moment has the same relation of dependency on the Creator. God transcends the world; the Divine Being in no way depends on the world for existence nor requires it as complement. Yet the Creator is also immanent in every existent at every moment, sustaining it in being. God knows the world in the act of creating it, and thus knows the cosmic past, present, and future in a single unmediated grasp. God knows the past and the future of each creature, not by memory or by foretelling, then, as a creature might, but in the same direct way that God knows the creature's present. When we speak of God's "foreknowledge," the temporal 'fore' has reference to our created reference-frame, within which the distinctions between past, present, and future are real. From God's side, however, there is only knowledge, the knowledge proper to a maker who is not bound by these distinctions.

Aquinas enters a formal defense of the thesis that God knows future contingent things.[84] Such things are contingent relative to their antecedent physical causes, which is why temporal creatures like us, whose assessments of the future depend on a knowledge of such prior causes, can only conjecture about their contingent outcomes. But God knows these outcomes directly in their presentness as their Creator; the act of bringing them to be has no temporal divisions within it. Some of the analogies Aquinas draws on here need careful construal: "He who sees the whole road from a height sees at once

all those traveling on it" (a.13, ad 3); "His gaze is carried from eternity over all things as they are in their presentness" (a.13, c.). Such analogies might suggest that our inability to predict a contingent outcome is simply due to our lack of proper vantage-point: the various events taking place at this moment on the road just happen to be out of our sight. This in turn might be taken to imply that the future is already set, that it is only our powers of knowing that are unequal to the task of grasping it. But contingency is real, as Aquinas elsewhere makes clear. God knows contingent things that are future to us not as a viewer would features of a landscape already determinate but rather as a maker might, a unique sort of a maker who respects contingency in the cross-causal connections between the things made.[85]

This is familiar, of course. It is all very conceptual, as philosophers' talk of God inevitably is. It is no more than an exploration of an initial postulate concerning the act of creation, when that act is understood as a bringing into existence and a holding in existence, both entirely outside the range of our experience. How would such an account be supported? How does it meet the two major objections that Augustine already anticipated: Can this way of construing the work of creation be made compatible with the reality of human freedom? Does it not saddle the Creator with responsibility for all of the manifest evils of cosmic history? I am leaving these familiar and troubling questions aside in order to focus on a limited but perhaps more tractable issue: How does the apparent defeasibility of the evolutionary line leading to the emergence of Homo sapiens fit with the view that the act of creation is a single atemporal action on the part of God?

What I want to argue is that both Christian evolutionists who have assumed that the purposes of the Creator can be realized only through lawlike, and more or less predictable, processes as well as those who on the contrary infer from the contingency of the evolutionary process to the lack of purpose and meaning in the universe generally, are mistaken from the perspective of the traditional doctrine of God's atemporality. Our notions of teleology, of purpose, of plan, are conditioned by the temporality of our world, in which plans gradually unfold and processes regularly come to term. In such a world, purpose depends on foreknowledge, and foreknowledge in turn depends on the predictability of the processes involved. Lacking such predictability, there cannot be reliable foreknowledge, and without foreknowledge purpose is ineffective. But a Creator who brings everything to be in a single action from

which the entirety of temporal process issues, does not rely on the regularity of process to know the future condition of the creature or to attain ends.

The notion of "purpose" must itself be reinterpreted in such a case. God's knowledge of how a situation will develop over time is not discursive; God does not infer from a prior knowledge of how situations of the sort ordinarily work out. It makes no difference, therefore, whether the appearance of Homo sapiens is the inevitable result of a steady process of complexification stretching over billions of years, or whether on the contrary it comes about through a series of coincidences that would have made it entirely unpredictable from the (causal) human standpoint. Either way, the outcome is of God's making, and from the Biblical standpoint may appear as part of God's plan.

Terms like 'plan' and 'purpose' obviously shift meaning when the element of time is absent. For God to plan is for the outcome to occur. There is no interval between decision and completion. Thus the character of the process which, from our perspective, separates initiation and accomplishment is of no relevance to whether or not a plan or purpose on the part of the Creator is involved. Reference to "cosmic purpose" in the evolutionary context need not, however, involve design in the traditional sense. That is, it does not point to features of the process or the outcome that specifically demonstrate the intervention of mind and that would, therefore, allow one to infer to the agency of a cosmic Planner. There is nothing about the evolutionary process in itself that would lead one to recognize in it the deliberate action of such a Planner. It does not look like the kind of process human designers would use to accomplish their ends. When critics of the Christian understanding of cosmic history conclude, in consequence, that we live in a universe lacking in purpose, they are pointing to the lack of independently recognizable design in evolutionary change.[86] But the Creator may not be a designer in this time-bound sense.

The type of contingency we have been discussing bears on the outcome of a process, the evolutionary process, so it involves time in an essential way. But contingency can take other forms, and at least one of these does not involve time directly. Discussions of the so-called anthropic principle begin from the claim that the application of quantum theory to the first moments of the cosmic expansion postulated in the Big Bang cosmological model shows how extraordinarily contingent the initial

conditions were that permitted a universe in which heavy elements, planets, and ultimately complex life, could develop. It had been assumed in cosmological discussions from Descartes' time onwards that no special setting of the initial conditions would be needed in order that a universe of the kind we know should come to be.[87] The shock of discovering that this was apparently not the case led to various attempts in the 1970's to explain how such an "unlikely" universe might have originated.

Two types of "anthropic" explanation were proposed.[88] Collins and Hawking suggested that if there were a vast number of independent universes, we would naturally find ourselves in one where human life could evolve, so there would be nothing surprising about the fact that the universe seems "fine-tuned" for life. A very different sort of explanation is theological in inspiration: the universe is the work of a Creator whose purposes in creating include humanity. God simply chooses the initial energy-density and the laws of force that would allow that purpose to be realized. In the evolutionary context that we have been discussing, contingency has been seen as a challenge to the possibility of cosmic purpose. In the cosmological case, on the contrary, contingency is regarded as a sign of cosmic purpose.[89]

The attribution of cosmic purpose in the two cases must be carefully distinguished. Proponents of the anthropic argument claim to find recognizable signs of design in the initial cosmic configuration, so that the cosmological evidence is urged as independent evidence of cosmic purpose and even of the existence of a Designer.[90] Whereas in the evolutionary context, the claim that the advent of human life displays purpose, despite the contingency of the process leading to it, is based not on the scientific evidence but on considerations that are either theological or metaphysical in nature.

Yet there is an important similarity between the two contexts also. In the anthropic case, the Creator achieves purpose by choosing the kind of universe whose laws will permit the accomplishment of that purpose in a fully "natural" way. In the evolutionary case, something similar is true though here God is choosing not between different kinds of universes, universes with different laws, but between different instantiations of the same laws. It will make a difference here whether the universe is regarded as deterministic or not.[91] If it is, then it will be a matter of God's choosing the appropriate initial cosmic conditions to bring about eventually the appropriate outcome of the particular contingent evolutionary

process. If the universe is indeterministic, God will choose among the range of possible outcomes of that causal component of the particular evolutionary process. This can be done without violating the probability distribution among these outcomes over the long run. Obviously, the indeterministic alternative is much the simpler to envisage.

The difference between this sort of action on God's part and the sorts of "special action" hypothesized by those who, for other reasons, prefer to suppose the Creator to be dependent on knowledge of the present for planning a future not otherwise accessible is that God does not have to "influence" a process that in the former scenario is already in progress. Rather, God's action is simply the timeless one of choice, in which the universe comes whole from the Creator's hands. There is no need for a top-down causality akin to that of mind on body or of the whole upon the part in chaotic process.

We can conclude, then, on the basis of the traditional doctrine of God's atemporality that the contingency or otherwise of the evolutionary sequence does not bear on whether the created universe embodies purpose or not. Asserting the reality of cosmic purpose in this context takes for granted that we already believe that the universe depends for its existence on an omniscient Creator whose action is sufficiently like ours to allow us to call it purposive, in an admittedly analogical sense. It does not mean that we are privy to that purpose, though the traditions of the Torah, the Bible, the Koran, would imply a recognition of at least a part of it. Only to the extent that such a prior recognition were possible could one allow cosmic purpose to constitute a special form of teleology (recalling that 'teleology' refers to a specific mode of explanation). When in the Confessions Augustine looks back over his life and finally recognizes a Providence at work through all the contingency, it is to teleology of this sort that he is appealing.

Linking plan to Providence in this way gives rise to many other questions, of course. One would need, in particular, to be allowed to distinguish between God's intending and permitting something to occur.[92] But the answers to those questions, important, indeed crucial, though they are, do not affect the contention of this essay: that if one maintains the age-old doctrine of God's atemporality, the

contingency of the evolutionary process leading to the appearance of Homo sapiens makes no difference to the Christian belief in a special destiny for humankind.

[1]Quentin Smith in William Lane Craig and Quentin Smith, Theism, Atheism, and Big Bang Cosmology, Oxford: Clarendon Press, 1993, p. 212.

[2]Smith makes the argument even more sweeping by arguing (1) that a universe brought to be by a benevolent Creator would have to have as one of its purposes the coming to be of animate creatures, and (2) that a theist cannot fall back on God's knowledge of counterfactuals because the needed counterfactual in this case "is inconsistent with the semantic properties of counterfactuals" (p. 213).

[3]James R. Moore, The Post-Darwinian Controversies: A Study of the Protestant Struggle to come to terms with Darwin in Great Britain and America 1870-1900, Cambridge: Cambridge University Press, 1979, chapter 10.

[4]The Origin of Species, Philadelphia: University of Pennsylvania Press, 1959, p.221.

[5]Christian de Duve, Vital Dust, New York: Basic Books, 1995, p. 9. See also his "The Birth of Complex Cells," Scientific American, 274 (4), 1996, 50–57.

[6]Vital Dust, p. 292. This last inference seems to risk begging the question.

[7]Vital Dust, p. 285.

[8]Vital Dust, p. 297.

[9]Vital Dust, p. 296. What strikes the reader, besides the ingenuity of the tentative reconstructions de Duve offers of the biochemical pathways that could have led from one stage to the next, is the exceedingly tentative character, by his own admission, of some of those reconstructions, and hence the real difficulty in specifying the probabilities involved in a step of the particular sort. There is a temptation to say that if the time taken between one major biochemical development and the next was in a particular instance T, then T is "the time it takes" for a transition of this kind to occur.

[10]Pierre Teilhard de Chardin, The Phenomenon of Man, New York: Harper, 1965, pp. 151, 149. Emphasis in the original.

[11]Drake's colleague, Carl Sagan, filled in the details of Drake's original sketch in his collaborative work with the Russian astrophysicist I.S. Shklovskii, in Intelligent Life in the Universe,

San Francisco: Holden-Day, 1966, chap. 29. See my comments in "Estimating the probabilities of extraterrestrial life," Icarus, 14, 1971, 291-4.

[12]This View of Life, New York: Harcourt, Brace and World, 1964, p. 189.

[13]Jacques Monod, Chance and Necessity, New York: Knopf, 1971, pp. 112–3. Emphasis his.

[14]Ibid., pp. 169–70.

[15]Ibid., pp. 119, 124, 127.

[16]Eight Little Piggies, New York: Penguin, 1993, p. 77.

[17]Ernst Mayr, a leading exponent of the synthetic theory, claims that an apparently discontinuous sequence of this sort can easily be incorporated into a broadly Darwinian account of evolutionary change; he recalls, indeed, that he had already indicated the need for such a modification in some of his own early work (Toward a New Philosophy of Biology, Cambridge, MA: Harvard University Press, 1988, chap. 26: "Speciational evolution through punctuated equilibrium").

[18]Wonderful Life, Cambridge, MA: Harvard University Press, 1989, p. 318.

[19]Wonderful Life, p. 318.

[20]See, for example, Kim Sterelny's review article, "Understanding Life: Recent Work in the Philosophy of Biology," British Journal for the Philosophy of Science, 46, 1995, 155-83; pp. 174–8. See also the extended polemic in Daniel Dennett, Darwin's Dangerous Idea, New York: Simon and Shuster, 1995, chap. 10.

[21]Wonderful Life, pp. 291, 289.

[22]Theodosius Dobzhansky, "Chance and creativity in evolution," in Studies in the Philosophy of Biology, ed. F. J. Ayala and T. Dobzhansky, London: Macmillan, 1974, 307-338; pp. 309, 311.

[23]"Chance and creativity," pp. 318, 329.

[24]Elliott R. Sober, "Progress and direction in evolution," in Creative Evolution?, ed. J. H. Campbell and J. W. Schopf, Boston: Jones and Bartlett, 1994, 19-33.

[25]Francisco Ayala, "The concept of biological progress," in Studies in the Philosophy of Biology, 339-56.

[26]David L. Hull, Darwin and His Critics, Chicago: University of Chicago Press, 1973, chap. 4: "Teleology"; p. 57. See also his Philosophy of Biological Science, Englewood Cliffs, N.J.: Prentice-Hall, 1974.

[27]Ernst Mayr, "The multiple meanings of teleological," in Toward a New Philosophy of Biology, 38-66; Francisco Ayala, "Teleological explanations in evolutionary biology," Philosophy of Science, 37, 1970, 1-15.

[28]The different roles played by material necessity (in the functioning, say, of the materials of the liver) and hypothetical necessity (in the teleological argument itself) leads to some intricate problems for contemporary Aristotle scholars. See John M. Cooper, "Hypothetical necessity and natural teleology," in Philosophical Issues in Aristotle's Biology, ed. Allan Gotthelf and James G. Lennox, Cambridge: Cambridge University Press, 1987, 243-74; D. M. Balme, "Technology and necessity," in the same collection, 275-85.

[29]Wolfgang Kullman notes however, that in practice, Aristotle's references to final cause are not entirely consistent with one another. See "Different concepts of the final cause in Aristotle," Aristotle on Nature and Living Things, ed. Allan Gottholf, Pittsburgh, PA: Mathesis, 1985, 169-75.

[30]Those who argue that teleological forms of reasoning are central to the biology of today make it clear that they depart from Aristotle at this point. Ayala concludes his defense of the teleological character of much explanation in biology with the remark that Aristotle's "error was not that he used teleological explanations in biology but that he extended the concept of teleology to the non-living world," ("Teleological explanations," p. 15).

[31]The long first part of the Timaeus is devoted to the "works of Reason." See Francis Cornford's classic commentary, Plato's Cosmology, New York: United Arts Press, 1957, 33-159.

[32]See, for instance, G. E. R. Lloyd, "Plato as a natural scientist," Journal of Hellenic Studies, 88, 1968, 78-92.

[33]Thomas Aquinas, Summa Theologica, I, q.2, a.3c.

[34]René Descartes, Fifth Replies (to Pierre Gassendi), in Oeuvres de Descartes, Charles Adam and Paul Tannery, Paris: Vrin, 1964-74, p. 375; translated in Daniel Garber, Descartes' Metaphysical Physics, Chicago: University of Chicago Press, 1992, p. 273.

[35]With a view to singling out the sort of teleology that is objectionable to Darwinians, Francisco Ayala draws a distinction between an external "teleology," a shaping action imposed by an external intelligence, and an immanent or internal "teleology" of a broadly Aristotelian kind that he finds unobjectionable and indeed indispensable in describing the living world ("Teleological explanations," p. 11). For a similar distinction, see T. A. Goudge, The Ascent of Life, Toronto: University of Toronto Press, 1961, p. 193; Theodosius Dobzhansky, "Chance and creativity in evolution," in Studies in the Philosophy of Biology, ed. F. Ayala and T. Dobzhansky, Berkeley: University of California Press, 1974, 307-311; p. 311. But this distinction does not, it seems to me, do the work required of it. Many of those who have found Darwinian natural selection an inadequate explanation postulate something like an élan vital (Bergson) or a psychic energy (Teilhard de Chardin) which is internal to natural process and guides its outcome in ways that indicate intelligent anticipation of outcomes. This form of "teleological" explanation of evolution is equally objectionable from the strict Darwinian standpoint. It is the action of a guiding intelligence, whether external or internal, that the theory of natural selection is held to render unnecessary.

[36]The term was first introduced by C. S. Pittendrigh in "Adaptation, natural selection, and behavior," in Behavior and Evolution, ed. A. Roe and G. G. Simpson, New Haven: Yale University Press, 1958, 390-416; p. 394.

[37]Mayr, "Multiple meanings," p. 45. Emphasis his.

[38]"Most of Aristotle's references to goal-directed processes refer precisely to the same things which Pittendrigh and I would call teleonomic," Mayr, "Multiple meanings," p. 47.

[39]G. G. Simpson, Biology and Man, New York: Harcourt, Brace, 1964, p. 34.

[40]Ayala, "Teleological explanations," p. 10.

[41]William Wimsatt brings out this feature of natural selection as a teleological process in his immensely detailed "Teleology and the logical structure of function statements,' Studies in History and Philosophy of Science, 3, 1972, 1-80.

[42]Mayr, "Multiple meanings," p. 43.

[43]Ayala, "Teleological explanations," p. 11.

[44]Mayr, as we have seen, would limit the term 'teleological' to processes only, on the grounds that only processes can, strictly speaking, have goals; "static systems" cannot ("Multiple meanings," p. 51). This leads to some linguistic oddities, reflecting the ambiguities of the 'telic" terms, since one obviously can speak of the liver, for example, as having a purpose in the functioning of the organism generally. Mayr is forced to say that "it may be necessary to invent a new term for...biological organs which are capable of carrying out useful functions, such as pumping by the heart" (pp. 52-3).

[45]Philip Kitcher, "Function and design," in The Philosophy of Biology, ed. David Hull and Michael Ruse, Oxford: Oxford University Press, 1998, 258-79; pp. 258-9.

[46]Richard Dawkins, The Blind Watchmaker, New York: Norton, 1986, p. 21.

[47]Loc. cit.

[48]G. G. Simpson, This View of Life, p. 212.

[49]Op. cit., p. 210.

[50]Op. cit., p. 268.

[51]Op. cit., p. 265.

[52]In correspondence with Asa Gray. See, for example, the letter of Darwin to Gray of 22 May, 1860, in The Correspondence of Charles Darwin, ed. Frederick Burkhardt et al., Cambridge: Cambridge University Press, 1993, vol. 8, p. 224.

[53]Gould, Wonderful Life, p. 291.

[54]The Biblical declaration that human beings were made in God's image has been assumed to authorize believers, conversely, to find in God some of the lineaments of the human, notably intelligence and will. The ascription of purpose, and more generally of personality, to the Creator has been

challenged from a variety of quarters in modern times as unduly anthropomorphic. It should once again be noted that the thrust of this essay is not to establish that purpose can be predicated of the Creator on the grounds of evidence found in the world around us, but to ask whether purpose on the Creator's part in regard to the human is consonant with what we know of evolutionary process.

[55]W. H. Vanstone, Love's Endeavour, Love's Expense, London: Darton, Longman and Todd, 1977, pp. 62-3. Quoted by John Polkinghorne, Science and Creation, London: SPCK, 1988, p. 62.

[56]Keith Ward, Religion and Creation, Oxford: Clarendon, 1996, p. 188.

[57]Op. cit., p. 257.

[58]Op. cit., p. 202.

[59]John Polkinghorne, Science and Christian Belief, London: SPCK, 1994, p. 81. God presumably does not choose to be temporal. If the future is not yet there to be known (by a temporal being), it is not clear in what sense one can hold that the limitations on God's knowledge and power that Polkinghorne postulates are a kenosis, freely chosen.

[60]Ward, Religion and Creation, p. 261.

[61]Galileo Galilei, Dialogue Concerning Two Chief World Systems, transl. Stillman Drake, Berkeley: University of California Press, 1953, 367-8.

[62] Peter van Inwagen, "The place of chance in a world sustained by God", in Divine and Human Action, ed. T. V. Morris, Ithaca: Cornell University Press, 1988, 211-235; p. 225.

[63]Loc. cit. Emphasis mine. Realizing that this last suggestion is likely to shock some of his fellow-Christians, van Inwagen adds a significant qualification: "I am sure that the existence of animals made in God's image—that is, rational animals having free-will and capable of love—is a part of God's plan." Though there is no theological reason that our own human race need be supposed to be part of God's plan (he has a strong sense of 'plan' in mind), there is, in his view, good theological reason to suppose that human-like life somewhere in the universe is part of God's plan. He is not alluding here to the vastness of the cosmic scale as the means to this end (he does not, in fact, regard this as sufficient to establish a "plan" on God's part). Rather, he supposes that it is sufficient for such a plan that God

should "decree" that rational life should arise somewhere in the universe by whatever means, leaving the specifics undeclared, so to speak.

[64]Van Inwagen uses the term, 'miracle,' in a broader sense than usual; it could cover, for example imperceptible processes at the quantum level of the sort that could affect evolution, where God could alter momentarily the causal powers of the entities concerned. If God were to do this, the alteration would, of course, have to be in a particular evolutionary sequence such as ours. In that event, the existence of the human race on earth would be part of God's plan. Though van Inwagen regards the current neo-Darwinian account of human origins as unsatisfactory ("Doubts about Darwinism," in Darwinism: Science or Philosophy? ed. J. Buell and V. Hearne, Richardson, TX: Foundation for Thought and Ethics, 1996, 177-191), he leans rather more to the hope that a later extended scientific account will satisfy. The other "special action" alternative he regards as "inelegant and unlovely" (personal communication).

[65]See Alvin Plantinga, "When faith and reason clash: Evolution and the Bible", Christian Scholar's Review, 21, 1991, 8-32. Two critical responses to his essay appear in the same journal issue: Howard J. Van Till, "When faith and reason cooperate," 33-45; Ernan McMullin, "Plantinga's defense of special creation", 55-79. Plantinga replies to them in turn: "Evolution, neutrality, and antecedent probability," 80-109. A further comment: Ernan McMullin, "Evolution and special creation", Zygon, 28, 1993, 299-335; and Plantinga's response: "Science: Augustinian or Duhemian?," Faith and Philosophy, 13, 1996, 368-94.

[66]See the references in the previous note.

[67]See the detailed review and critique of the views of William Pollard, Arthur Peacocke and John Polkinghorne on Divine action, in Steven D. Crain, Divine Action and Indeterminism: On Models of Divine Agency that Exploit the New Physics, Ann Arbor, MI: Ann Arbor Microfilms, 1993.

[68]See the exchange between the two authors in John Polkinghorne, 'Creatio continua and divine action" (a comment on Peacocke's approach), and Peacocke's accompanying "A response to Polkinghorne," Science and Christian Belief, 1, 1995, 101-8; 109-15.

[69]John Polkinghorne, Belief in God in an Age of Science, New Haven: Yale University Press, 1998, 57-75.

[70]Op. cit., p. 72.

[71]Op. cit., p. 60.

[72]See Steven D. Crain, "Divine action in a world of chaos: An evaluation of John Polkinghorne's model of special divine action," Faith and Philosophy, 14, 1997, 41-61. Peacocke argues, correctly to my mind, that Polkinghorne's way of inferring from the practical unpredictability of chaotic process to the ontological indeterminism of the process itself cannot properly appeal to what philosophers of science call scientific realism. This latter authorizes provisional inference to the existence of the entities postulated in scientific theories. It does not authorize what Polkinghorne calls inference from the epistemological to the ontological, from our practical inability to specify the initial conditions of certain dynamic processes to the claim that the initial stage of the process does not determine later stages ("A response to Polkinghorne," p. 111). Many of the essays in Chaos and Complexity (ed. Robert J. Russell, Nancey Murphy and Arthur Peacocke, Rome: Vatican Observatory, and Notre Dame: University of Notre Dame Press, 1995) deal with this and related issues.

[73]Arthur Peacocke, Theology for a Scientific Age, Minneapolis: Fortress, 1993, p. 155.

[74]Peacocke, "God's interaction with the world: The implications of deterministic 'chaos' and of interconnected and interdependent complexity," in Chaos and Complexity, ed. Russell et al., p. 180. "God cannot know precisely the future outcome of quantum dependent situations, so cannot act directly to influence them in order to implement the divine purpose and will" (p. 281). Our "newly-won awareness" of the unpredictabilities of physical process "does not, of itself, help directly to illuminate" the manner of God's action in the world (pp. 281-2).

[75]In his most recent work, Peacocke has restricted the scope of unpredictability-in-principle to quantum systems only ("God's interaction with the world," pp. 271, 277). Earlier, he maintained that many dynamic systems that are governed by non-linear equations are unpredictable in principle, notably

chaotic systems. (See, for example, Theology for a Scientific Age, p. 51.) This has now become a point of disagreement between himself and Polkinghorne.

[76]Theology for a Scientific Age, p. 166. See also "God's interaction with the world," p. 281.

[77]Peacocke, "God's interaction with the world," p. 283.

[78]There is a larger issue that I have left aside here, the issue of whether quantum theory really does establish the indeterminism of quantum processes. The "top-down" models seem to rely on the indeterminism of processes at the lower level. (Would Peacocke's "top-down" account work in a deterministic universe?) But, although the standard "Copenhagen" interpretation of quantum mechanics which has been more or less taken for granted since the 1930's is indeterministic, the alternative Bohm interpretation of the quantum formalism which is deterministic has never really been eliminated from contention and has recently come in for renewed attention. James Cushing argues that the factors favoring the original adoption of the indeterminist alternative were, to a significant extent, historically contingent in character. See his Quantum Mechanics: Historical Contingency and the Copenhagen Hegemony, Chicago: University of Chicago Press, 1994.

[79]See, for example, Alan G. Padgett, God, Eternity, and the Nature of Time, New York: St. Martin's Press, 1992, chap. 3: "The doctrine of Divine timelessness: A historical sketch." I am grateful to David Burrell and Fred Freddoso for our discussions of the issues arising in this section.

[80]How to relate the temporality of the creature with the eternality of the Creator without either making temporality unreal (by assuming that the future already exists) or making God quasi-temporal, has vexed philosophers from Aquinas's day to our own. See Eleanor Stump and Norman Kretzman, "Eternity," Journal of Philosophy, 78, 1981, 429-459.

[81]See G. D. Yarnold, "Everlasting or eternal?", chap. 9 in The Moving Image, London: Allen and Unwin, 1966, 139-152; Brian Davies, "A timeless God?", New Blackfriars, 64, 1983, 218-224; Julie Gowan, "God and timelessness: Everlasting or eternal?," Sophia, 26, 1987, 15-29.

[82]'Atemporal,' however, has some unfortunate overtones of its own, unfortunate that is for our purposes here, since it is sometimes used to describe entities like numbers or Platonic forms to which

likewise the category of time does not apply. But 'atemporal' merely says what its referents are not, not what they are. Numbers have no existence as causes in their own right, whereas God is First Cause exercising the fullness of activity.

[83]The Consolation of Philosophy, 5.6.

[84]Aquinas, Summa Theologica, I, q.14, a.13.

[85]Debate about the manner of God's knowledge of future contingents intensified after Aquinas's day, particularly about how it was to be reconciled with the reality of human free choice. It came to a head between the Dominican supporters of Bañez and the Jesuit followers of Molina at the end of the sixteenth century in the famous controversy "de auxiliis." For an account of the subtleties to which this protracted discussion gave rise, see William L. Craig, The Problem of Divine Foreknowledge and Future Contingents from Aristotle to Suarez, Leiden: Brill, 1988.

[86]Some of them are making what they take to be an even stronger case: that the living world is full of examples of "bad" design—the "Panda's thumb" argument: "If God had designed a beautiful machine to reflect his wisdom and power, surely he would not have used a collection of parts generally fashioned for other purposes.... Ideal design is a lousy argument for evolution, for it mimics the postulated action of an omnipotent creator. Odd arrangements and funny solutions are the proof of evolution—paths that a sensible God would never tread but that a natural process, constrained by history, follows perforce." (Stephen Jay Gould, The Panda's Thumb: More Reflections in Natural History, London: Penguin, 1980, p. 20). But a theist will surely ask why a sensible God should not make use of natural process, with whatever "odd arrangements" or "outright imperfections" (Richard Dawkins' stronger phrase in The Blind Watchmaker, p. 91) that this may entail. Timothy Shanahan makes this point in "Darwinian naturalism, theism, and biological design," Perspectives on Science and Christian Faith, 49, 1997, 170-8.

[87]See Ernan McMullin, "Indifference principle and anthropic principle in cosmology", Studies in the History and Philosophy of Science, 24, 1993, 359-389.

[88]For a useful review, see John Leslie, Universes, London: Routledge, 1989.

[89]The anthropic argument, it should be emphasized, is a vulnerable one in a number of respects. See Ernan McMullin, "Fine-tuning the universe?," in Science, Technology, and Religious Ideas, ed. M. Shale and G. Shields, Lanham, MD: University Press of America, 1994, 97-125.

[90]See, for example, M.A. Corey, God and the New Cosmology: The Anthropic Design Argument, Lanham MD: Rowman and Littlefield, 1993; Nancey Murphy, "Evidence of design in the fine-tuning of the universe," in Quantum Cosmology and the Laws of Nature, ed. R. J. Russell, N. Murphy and C. J. Isham, Rome: Vatican Observatory, and Notre Dame: University of Notre Dame Press, 1993, 607-35.

[91]Thomas Tracy offers a helpful analysis from the theological standpoint of what this difference may amount to: "Particular Providence and the God of the gaps," CTNS Bulletin, 15(1), 1995, 1-18.

[92]Following once again a traditional path, it seems consistent to maintain that sinful actions on the part of free agents or natural evils like the AIDS epidemic need not be intended by the Creator but are permitted because they are necessary consequences of something that is intended. I am inclined to think that this is the only way one might meet the objection that has troubled so many since Darwin first proposed the hypothesis of natural selection: how can a good God allow suffering on the cosmic scale that selection appears to require? But the issue of theodicy lies outside the scope of this essay, already over-large.