THE QUESTION OF FINAL CAUSALITY IN ARISTOTLE'S PHYSICS

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From the time that I first read Aristotle's Nicomachean Ethics as a sophomore in college, I fell in love with it, and I looked to it for guidance as to how I should live. It appealed to me by its presentation of the moral life as a life of fineness, rather than of mere obedience to law, and also by its encouragement to the striving for excellence. I was intrigued by its suggestion, so unlike anything I had heard before, that taking pride in one's excellence is not a vice but a virtue, which as such can coexist with and which even enhances the comprehensive social virtue of justice. And above all, the Ethics struck a chord in me by its claim that activity in accordance with virtue is both the natural end of man and the core of happiness; for although I scarcely understood this claim at the time, I was moved by its promise of a meaningful and happy life, a life that seemed beautifully reflected, moreover, in the discussions of friendship and contemplation with which the book concludes. But as I continued to study, and became more and more persuaded by Aristotle's teaching about human life, I began to be troubled by the fear that this teaching might depend on an obsolete and indefensible view of nature. For how can virtuous activity be the natural end or purpose of human life if, as I had been taught to believe, modern natural science has shown that there are no such things in nature as ends or purposes? Must we not say, therefore, that ends are not given to us

by nature, but that we give ourselves our own ends and create our own meanings? For a time, I tried to ignore this difficulty by telling myself that natural science was not relevant to an understanding of human life, and by giving it, accordingly, as little thought as possible. But this evasion could not go on forever, and I eventually had to face the challenge that modern natural science presents for anyone who wants to return to the Aristotelian teaching about man. I therefore welcomed the opportunity as a tutor at St. John's to study this science in some detail. At the same time, I began to study Aristotle's Physics, and in particular his arguments for the existence of ends or purposes in nature, to try to see whether his natural philosophy, on which his moral philosophy at least in part seems to depend, might possibly be true.

But enough of this talking about myself. Instead, let me proceed by discussing the question of natural ends -- or of teleology, as it has come to be called -- directly. My discussion will focus primarily on Aristotle's treatment of this question in his Physics. For the modern objections to teleology are already present, and responded to, in the Physics itself. And modern science, it turns out, has nothing conclusive to say about the matter. Contrary to what I had been told in school, modern science has not shown that there are no purposes in nature. Indeed, it has not even attempted to do so. What it does, rather, is systematically to disregard the possibility of their existence. As Jacques Monod, a Nobel Prize-winning biologist, has written in his work Chance and Necessity,

> The cornerstone of the scientific method is the postulate that nature is objective. In other words, the *systematic* denial that "true" knowledge can be got at by interpreting phenomena in terms of final causes -- that is to say, of "purpose." An exact date may be given for the discovery of this canon. The formulation by Galileo and Descartes of the principle of inertia

> laid the groundwork not only for mechanics but for the epistemology of modern science, by abolishing Aristotelian physics and cosmology. ..... science as we understand it today ... required the unbending stricture implicit in the postulate of objectivity -- ironclad, pure, forever undemonstrable. For it is obviously impossible to imagine an experiment which could prove the *nonexistence* anywhere in nature of a purpose, of a pursued end.
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> But the postulate of objectivity is consubstantial with science; it has guided the whole of its prodigious development for three centuries. There is no way to be rid of it, even tentatively or in a limited area, without departure from the domain of science itself.[1]

I will not bother to quarrel here with Monod's contention that the systematic denial of purposes in nature is a requirement of science. What is important, rather, is his clear awareness that this denial is merely a postulate of modern science, not the assertion of an evident truth. And Monod's statement to this effect, far from being the unmasking of a hitherto unseen limitation of modern science, is only the restatement of a thought that was well understood by its originators.

Indeed, some of the founders of modern science appear personally to have believed in purposes in nature, even as they excluded all reference to them from their strictly scientific work. As Descartes put it in his Fourth Meditation, in addressing the question whether it is for the better that God made him subject to error,

> ... it occurs to me in the first place that I should not be astonished if my intelligence is not capable of comprehending why God acts as he does; ... knowing that my nature is extremely feeble and limited, and that the nature of God is on the contrary immense, incomprehensible, and infinite, I have no further difficulty in recognizing that there is an infinitude of matters in His power, the causes of which transcend my knowledge; and this reason suffices to convince me that the species of cause termed final finds no useful employment in physical [or natural] things; for it does not appear to me that I can without temerity seek to investigate the [inscrutable] ends of God.[2]

Now questions have been raised about whether Descartes' professions of piety are wholly sincere. But at all events, his argument against the attempt to explain natural things in terms of ends or purposes is compatible -- to say the least -- with there being such purposes in fact. Or to take another example, Newton himself, whose account of the motions in the solar system remains one of the greatest achievements of modern science, claimed that the solar system was originally put together by an intelligent God acting for a purpose. For although the planets and the comets, he wrote,

> may, indeed, continue in their orbits by the mere laws of gravity, yet they could by no means have first derived the regular position of the orbits themselves from those laws. ... This most beautiful system of the sun, planets, and comets, could only proceed from the counsel and dominion of an intelligent and powerful Being.[3]

Newton's claim, however, about the origin of the solar system appears only in a General Scholium that he appended to his Principia twenty-six years after its first publication. And these theological reflections play no role in the body of the work, just as they have played no role in the subsequent history of modern physics.

More generally, modern science from the beginning has sidestepped the question of ends or purposes in nature, while encouraging people to take less and less seriously the possibility of their existence, by trying to formulate laws that would encompass as many phenomena as possible without any reference to such ends. And even in the case of those phenomena that it does encompass, the claim that it has understood them adequately is dubious. For its laws are mathematical idealizations, idealizations, moreover, with no immediate basis in experience and with no evident connection to the

ultimate causes of the natural world. Newton's First Law of Motion, for instance, the law of inertia, requires us first to imagine a body that is always at rest or else moving aimlessly in a straight line at a constant speed, even though we never see such a body, and even though according to his own theory of universal gravitation it is impossible that there could be one. This fundamental law, then, which begins with a claim about what would happen in a situation that never exists, carries no conviction except insofar as it helps to predict observable events. Thus, despite the amazing success of Newton's laws in predicting the observed positions of the planets and other bodies, Einstein and Infeld are correct to say, in The Evolution of Physics, that "we can well imagine that another system, based on different assumptions, might work just as well." Einstein and Infeld go on to assert that "physical concepts are free creations of the human mind, and are not, however it may seem, uniquely determined by the external world." To illustrate what they mean by this assertion, they compare the modern scientist to a man trying to understand the mechanism of a closed watch. If he is ingenious, they acknowledge, this man "may form some picture of a mechanism which could be responsible for all the things he observes." But they add that he "may never be quite sure his picture is the only one which could explain his observations. He will never be able to compare his picture with the real mechanism and he cannot even imagine the possibility or the meaning of such a comparison."[4] In other words, modern science cannot claim, and it will never be able to claim, that it has the definitive understanding of any natural

phenomenon. And accordingly, we should not allow ourselves to be so dazzled by it as to suppose that it has refuted Aristotle's teaching about natural ends.

Let me now turn to my discussion of Aristotle and begin by reminding you of his doctrine of the four causes, among which the end or final cause is included. In trying to explain anything, or to answer the question "why?" about it, there are four ways, according to Aristotle, that we can respond. These four kinds of responses, these four ways of saying "because," are each a kind of cause of the matter in question. In one sense, we speak of the cause of something as the constituent or constituents from which it comes into being and of which it is composed. Thus, for instance, we call the bronze in a statue a cause of it, because the statue could not exist without the bronze that it is made of. In another and more important sense, however, we say that the cause of something is its form, since it is the form, rather than the constituent material, that explains why the being is what it is. Thus the bronze constitutes a statue because it has the form of a statue, not because it is bronze. And by the "form" of a being we do not mean its visible shape alone, but rather its whole character, a character that we may not be able to articulate clearly at first, but that we must already understand to a considerable degree simply to identify the being as what it is. To take our example again, we call a statue a statue because of its form, by which we do not mean its shape alone, but more importantly its being the sculpted image of some other being, such as a man or a god. Similarly, we call a human being a human being because of its form, by which we mean

above all that we are animals capable of reason. Now in addition to the constituent cause and the formal cause, a third kind of cause, which helps to explain coming into being as well as all other changes or motions, is the source from which a given change begins. Hence, for example, the sculptor is a cause of the statue's coming into being, and therefore also, in a sense, of the statue itself, as the parent is a cause of the birth of its offspring and the wind is a cause of rustling in the leaves. This principle of change, which Aristotle sometimes calls the moving cause, can also, however, be a cause of a state of rest, as when a man decides to stop running and to remain still. Finally, a fourth kind of cause is the end or purpose for which something comes into being or for which it exists. Thus health, for instance, can be a cause of walking by being the purpose for the sake of which someone might take walks. Or to return to our first example, giving honor to a god or perhaps pleasure to the human beholders might be the end – or the final cause, as it is also called – for the sake of which the sculptor produced the statue.

To focus specifically now on final causality, the examples I have just given, like those that Aristotle gives himself, suggest a definite manner in which the end of a motion operates as a cause. First, it is present in thought to the agent who begins the motion, and it is thought of as being good, and as being attainable by his own efforts. And as a consequence, the agent proceeds to try to realize in deed the end that he originally had in mind. In these cases, then, the final cause is itself a factor, together with what we have called the moving cause, in initiating the motion that leads up to it as an end. And

most of us would agree, I think, that this is a true account of such motions as that of a statue being sculpted, for it is the craftsman's anticipation of the completed work that directs his hands and tools. But Aristotle says explicitly that the end is a cause of natural motions, such as the growth and reproduction of living beings, and not only of motions initiated by human art.[5] Indeed, he justifies his use of analogies from the arts to help explain natural processes by claiming that art imitates nature; and he means by this not merely that some arts are representational, but more broadly that all the arts derive their own directedness toward ends from that already to be found in nature.[6] He even goes so far as to speak of Nature herself as a kind of artisan who makes all things for a purpose and nothing in vain.[7] Yet we have no clear evidence to suggest that nature is an intelligent or even a conscious being, and so it is difficult for us to understand how it can act for a purpose. Nor is it easy to conceive of a way, other than as the object of intelligent forethought, that the end of a motion could play any role at all in first bringing that motion about. So couldn't it be, instead, the result of accident that natural processes often turn out in a manner that seems to suggest motion for the sake of an end? Now this is not, as it might appear, an anachronistic or post-Darwinian question, but is in fact a central question that Aristotle explicitly confronts throughout his account of purposes in nature. To see how he responds to it, let us look more closely at the text of the Physics itself.

Aristotle discusses accidental causation immediately after his account of the four causes, and he indicates the tremendous scope of the question about it by noting that some men had attributed the existence of this world, and indeed of all ordered worlds, to chance. Now by "this world" Aristotle does not mean the hypothetically expanding universe of contemporary science, but rather this perceptible world, the world in which we live, along with other animals and plants, upon the earth and under the heaven. The beauty and grandeur of this world have always aroused in men a sense of wonder, and many have felt, as Newton did, that it must be the product of intelligent forethought.[8] Yet according to some of the early philosophers, this world of ours came into being, like many other worlds, merely by chance. Now in response to these philosophers, Aristotle begins by saying that their claim is worthy of wonder. For those, he says, who attribute the world and the most divine of the manifest beings (i.e., the stars) to chance do not speak of animals and plants as coming into being by mere luck, but rather by nature or mind or some other such cause, on the grounds that each kind of seed typically produces some definite kind of result. And on precisely these grounds, he continues, what they say about the world as a whole is especially strange, since we see nothing in the heavens coming into being by chance, whereas we see many things resulting from luck among the perishable beings here on earth.[9] Now at this point, it would certainly be possible for us to raise objections to Aristotle's argument, and some of these may have occurred to you already. But I would suggest that we defer our objections and consider

instead that Aristotle has not said, at least not yet, that those who attribute the world to chance are wrong, but merely that their assertion is wonderful and strange -- as I venture to say it is. And he adds that if what they say is true, this very fact deserves careful attention, as indeed it does. Rather than assume, then, that Aristotle has already rejected the view in question about the origin of the world -- whether on adequate or on inadequate grounds -- we would do better to follow him as he goes further into the matter by investigating more generally what chance is and what its relation is to nature.

Aristotle begins his account of chance by first discussing what he calls luck, and by observing that we do not speak of luck as a cause of those things that come into being always or for the most part in the same way, but rather of those that come about contrary to any such necessary or usual patterns. Yet it is not simply the unusualness of an occurrence that makes it a case of luck. It is also necessary that it be the kind of occurrence that <u>might</u> have been brought about for the sake of something and from intelligent choice. Such a result, when it comes about, however, merely by concomitance, is what is properly said to be from luck. Aristotle offers an example to help clarify what he means in saying that luck is a cause of its results by mere concomitance. A certain man, he says, would have gone to the marketplace to recover the money he was owed if only he had known that his debtor was there. But he did not know, and so he did not go to the market for that purpose; it was merely a concomitant of his going for some other reason that his trip served the purpose of recovering his debt. Thus, the

result came about from luck, and the man is said to have gone to the marketplace from luck. If, however, he had chosen to go to the market for the sake of this result, or if he always or for the most part recovered money when he went there, neither his going nor its result would be from luck. To speak of luck as a cause, then, is not to deny that there must always be some definite, particular cause of a lucky result. Indeed, in keeping with the fact that luck is responsible only for the kinds of outcomes that might have resulted from intelligent choice, only agents who are capable of such choice can be said to act from luck. But we attribute the result to luck when the agent's action merely happens to serve a purpose without his having intended it to do so.

After preparing the way with this account of luck, which has the merit of being immediately intelligible, Aristotle turns to the discussion of chance, or spontaneity, as we might also translate the Greek term. Chance is a broader class that includes luck as a subclass. Like luck in particular, chance in general belongs to the over-all category of moving causes.[10] And it too is a cause of something which, while it is the kind of thing that might have been brought about for a purpose, does not in fact occur for the sake of what results. The greater extension of the term "chance" is due largely to the fact that the particular cause of what we call a chance outcome need not be an intelligent agent, as it must in the case of luck, but can be any being, whether animate or even inanimate. Yet Aristotle suggests more of a difference between chance in the wider sense and luck in particular than this. He also suggests that chance results need not be of such a kind

as even normally to require an intelligent agent, but that in some cases they are ones that might have been brought about by nature, where nature is understood as a power, distinct from intelligence, that nevertheless also acts for a purpose.[11] This suggestion, however, is a difficult one. For as I have already mentioned, it is hard to see what it can mean to act for a purpose if not to act from intelligent forethought, and so it is hard to understand what that nature could be that Aristotle is contrasting with chance. The examples, moreover, that he gives as illustrations of chance serve to highlight this difficulty. Let me mention only one of these examples, in which the difficulty becomes explicit. Aristotle says that a stone fell by chance when it hit a man who was passing by below; and the reason he gives for attributing its fall to chance is that it might have fallen through someone's agency, and for the sake of striking the man, although in fact it did not. In other words, to explain what he means by a chance event, he contrasts it, not with one that might have come about from nature, but with one that might have been chosen by an intelligent, if in this case an unfriendly, being.[12]

Now Aristotle is aware that his examples do not fulfill our expectation that chance results are sometimes to be contrasted with what nature, as distinct from intelligence, might have brought forth. And so he adds that chance in the wider sense is most distinct from luck in the sphere of natural generation, when an animal or plant comes into being contrary to nature, i.e., maimed or with some deformity. In such cases, he says, we do not speak of luck, but rather of chance, and this not merely, it seems,

because these particular beings have not been produced by intelligent agents, but also because the nature that might have produced them, and done so for a purpose, is itself not an intelligence. Aristotle adds, on the basis of a consideration that we will come back to later, that these impairments and deformities are not precisely even from chance. Nevertheless, his reference to them serves to support the suggestion that chance, as distinct from luck, can be a cause of what might have arisen from the purposive action of nature.

The question remains, however, of what it can mean for nature to act for a purpose. And Aristotle again calls our attention to this difficulty, in the course of a renewed attempt to answer the question about the cause of the world. What he says is this: since chance and luck are causes by mere concomitance of what either mind or nature might have caused, they cannot be prior to mind and nature themselves; so that even if chance is responsible for the world, mind and nature are necessarily prior causes, both of many other things and of this whole.[13] Now it is not immediately clear, of course, how Aristotle arrives at this conclusion, or how it is to be understood. But what I would first like to emphasize is his claim that both mind and nature must be prior to chance, even on the assumption that chance is responsible for the world. That he makes this claim about mind, in particular, comes as a surprise. For the assumption about a chance origin of the world can refer, and almost certainly does refer, to chance in the wider sense, as distinct from luck. After all, the philosophic position to which

Aristotle is responding claims that our world came into being through the blind interaction of the elements, not from the lucky or unlucky actions of an intelligent being. Yet if we assume that chance in this sense is responsible for the world, one might have supposed, perhaps, that nature is a still prior cause, on the grounds that chance is a cause of what might have been produced by nature, which must, therefore, already be at work. But what Aristotle says, to repeat, is that nature and mind must both be prior causes of the world. And if mind, as well as nature, must already exist for there to be chance in the wider sense, this would seem to imply that nature is not capable of acting for the sake of ends -- those ends that are presupposed whenever we speak of chance -- unless it is somehow accompanied by intelligence. And however much this view of nature might help us to understand how nature can act for a purpose, it is at odds with Aristotle's earlier suggestion that it can do so on its own.

And yet perhaps this new suggestion, that nature depends on intelligence in order to do its work, is an intentional modification of the earlier one; and in fact, the very next chapter tends to support this modified view of nature. Aristotle says there that a natural being has two sorts of moving causes, one of which is not natural itself, since it is wholly unmoved. He then identifies this unmoved mover with the being's end, or final cause, and also with its form; but the form he is referring to cannot be the form as it exists in perishable beings, since we have already been told that these forms are perishable themselves, and hence not entirely unmoved.[14] The reference must therefore be to

some other kind of form, and the only other kind that Aristotle believes to exist is the form as it exists in thought, whether in human thought or divine thought. If natural change, then, is to be initiated in part by final causes that are also unchanging forms, it seems that these forms must be present in a divine mind, a mind that somehow solicits natural beings to move toward the perfection of their exemplars.[15] And indeed, Aristotle has already suggested something like this earlier in the Physics, where he said that the two highest principles of nature include one that is divine and good and aimed for and another that naturally aims for and reaches toward the first one.[16] And there are quite a few passages scattered throughout Aristotle's works that speak of a divine mind as the prime mover and ultimate source of all life and nature.[17]

And yet despite the attractiveness of this suggestion about the subordination of nature to a divine mind, it does not yet allow us to see how natural motion as such can be for a purpose. For purposive motion, at least as we understand it, presupposes more than the mere existence in some mind of the form that is to be aimed for as its end. It also presupposes that this form exist in the mind of an agent, such as a craftsman, that can set itself in motion with a view to that end. Thus, for instance, if the heavenly spheres are intelligent, living beings, as Aristotle says they are, it is at least conceivable that they might set themselves in motion in order to approximate the perfection of the divine forms.[18] But unless even the seeds of natural beings here on earth are self-moving, intelligent agents, or unless they are tools in the hands of some other such

agent, the assertion that the forms exist in a divine mind does not yet make it intelligible how natural growth, for instance, can be purposive. Perhaps, then, the claim that led us to these speculations about the divine mind, the claim that both mind and nature must necessarily be prior to chance, allows for another interpretation. In particular, in saying that mind must be prior to chance, even if chance is responsible for our world, Aristotle may not be trying to help us to see how nature could act for a purpose, i.e., in conjunction with mind, but rather to indicate something about mind and chance in themselves.

And in fact, there is such a way of interpreting the claim about mind being prior to chance. For according to Aristotle, there are different senses of priority, not all of which need apply to the same member of a given pair. In particular, if knowledge of one thing is presupposed by that of another, the former is said to be prior in terms of knowledge, and yet it is not necessarily prior in other senses, such as that of existing earlier in time.[19] Thus, if we assume, as Aristotle invites us to do, that the world emerged through chance, it might still be true, as he claims, that mind must be a prior cause of it; but perhaps this is only because of priority in terms of knowledge. At all events, Aristotle would have good grounds for saying that mind is prior to chance in this sense, for chance results are defined as those that might have been brought about for a purpose, and we understand purpose as that for the sake of which an intelligent being would act. Knowledge of chance, then, presupposes a prior knowledge of mind, or, more precisely, of the kind of minds that are capable of choice.[20] Moreover, if being in the paramount

sense is what is true, or what is truly understood by some intelligence -- and Aristotle makes this claim in the Metaphysics -- then this priority of mind to chance in terms of knowledge also implies a certain priority in terms of being.[21] Chance would not be fully what it is if it were not understood, understood, that is, in its relation to the ends pursued by intelligent beings. And to say all this is indeed compatible with the possibility that such intelligent beings may have come into existence, as our world itself may have done, through chance.

In trying to account for the priority of mind to chance, I said that the definition of chance contains the notion of purpose, and that purpose is understood as that for the sake of which an intelligent being would act. And yet we cannot forget Aristotle's earlier suggestion that what is for a purpose is what might have been done either from intelligence or else from nature.[22] Thus, it seems that I have been overhasty in claiming that we need to understand intelligent choice, as distinct from nature, in order to understand chance. However, the difficulty of even conceiving what it can mean for nature to act for a purpose has been our chief puzzle all along. And so let me suggest that natural ends themselves, like the ends that just happen to result from chance, can not be understood without a prior understanding of those ends that are pursued through intelligent choice.[23] Now it is true that when Aristotle first speaks of purpose in the Physics, he makes no explicit reference to intelligence or choice. What he says, rather, is that "nature," by which he means the form of a natural being, "is an end and [that] for the sake

of which; for in the case of those beings whose motion is continuous and has some end, this last stage is also that for the sake of which."[24] And yet he has to add immediately that not just any last stage of a being's continuous motion is a true end or purpose; after all, he observes, it was ridiculous of the poet -- presumably a comic poet -- to say that death was the purpose for which a certain man had been born. Aristotle goes on to explain that only the best kind of last stage wishes to be an end; and he speaks repeatedly of ends or purposes as being, or as wishing to be, what is better or best.[25] But to be better or best presupposes a range of alternatives, and some being with the intelligence to compare these alternatives and to choose among them. Accordingly, all knowledge of what it is to be an end, including a natural end, depends on knowledge of the features of intelligent choice.

My argument has now shown, I think, how Aristotle could justify his claim that even on the hypothesis that our world emerged through chance, mind would still be prior in causality to chance. But it has not made sense of the other half of Aristotle's claim, namely, that nature would also, on this hypothesis, be prior to chance. For I have not relied on the assumption that nature, as distinct from mind, acts for the sake of ends. But unless nature does act in this way, it is not even clear how it differs from chance, let alone how it must be prior to it. After all, chance happenings themselves are of such a kind that they might have come about for the sake of ends. Now there is one difference between nature and chance, which I alluded to earlier, when I said that congenital

impairments and deformities in natural beings are not precisely from chance. For Aristotle's definition of chance included a criterion that I have not yet mentioned, namely, that the causes of chance results must be external.[26] Congenital impairments and deformities, by contrast, are said to have an internal cause. And it is not only such deformities in natural beings that can be distinguished from chance results on the basis of this criterion. Their normal development is also said to originate from a cause within themselves.[27] Thus, the normal growth of living beings is said to be from nature, rather than chance, since it begins from a parental seed, which has within itself, as the parent did already, the power to initiate those motions that lead to a mature animal or plant. On the other hand, Aristotle thinks, rightly or wrongly, that in some species of living beings the usual mode of generation is spontaneous, i.e., from chance. Such generation comes about, he says, because the material, such as putrefying slime, from which these animals or plants begin their development can be moved by itself with the kind of motion that more typically must be caused in maternal residue by a paternal seed.[28] In generation from chance, then, the original source of motion is something other than the kind of being that results from it; and in general, we can distinguish nature, as an internal source of change, from all external causes such as chance. Still, however, this criterion by itself does not suffice to explain why natural motion is said to be for a purpose. And neither does it allow us to understand Aristotle's claim that nature must be prior to chance. Indeed, the view that nature is only an internal cause of motion adds an

additional reason for doubt on this score. After all, the survival, growth, and reproduction of natural beings are dependent on a great many external conditions. Accordingly, nature, or at least the nature of each kind of perishable being that we know of here on earth, must depend for its very existence on something else – either on some higher principle of order or else on chance.[29] And on the hypothesis that our world as a whole emerged through chance, chance would seem to be prior to nature, rather than the other way around.

If, moreover, one holds that the world as a whole emerged through chance, it becomes all the harder to see how there could be a purpose behind the internal development of particular natural beings. And some of Aristotle's philosophic predecessors had in fact argued that there was none. Aristotle recasts their argument in the form of a perplexity, as follows. Zeus does not cause rain, the argument begins, in order to make the crops grow, any more than it rains in order to damage the crops on some poor farmer's threshing-floor; rather, the rain falls by necessity as the evaporated moisture rises and then cools, and it just happens to be advantageous or harmful for human beings. And if such blind causality is the truth behind the apparently benevolent order of the world as a whole, what prevents there being the same kind of causality at work in the formation of particular natural beings? This argument acknowledges that the parts of organic beings are suitably arranged for the activities through which they survive and reproduce. But it claims that these arrangements first originated from blind necessity, as

did many others, and that it merely turned out that these were serviceable, as the others were not, for survival and reproduction. The animals and plants that we see around us continue to survive because their parts turned out as if they had been organized for a purpose; but they were not organized for any purpose in fact.

Aristotle admits that one might be perplexed by this attempt to explain away the apparent purposiveness in the structure of organic beings, but he denies that things could have happened in the way that it suggests. He offers in rebuttal a whole series of arguments that nature is truly a cause for the sake of something. And at least the first of these arguments suggests that natural purposiveness is not limited to the internal structure of organic beings. For instead of granting the premise that the causes of rain are indifferent to good and bad, and arguing that the parts of living beings are nevertheless arranged for a purpose, he disputes even about the rain, or at least about its seasonal patterns.[30] Apparently, then, he agrees that it does not make sense to think of nature as acting for a purpose within a limited realm unless the world as a whole is ordered for the sake of ends.

Unfortunately, however, this first in his series of arguments for natural purpose is extremely problematic. And yet partly for this very reason, it is of such importance that I wish to go through it in detail. Aristotle begins by saying that "these things, and indeed all things that are by nature, come into being either always or for the most part in the same way," but that "nothing that is from luck or from chance does so." In support of

this assertion about luck and chance, he adds that "it is not believed to be from luck or from coincidence" – which latter term appears to be a synonym for chance -- "when there are frequent rains in winter, but [only] if they come during the dog days [i.e., in summer]." Similarly, he says, "heat during the dog days is not [believed to be from luck or from coincidence], but [only] if [it happens] in winter."[31] Now it is noteworthy that the explicit basis for Aristotle's claim that normal weather patterns are not from coincidence is what is commonly believed. For those who make the argument against him, and who speak of a temporal origin of the various species of living beings, would object that common opinion has too limited a time frame, and that the patterns whose regularity it is struck by exist only for a short time, in the light of eternity, as does our world itself.[32] They would say that even if the persistence of these regular patterns is not merely coincidental, but a necessary consequence of the elements in their juxtaposition, the whole order within which these patterns exist is the temporary and unintended aftereffect of an original coincidence. And yet despite the obviousness of this objection, Aristotle does not even attempt to justify, at least not here, his reliance on the common perspective regarding the permanence of our world; and by being explicit about this reliance, he calls attention to the question of whether that perspective is adequate.

Aristotle continues his argument as follows: "If, then, [things] are believed [to be] either from coincidence or for the sake of something, and if it is not possible for these things to be either from coincidence or from chance, they would be for the sake of some-

thing."[33] Now this conclusion follows, of course, if its premises are sound. But the premise that things must be either from coincidence or else for the sake of something is open to doubt. For what about the bad things that happen always or for the most part? In particular, what about the death that comes inevitably to all living beings here on earth? The fact that birth is followed by death is no mere coincidence, if anything is not, and yet it is hard to see a purpose for it. Aristotle helps us, moreover, to see the dubiousness of the claim that being from coincidence or else being for a purpose is an exhaustive alternative by explicitly basing this premise too on common opinion. And a further sign that he is aware of its weakness is that he does not go on to claim that everything by nature is for a purpose, even though he had begun his argument by asserting that everything by nature comes about always or for the most part in the same way. For if nothing that happens with such regularity can be from coincidence, as he asserts, and if being from coincidence and being for a purpose are the only alternatives, it would follow that everything by nature is for a purpose. And yet, to repeat, Aristotle does not even claim that this is true. What he says, rather, is that if the particular things in question, such as normal weather patterns or the arrangement of parts in living beings, cannot be from coincidence or from chance, then these things would be for a purpose. By thus retreating from the full implications of his argument, Aristotle suggests that this more limited conclusion, regarding the parts of organic beings and the like, is not meant to rely wholly on the reasons that have been made explicit. Finally, Aristotle

concludes his over-all argument by observing that all such things are by nature, so that there is purpose, or "the for the sake of something," among the beings that come into being and that are by nature. But this final conclusion, since it is based on the previous one, can also not be justified by the explicit argument alone.

The disregard, in Aristotle's explicit argument, of natural evils such as death is closely related to its other difficulty, its failure to respond to his adversaries' contention about the origin of the world. For whatever weaknesses there may be in the doctrine that our world order, and in particular its species of living beings, emerged through chance and necessity alone, this view certainly allows for a straightforward account of death and other natural evils. And so by pointing to his awareness that he has failed to acknowledge these evils in his own argument, Aristotle calls still further attention to his having left it open, at least for now, that his adversaries might be right about the question of ultimate origins.

But what, then, is the basis for Aristotle's emphatic assertion, throughout this whole series of arguments and elsewhere, that the end or purpose is a cause of natural development? For if there is no evidence that such development is initiated by a self-moving, intelligent agent, and if the possibility must even remain open that life itself first emerged through chance and blind necessity alone, how can he speak with such confidence of purposes or ends in nature? Now to answer this question, we must begin by noting that whatever the origin of life, if it had an origin, and whatever the more

immediate moving causes of natural development may be, it remains true that this motion issues regularly, throughout human experience, in living beings whose parts work wonderfully well together in carrying out their life activities. These activities, such as nutrition, reproduction, perception, locomotion, and thought, are the manifestations of the form, or soul, of the being in question, and this form cannot be understood in the light of its material conditions alone. Rather, it is only in the light of the form that the material conditions can be seen as what they are. The bodily organs of a living being must be seen as instruments for performing its characteristic activities, activities without some of which, at least, the body itself would cease to exist; and even the more ultimate conditions of life must be understood, at least in part, in the light of their contribution to this end.[34] Accordingly, even if in general the term of natural development plays no role at all in initiating it, as it would do if it were a purpose in the strict sense, the notion of purpose, or of what something is good for, remains central to the proper understanding of natural beings. And since living beings become what they most truly are by attaining their mature form, their typical growth toward maturity must also be seen in the light of this end. This is not to deny that mature development may indeed result from the same kind of blind necessity, given certain conditions, as does deformity or premature death, given certain others. But as words like "deformity," "mature," and "premature" themselves already suggest, we nonetheless see these outcomes either as successes or as failures of a tendency toward a natural goal. We can disregard, or pretend not to

notice, this privileged status of the mature form; but it remains an inescapable fact of the world as it presents itself to our experience.

Now these conclusions, to repeat, are independent of the question whether the world as a whole emerged through chance. And thus the centrality of form to the understanding of natural beings also allows us to make sense of the claim that even if the world did emerge through chance, nature would still be a prior cause of it. For the world consists primarily of natural beings, and of living beings in particular, which are properly seen as what they are in the light of their forms. Hence knowledge of these natural forms, and of these forms as the normal ends of growth, is presupposed by the very question of whether the beings they characterize, or even the world as a whole, first originated through chance. Nature as form and as the end of motion is necessarily prior to chance, at least in the sense that chance can not be understood without a prior knowledge of this nature, just as we saw that it could not be understood without a prior knowledge of the features of intelligent choice.[35]

This notion of the mature form as the end of natural development is a far cry from the strict sense of purpose, according to which the end is anticipated by thought and thus helps to initiate the motions that lead up to its realization. And much of the difficulty in understanding Aristotle's account stems from the fact that he has blurred the distinction between these two senses of final cause. Now it would have been easy enough for him to insist on this distinction, and so I conclude that he chose not to, even though it is

only the weaker sense of final cause that he regards as being applicable to nature in general. In other words, I contend, he consciously wrote in such a way as to mislead his readers. Now I know that it will strike many of you as an odd suggestion that Aristotle would thus mislead his readers, and especially in what seems to be a purely theoretical account of the natural world. And yet there is considerable support for this suggestion, at least in general, among the ancient and medieval commentators. Themistius, for instance, writing in the fourth century of our era, practically begins his paraphrase of the Posterior Analytics by saying that "many of the books of Aristotle appear to have been contrived with a view to concealment ...."[36] Simplicius, writing two centuries later, concludes the introductory section of his commentary on the Physics with a fuller statement of the same thought. He says, and I quote, that

> [Aristotle's] writings are divided into two classes, into the exoteric ones, such as those in the form of inquiries and dialogues and in general those that are not concerned with the highest accuracy, and into the esoteric ones, [or those that are meant for hearing only], which include this treatise [i.e., the Physics]; and in the[se] esoteric ones, he deliberately introduced obscurity, repelling by this means those who are too easy-going, so that it might seem to them that they had not even been written.[37]

And still later, in the tenth century, the Islamic philosopher Alfarabi wrote in his "Harmonization of the Opinions of Plato and Aristotle" that

> whoever inquires into Aristotle's sciences, peruses his books, and takes pains with them will not miss the many modes of concealment, blinding and complicating in his approach, despite his apparent intention to explain and clarify.[38]

This consensus, then, across the centuries, that Aristotle deliberately concealed some of his thought should help make it at least conceivable that my interpretation of his account of natural purpose is correct.

But why, you will ask, would Aristotle write books in which he deliberately concealed his thought? Now the primary answer to this question, an answer that will seem surprising only to those who are unfamiliar with political conditions in the ancient world, is the fear of persecution. We are told, in fact, that despite all his precautions, Aristotle was indicted on the charge of impiety late in his life and that he had to flee Athens in order to escape the fate of Socrates. And underlying this charge against Aristotle is the fact that the study of nature was not in his time a respectable pursuit. Those who devoted themselves to natural philosophy were suspected of being atheists and corruptors of the young, and even Plato's Socrates did not try to dispel this suspicion at his trial, choosing instead to deny that he had ever been a natural philosopher himself.[39] Now in this precarious situation for the study of nature, Aristotle undertook the project of trying to make it a permissible, and even a respectable, activity. And largely for this reason, I think, he exaggerated the extent of his agreement with popular beliefs about the world -- such as the popular belief that things happen, in general, for a purpose -- and he concealed from his less careful readers much of his deepest thought about nature and the divine. He was, moreover, quite successful in this project of winning respectability for the study of nature. One measure of his success is the unbroken tradition of commentary on his works that extended for several millennia after

his death, a tradition to which we largely owe the little that still survives from the writings of his predecessors in natural philosophy.

However, fear of persecution and concern for the respectability of natural science are not the only reasons for Aristotle's willingness to accommodate the expression of his thought to popular opinion. There are also educational reasons, which stem from his insight that natural science, unlike mathematics, is necessarily an ascent from what is more familiar to us, in all its confusion, toward what is clearer or more knowable by nature.[40] Given our remoteness from the ultimate causes of things, natural philosophy can not be taught as a deductive science, but must begin, at least, as an ascent from common opinion. Thus, for instance, insight into the truth that natural beings become what they most truly are by attaining their mature form emerges more or less directly as a refinement of the common belief in higher purposes.[41] And one of the surest ways to prevent access to this insight is dogmatically to reject that common belief or dogmatically to pretend that it doesn't matter whether its claims are true. For these reasons as well, then, Aristotle first presents himself as being in fuller agreement with that belief than he really is.

In conclusion, let me return briefly to the question of the origin of the world. For although my account of why Aristotle speaks of nature as an end is compatible -- as is the bulk of the Physics -- with the possibility that our world emerged through chance, the fact remains that the final book of the Physics and the first book of On the Heavens contain elaborate arguments for its being eternal. And since Aristotle also claims, as I mentioned earlier, that the highest principle of the world is a divine mind, he holds out

the hope that natural motion is somehow, in a way that we may never perhaps be able to understand, activity for a purpose in the strict sense of the word. Yet I do not think that Aristotle himself could have placed much stock in a suggestion that anything other than a self-moving, intelligent agent – which the divine mind of his theology is not – can act for a purpose in the strict sense.[42] And at all events, there is a more important reason for his attempt to show that the world as we know it is eternal, and dependent on an intelligence more or less like our own. For if it is not, this does not necessarily mean that it is the product of natural elements that have come together by chance; there is also the possibility that it owes its existence to the will of a mysterious god or gods. And in that case, what we call nature would be at most a subordinate order whose continuance depends on the sufferance of this god or these gods;[43] and so science, or the attempt to understand nature in the light of its intelligible principles, would be a questionable and perhaps even a wholly misguided pursuit. Accordingly, Aristotle's own theology, and the associated doctrine of the eternity of the world, serves above all as a response to this radical challenge to the scientific enterprise. It is not, however, an adequate response to it, since his arguments for the eternity of the world, at any rate, are inconclusive. Indeed, some of the deficiencies in these arguments are so manifest, it seems to me, that Maimonides must surely be correct to say, in The Guide of the Perplexed, that Aristotle himself did not regard them as genuine demonstrations.[44] Aristotle either had some other way, then, of justifying the life of science, and its first premise that the world is a natural one, or else he too must have been perplexed by this fundamental question.

ENDNOTES

1. Chance and Necessity, Jacques Monod, translated from the French by Austin Wainhouse (New York: Vintage Books, 1972), p. 21. The claim made in this passage is significantly qualified on p. 41 (which should be read in connection with p. 104, along with the slightly more tentative remarks on pp. 112-113). The original claim is restored, however, on pp. 176-177. Note also the quotation marks around the word "true" on pp. 21 and 176.

2. The Philosophical Works of Descartes, translated by Elizabeth Haldane and G.R.T. Ross, Volume One (London: Cambridge University Press, 1972), p. 173; contrast, however, p. 194.

3. Principia, Volume II, The System of the World, Motte's Translation Revised by Florian Cajori (Berkeley: University of California Press, 1934), pp. 543-544. Compare p. 546 and pp. 668-670.

4. The Evolution of Physics, Albert Einstein and Leopold Infeld (New York: Touchstone Books, 1966), p. 31.

5. See, for instance, On the Soul 415a22-b21; On the Parts of Animals 641b23-33; On the Generation of Animals 730b8-32; Physics 199a20-b14.

6. Physics 194a21-22; 199a15-17.

7. On the Parts of Animals 641b10-12; On the Heavens 291b13-14, 271a33; Politics 1256b20-22; Posterior Analytics 94b36.

8. See On the Parts of Animals 641b10-23; compare Plato, Philebos 30a9-c8; Laws 885e7-886a4.

9. Physics 196a24-b5.

10. Physics 198a2-4.

11. Physics 196b21-22; 198a3-6; cf. 197a5-6 and 197b18-22.

12. cf. Aristotle's "Physics" (Books I and II), translated with introduction and notes by W. Charlton (London: Oxford University Press, 1970), pp. 109-110.

13. Physics 198a5-12.

14. Physics 192a34-b1; 198b1-4 (but contrast 224b5-6).

15. Physics 194b26; Compare Charles H. Kahn, "The Place of the Prime Mover in Aristotle's Teleology," in Aristotle on Nature and Living Things: Philosophical and Historical Studies Presented to David M. Balme (Pittsburgh: Mathesis Publications, 1985), pp. 182-205. See also Thomas Aquinas, Summa Theologica I, Q.2, A.3; I-II, Q.40, A.3.

16. Physics 192a16-19.

17. See, for instance, Metaphysics 1072b13-14; On the Heavens 279a22-30.

18. On the Heavens 292a14-22; 285a29-30; On the Motion of Animals 700b25-32; Metaphysics 1072a19-b4; 1073a22-b1.

19. Compare Metaphysics 1018b14-37; Categories 14a26-b8.

20. Compare Wolfgang Wieland, Die aristotelische Physik, 2nd edition (Göttingen: Vandenhoeck and Ruprecht, 1970), pp. 259-260.

21. Contrast Metaphysics 1051a34-b6 with 1027b18-1028a6. See also On the Soul 426a15-26; 430a19-22; 431a1-4; and compare Physics 223a16-29.

22. Physics 196b21-22; cf. endnote 10.

23. It is almost surely for this reason, by the way, that Aristotle discusses the more particular topic of luck before turning to chance in general, despite his announced intention at the beginning of the Physics to proceed from the general to the particular (184a23-24; 189b30-32). For what is from luck, we recall, was defined as what might have been brought about for a purpose from intelligent choice, and this notion of purpose makes more sense, at least at first, than the broader notion, which includes natural purpose, that Aristotle employed in his definition of chance.

24. Physics 194a28-30 ff. Translations from the Greek are my own.

25. Physics 194a32-33; 195a23-26; 198b8-9; 198b16-17.

26. Physics 197b18-22; 197b35-37; 196b34-197a2.

27. Physics 192b8-32; 199b14-17; and contrast 197a1-2.

28. Metaphysics 1034b4-7; cf. 1032a25-32; On the Generation of Animals 715b25-30; 762a8-763b16; History of Animals 539a21-25; 547b18-23.

29. Consider Posterior Analytics 95a3-6.

30. Cf. David Furley, "The Rainfall Example in Physics ii 8," in Aristotle on Nature and