from A. Gotthelf, Teleology, First Principles, and Scientific Method in Aristotle's Biology, Oxford 2012 (paper originale 1977 + postscript 1987)

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Aristotle's Conception of Final Causality

I

Aristotle's teleology is a central component of his philosophy, and interpretations of it often heavily influence evaluations of the significance of his thought, both in science and in philosophy. Much has been written about this aspect of his philosophy, but surprisingly little sustained attention has been directed to what is clearly the fundamental question: what, precisely, does Aristotle mean when he asserts that something is, or comes to be, *for the sake of* something?[1]

II

If we are to answer this question with both historical accuracy and philosophical precision, how must we proceed?

The place to begin, of course, is with the text—ideally, with Aristotle's own statement of an answer. One would expect to find, somewhere in the vast Aristotelian corpus, a thorough analysis and explicit definition of this central notion. Surprisingly, it is not there to be found. Readers of the corpus will search in vain for a detailed analysis of what it is to be (or come to be) for the sake of something.

The longest continuous passages on final causality, *Physics* II.8 and (sections of) *Parts of Animals* I.1, while containing much that eventually proves helpful, do not address themselves directly to this issue. In each case, the purpose is to argue for the applicability to nature of a conception of final causality whose precise meaning and statement is largely taken for granted.

This paper is reprinted substantially as it appeared in 1976 (Gotthelf 1976/77). A 'Postscript 1986' and some notes were added for the 1987 reprinting (Gotthelf 1987b); those additional notes were placed, and remain, in square brackets. (For the present reprinting, a few small editorial changes have been made, and occasional references have been added, signaled by expressions such as 'see now', as in n. 1 below.)

[1] [Since this essay was first published much good work as been done on this issue. I comment on some of it in notes which follow, and in the appended Postscript 1986. For comments on post-1986 work, see now Gotthelf 1992 and chapter 3 below.]

In looking for such an analysis outside these chapters, one thinks first of the passages in which the final cause—'that for the sake of which'—is being introduced as one of the four (types of) causes.[2]

The main text is *Physics* II.3 194b32-195a3.[3] A careful reading of these lines, however, shows that here too Aristotle is not introducing or defining the concept of *being for the sake of* in terms of more familiar concepts. Rather, assuming a familiarity with the notion from its ordinary use, he is arguing for its status as a (type of) cause. More precisely, in fact, Aristotle is arguing for the inclusion of the *end* (*to telos*) in the list of causes. In a literal translation, the relevant portion reads:

> In yet another way we call <something> a cause as <being> the end; this is that for the sake of which—e.g., of walking, health. For, why does one walk? We say, 'in order to be healthy,' and speaking so we think we have given the cause.[4]

[2] 'That for the sake of which' is a literal rendering of Aristotle's *to hou heneka*. *heneka* is an ordinary preposition in Greek, appearing mostly in the construction *A*-verb-*heneka*-*B*, with *A* the subject and *B* the genitive object (e.g., 'he walks for the sake of his health'). Aristotle formed abstract substantive expressions to designate the terms of the relation (*to hou heneka* for *B, to toutou heneka* for *A*) and the relation itself (e.g., *heneka tou*). I follow the traditional rendering of *aitia* and *aition* as 'cause'. I am not convinced by the arguments against this translation given by Gregory Vlastos in his 1969, 292-94. There is much to be said for the view that Aristotle is offering a conception of causality different from the Humean one that has so infiltrated the speech, and structured the intuitions, of many philosophers. One should not equate a particular *conception* of causality with the *concept* of causality as such. I cannot argue this here in any detail, though for some brief remarks see n. 51 below. [See also Gotthelf 1980, 368; Cooper 1987, 273-74; and Balme 1987c, 281.]

[3] *Metaph.* A.3 983a31-32 refers us to *Phys.* II.3; Δ.2 is an almost exact duplicate of part of II.3; and *APo.* II.11 merely repeats II.3's illustration.

[4] 194b24, 32-5. In canonical form the argument runs:

P_1 That for the sake of which is a cause.
P_2 <u>The end is that for the sake of which.</u>
The end is a cause.

P_1 is not actually stated, but is the implicit conclusion of a subsequent argument, embedded in the walking example which may be put:

P_3 An acceptable answer to a 'why' question states a cause.
P_4 <u>Stating that for the sake of which is an acceptable answer to some 'why' questions.</u>
That for the sake of which is a cause.

Neither P_3 nor P_4 is felt by Aristotle to need explanation or defense, and the wording of the example which generates P_4 makes clear that Aristotle is assuming that his readers are thoroughly familiar with the notion of being for the sake of, at least in its application to human action. Nowhere in the passages describing the four causes is a statement given of what it is to be (or come to be) for the sake of something. (In support of this reading, cf. the summary passage in the same chapter, at 195a24-26, and the similar arguments in the passages listed in n. 3.)

Failing to find an explicit account of the nature of final causality in the passages listing the four types of causes, one thinks next of looking through the corpus for passages which contain an explicit statement of conditions necessary and/or sufficient for something's being or (coming to be) for the sake of something. As it turns out, there are ten to fifteen passages which appear to offer this, but, once again, it can be shown that none of them gives what can be considered a definition—an account of what it is to be (or come to be) for the sake of something.[5]

III

Since the text does not provide us with an explicit answer to our main question, some indirect method of determining the answer is required. There are at least three such methods that might profitably be used.

(1) One might examine the passages just referred to in which, at least apparently, Aristotle gives conditions for something's being (or coming to be) for the sake of something, in the attempt to determine what particular conception(s) of final causality, if any, they presuppose.
(2) One might examine the various passages in which Aristotle is presenting arguments for his thesis that final causality is operative in nature, in the attempt to determine what particular conception of final causality is the subject of this thesis.[6]
(3) One might examine relevant texts throughout the corpus in the attempt to determine Aristotle's position on what is now known as the problem of (biological) reduction.

Of course, the manner in which one would proceed to do this last, and the point of such a procedure—i.e., the relevance to Aristotle's conception of final causality of his position on reduction, if he can even be said to have one—are by no means obvious, and eliciting them would require some sustained discussion. Since this

[5] Demonstrating this would require a longer discussion than is possible here. For now, I simply list the passages. There are eight or so distinct statements of conditions, two of which, notably, are repeated several times in different works. They are, in order of Bekker pagination: *APo*. II.11 95a6-9; *Phys*. II.2 194a28-32 (with II.8 199a8-9; b15-17; *PA* I.1 639b27-30; and 641b24-25); *Phys*. II.5 196b21-22; II.8 199a17-20; *An*. II.4 415b1-2 (with 20-21; *Phys*. II.2 194a35-36; *Metaph*. *Λ*.7 1072b2-3; and *EE* VIII.3 1249b15); *Metaph*. *α*.2 994b9-10; *Metaph*. *Δ*.17 1022a4, 6-8; and *Protrep*. Fr. 2 (Ross). [These passages are discussed in chapter 2 of my dissertation (Gotthelf 1975). Cf. also n. 13 below.]

[6] We should expect these arguments to have some such form as: 'Any phenomenon which is such-and-such is for the sake of something; some natural phenomena are such-and-such; therefore, some natural phenomena are for the sake of something.' The first premise, very possibly unstated in the text itself but easily formulable, might well be of some help in identifying what, for Aristotle, it is for something to be for the sake of something, if not itself already such an account.

method turns out to be the most fruitful—the others being more valuable for providing possible support to an interpretation already arrived at than for discovering and formulating a new one—let us turn directly to this discussion.

One might come to see the value of this method by means of the following considerations. First, in almost every passage in which Aristotle introduces, discusses, or argues for the existence of final causality, his attention is focused on the generation and development of a living organism.[7] In line with this, then, we ought to direct our attention to organic development and ask our main question of this type of case: what, precisely, does Aristotle mean when he asserts that the coming to be (or any stage in the coming to be) of a living organism is *for the sake of* the mature, functioning organism which results?[8]

Secondly, in considering this question we should remember that such an assertion is intended by Aristotle to convey an *explanation* of the occurrence and character of the stages in the development (and thus of the development itself), since that which the development is for the sake of is one of its 'causes'. Thus, a condition on any successful account of Aristotelian final causality is that it illuminate why Aristotle thinks reference to the end of a development might serve to explain the existence and character of that development.

This condition takes on a special importance when we remember, further, that in Aristotle's own study of organic development, *Generation of Animals*, he offers a detailed exposition of the 'mechanisms' involved in development, identifying sequences of changes in quality and place of the embryonic materials. In fact, it is often thought that *Generation of Animals* provides conclusive evidence that Aristotle himself believes that it is at least in principle possible to account for the development of a living organism fully in terms of features of the organism's constituent materials, features which make no reference to the development's outcome.[9]

[7] Cf. the passages listed in nn. 3 and 5. While the *Phys.* II.3 passage discussed above (see n. 4) and its counterparts (see n. 3) are restricted to examples of human action, the point of listing and describing the four types of cause is stated to be the contribution that knowing the types of causes will make to the investigations of the natural scientist (194b16-23); and in coming to understand that 'The nature is among the "for-the-sake-of-something causes"' (II.8 198b10-11, the chapter's opening lines), what the natural scientist learns is that the development of (the parts of) a living organism is for the sake of (their contribution to) its mature functioning. (Cf. Charlton 1970, 120-21, 122-23 and below n. 41.)

[8] That Aristotle's preoccupation is with organic development's being for the sake of something is no accident. It can be shown, once the correct interpretation of this use of 'for the sake of' is established, that all other uses of it are derived from and partially definable in terms of this one. See below n. 19.

[9] [Expressed most recently, in one form or another, in Nussbaum 1978 and (with reservations) Sorabji 1980. I have discussed Nussbaum 1978 in Gotthelf 1980 and 1981/82; for Nussbaum's latest views, see Nussbaum 1980, 1982, 1983, 1984. I discuss Sorabji 1980 in section II of 'Postscript 1986' (below, pp. 35-38, 39; cf. also the name index *s.v.* Sorabji, R.).]

If this is the case, we may properly wonder what the explanatory significance is of statements that refer the development's existence and character to its end, and thus in what precise sense the development is *for the sake of* the mature, functioning organism which issues from it. Alternatively, if Aristotle rejects, explicitly or implicitly, such a reduction, this too might well shed important light on what it is for a development—or for anything—to be *for the sake of something*.

Such, in brief, is the rationale for pursuing our main question through an examination of Aristotle's position on the problem of biological reduction.[10]

IV

Let us now give a more precise statement of the reducibility question, first in general, and then as it applies to Aristotle's own philosophical and scientific context. That will make us better able to discuss Aristotle's position on the question, and the implications of this position for our understanding of his conception of final causality.

The problem of biological reducibility is, for our purposes, the problem of determining the relationship between the laws of action of organic phenomena and the laws governing the living organism's material constituents. Specifically, can one account for a particular living process in terms of laws governing the material involved in the process, laws which make no mention of the end or goal of the process? In the case of organic development, can one give an account of the process of development solely in terms of laws of chemical interaction, laws which make no mention of the end to be realized, so that in principle one could give a chronological list of sets of chemical transformations of initial and added material such that the end result is a correct chemical description of the structure of a mature

[10] Some contemporary writers distinguish, under the general heading of biological reduction, two theses: (1) that teleological explanation can be reduced to non-teleological explanation; and (2) that biology can be reduced to chemistry (or physics, via chemistry). For example, Ernest Nagel, in a now classic discussion (1961, 398-446), argues that the first thesis is necessarily true, while the second is an empirical matter which is not currently known either to be true or to be false. Charles Taylor (1964, ch. 1), on the other hand, has argued convincingly that Nagel's case for the first thesis presupposes at key steps the truth of the second thesis. Taylor takes the position that the *first* thesis is an empirical matter, then argues that the claim that a system is teleological, that it 'inherently tends' in a certain direction, involves, essentially, the claim that such a reduction *cannot* be effected. 'It involves, for instance, the assumption that the basic level of explanation has been reached. For the claim that a system is [teleological] is a claim about the laws holding at the most basic level of explanation' (18). This view turns out to parallel Aristotle's own in important ways, and that is one reason the two reduction theses are not distinguished here. Furthermore, since all of Aristotle's distinctively biological 'laws' are teleological in character, thesis (2) for Aristotle reduces to thesis (1) at least with regard to the 'derivability' condition—see the next note).

living organism, without any of the laws of transformation making any reference to the end result? Such is the question stated generally.[11]

If one asks this question of Aristotle, one is immediately struck by the fact that Aristotle makes no use, and certainly no explanatory use, of the concept of *law* involved in the formulation of the problem. If we are to understand Aristotle's position on reducibility—and his teleology—we must understand *his* approach to explanation, his alternative to the concept of law, and also the equivalent in his system of what are for contemporary science the laws of physics and chemistry, the laws of the behavior of the material constituents of living organisms.

Now, Aristotle's central explanatory concepts are 'nature' (*phusis*) and 'potential' (*dunamis*). Compressing as much as possible, and simplifying somewhat, we may say that Aristotle's manner of explanation of natural changes and processes goes as follows.[12] Nature consists of individual entities, each of a specific kind, possessing various attributes, moving and changing in various ways. Some are living, some not; all are composed of the four simple bodies, the 'elements', which are themselves analyzable into combinations of elementary qualities and some sort of underlying matter. All these things which exist by nature—simple bodies, inanimate compounds, plants animals and their parts—move and/or change in ways characteristic of themselves if not impeded, which is to say, each has a *nature*. If an entity or material body is acting in such a characteristic way, it is a sufficient explanation of its action to identify that it is acting in accordance with its nature.[13]

[11] For a more rigorous and detailed analysis of what might constitute a reduction, see, e.g., Nagel 1961, 345-66, 433-35, summarized usefully in Ayala 1972, 1-6, or Schaffner 1974, 111-18. The problem as I have defined it here corresponds to the condition for a successful reduction which both Nagel and Schaffner call the condition of 'derivability'. Omitted in this essay is a consideration of the Aristotelian position on the second of the two formal conditions these writers lay down (which is called 'connectability' by Nagel and 'referential identity' by Schaffner). While a full-scale treatment of our subject would require discussion of this issue, such discussion is not possible in the present context, involving as it does the questions of the relationships of an Aristotelian entity (*ousia*) and its form, respectively, to the entity's constituent material, and of actions of (or identified in terms of) the entity to actions (i.e., motions and changes) of the entity's constituent materials. This involves many issues extraneous to our immediate concerns. Determining Aristotle's position on the 'derivability' issue will be sufficient to determine both his position on reduction and his conception of final causality. [On some of those 'extraneous issues' see Balme 1987d, Kosman 1987, Freeland 1987, the brief discussion of metaphysical issues in ch. 7 below, pp. 171-80, esp. 175-79, and the fuller study on which the latter discussion is based in ch. 10 below.]

[12] What follows is a fairly standard account, making use of central themes of several of Aristotle's works. The *loci classici* for 'nature' (*phusis*) and 'potential' (*dunamis*) are respectively, of course, *Ph.* II (with *Metaph.* Δ.4) and *Metaph.* Θ (with Δ.12). The exposition is so familiar that, with only one exception, references are cited only for quotation. The account will be slightly oversimplified in places, so as not to burden it with so many qualifications that the relevant points are lost; on this (and for the exception) see the next note.

[13] Cf., e.g., *Cael.* IV.3 310b15-19. Omitted here as irrelevant to our immediate purpose are the role of the efficient cause of locomotion to natural place and the role of the Unmoved

Not all motion and change, however, can be explained solely in terms of the nature of the moving or changing entity. Most motion and change, in fact, is due to *interaction*. Things act on other things, and things respond to the action on them of other things, in characteristic ways. In addition to having 'within themselves a source of motion-or-change and rest',[14] each natural thing has within itself 'a source of being moved-or-changed by another'[15] to which, in each case, corresponds a 'source' in that other of so changing the first. Thus, for Aristotle, in addition to having a nature, each natural thing has *potentials*—potentials to change certain other things in certain ways (which we may call 'active potentials') and potentials to be changed by certain other things in certain ways (which we may call 'passive potentials').[16]

Mover, for both of which see *Ph.* VIII. [There is a valuable discussion of these matters in Waterlow 1982.] Ignoring the latter, and the *Metaph.* Λ discussion of its role as the final cause of the rotation of the outermost sphere (especially 1072b2-3 and its sister passages—listed in n. 5 above), will be thought by some to be a serious mistake. Space limitations prohibit anything more than the following brief remarks. The passages which identify or refer to two ways in which *to hou heneka* is 'said' are intended to isolate the sense of 'that for the sake of which' which plays a technical role in Aristotle's philosophy from an ordinary use, approximating 'beneficiary', and as such are neither intended to nor do shed light on that technical sense. [For a somewhat different view see Kullmann 1985.] Secondly, the sense in which the action of (the *nous* of) the outermost sphere is for the sake of something is parallel to that in which human action, also directed by *nous*, is. If it can be shown that this sense is derivative from the sense in which organic development is for the sake of something, then an examination of the role of the Unmoved Mover as final cause cannot substitute for the examination undertaken herein—and in fact does not contribute anything to the attempt to answer our main question. On the priority of senses, see n. 19. [Charles Kahn has argued for an interpretation of Aristotelian teleology that gives a central role to the Prime Mover as final cause (Kahn 1985). In this interesting paper he maintains that the capacity of most living things to produce offspring one in form with themselves—which will be argued in this paper to be fundamental to Aristotelian teleology—is itself explained teleologically 'from general principles of cosmic perfection' (Kahn 1985, 195, 200). Among other passages, he appeals to *GA* II.1 731b18-732a1, *GC* II.10 336b25-34, and *An.* II.4 415a23-b7. There is not space to treat the issues Kahn raises at the length his discussion warrants (several are anticipated in Gotthelf 1975, 46-50, 260-61, 304-306 [esp. n. 161], 317-43); I can only make two points here. First, the thrust of these three passages is to assimilate generation to *self*-preservation (not the preservation of the species). (For discussion, see, e.g., Balme 1972 [1992], 96-97, Gotthelf 1975, 331-39, Lennox 1985a, and Balme, 1987c, 279-80.) Second, to relate the striving for self-preservation to the general striving for the better is not to make self-preservation an expression of some wider, cosmic goal the striving for which *explains* the striving for self-preservation. The striving for the better over which such passages generalize just *is*, in the end, a striving for self-preservation, and the arguments in each of these three passages *could* be stated without mention of 'the better' or of 'the divine' (cf. nn. 18 and 38 below, with references). But Kahn's wide-ranging paper deserves fuller attention than can be given here.]

[14] *Phys.* II.1 192b13-14.

[15] *Metaph.* Δ.12 1019a15-16; cf. Θ.1 1046a10-11.

[16] Any interaction will be, in fact, the actualization of a specific potential pair, an active and a passive, and there will be for any interaction a scientifically fundamental and ultimate way of describing it. We should note that the scientific account may not recognize a distinct potential,

These two concepts, 'nature' and 'potential', are *the* basic explanatory concepts for motion and change in Aristotle's scientific theories, and statements identifying the natures and potentials of things are the closest Aristotelian equivalents of 'laws' in modern science. Every process in nature, every motion or change, according to Aristotle, *is* action in accordance with a nature, *or* the actualization of a coordinate pair of active and passive potentials, *or* the sum of some combination of these. A natural motion or change is *explained* when it is shown to be the result of: action in accordance with one or more natures and/or actualizations of one or more irreducible potential-pairs. Explanation, to this extent, is for Aristotle subsumption (not under general laws but) under the natures and potentials of the acting and changing entities—and thus in large part consists simply of correctly identifying, in causally fundamental terms, *what* is actually happening.

V

As for the Aristotelian equivalent of modern physical and chemical laws, let us briefly consider the form that his account of the action of the material constituents of living organisms takes.

According to Aristotle, the material constituents of bodies, the 'so-called elements' (earth, water, air, fire), each has a nature and potentials. The nature of a simple body—its characteristic way of acting, if unimpeded—is locomotive, and its potentials—its characteristic ways of interacting with other such bodies—are primarily qualitative: each has a pair of primary qualities, and it is these that determine their interactions, including their mutual transformations.[17]

even though it might appear to be recognized in ordinary speech. For example, one could describe the collapsing of a row of dominoes as the actualization of the single (passive) potential of the row to be knocked over. This potential, however, consists of—is reducible to—the potentials of each of the dominoes (in virtue of the material of which it is made, and its shape) to be knocked over (and to knock the succeeding one over), and as such would not be, fundamentally or scientifically, a distinct potential. For a clear-cut conception of what for Aristotle would be the ultimate, irreducible potentials of the inanimate world, one would have to examine very closely the physical works, including *Meteor.* (esp. IV, now generally agreed to be authentic [cf. Furley 1983]), *GC* and *Cael.* It will always be an empirical matter which potentials are irreducible. (The potential of opium to cause sleep, for instance would *not* be—for Aristotle or for us—irreducible, and thus ascribing a 'dormitive virtue' to opium would for Aristotle *not* be explanatory.) [There is an interesting discussion of this point in Sorabji 1980, 171-72; I remark on it in my discussion of Sorabji in section II of 'Postscript 1986', p. 36 below). See also the quotation from Taylor 1964 in n. 10 above.]

[17] To simplify terminology we will designate the locomotive natures and qualitative potentials of the elements jointly as 'element-potentials'. For various reasons, the difference between a nature and a potential (though important in certain contexts) is not a great one, and Aristotle himself licenses this usage at *Metaph.* Θ.8 1049b6-11. (For the relationship between explanation in terms of natures and potentials—the type of Aristotelian explanation just expounded—and

To arrive at the Aristotelian form of the problem of reduction, then, one need only state the reducibility question in terms of element-potentials instead of laws of chemical interaction. With this substitution the question takes the following form: can one account for a particular living process completely in terms of the element-potentials involved in the process, making no mention of the overall end or goal of the process? In the case of development, can one give an account of the process of organic development solely in terms of element-potentials which make no reference to the overall outcome of the process, viz., the form of the mature, functioning organism? Or must at least one of the potentials involved in the account be irreducibly a potential for the development's end, for an organism of that form? If the latter is the case, one can think of the development as primarily the actualization of that irreducible potential, and any element-potentials additionally involved would be viewed as subsidiary to that one. Then, focusing on development, and with our discussion of the Aristotelian approach to explanation of natural motion and change in mind, we may put the reduction question as follows: *Is the development of a living organism the result of a sum of actualizations of element-potentials, or is it primarily the actualization of a single potential for an organism of that form, a potential the actualization of which involves the actualization of element-potentials, but is not reducible to them?*

VI

The answer to this question is the key to understanding the precise nature of Aristotle's conception of final causality.

It is the thesis of this essay:

(1) that Aristotle posed precisely this question, and that it was on this question more than on any other that he saw himself differing directly from his 'mechanistic' predecessors;

(2) that the evidence of the text—in the metaphysical and the physical, as well as in the biological, works—is that Aristotle's response to this question was an unwavering advocacy of the second alternative: that his view was that the development of a living organism is *not* the result of a sum of actualizations of element-potentials the identification of which includes no mention of the form of the mature organism, but *is* in fact the actualization primarily of a single potential for an organism of that form, an actualization which incorporates many element-potentials, but is not reducible to them;

explanation by causes, see n. 51 below. The connection between these two is, in large part, the deeper theme of this essay.)

(3) that this question and the question of whether a living organism develops *for the sake of* being a mature, functioning organism are *one and the same question*; and thus

(4) that the irreducibility to element-potentials of organic development is the core of the meaning of the assertion that the development is *for the sake of* the mature organism, and thus the core of Aristotle's conception of final causality.

In regard to this last, it is thus the thesis of this essay that Aristotle's concept of *coming to be for the sake of* may be defined as follows:

A stage in development, *A*, comes to be for the sake of the mature, functioning organism which results from the development, *B*, if and only if: (1) *A* is a necessary (or 'best possible') stage in a continuous change resulting in *B*, and (2) this change is (in part) the actualization of a potential for *B* which is not reducible to a sum of actualizations of element-potentials whose identification does not mention the form of *B*.[18]

[18] Two comments on this definition: First, the definition is formulated to apply only to those cases where the mature organism actually results. Since an organic development which does not succeed in reaching its goal is nevertheless for the sake of that end, a definition which applied to these cases as well would have to reformulate condition (1). For these cases, 'resulting in' would have to be replaced by something like 'tending to'. However, since 'tending to' for Aristotle can ultimately only be defined in terms of an irreducible potential for *B* (cf. Taylor's account, quoted in n. 10 above), there would be no need for condition (1) for these cases. In fact, condition (1) is superfluous, being a consequence of (2), and is included only to stress the contrast of this interpretation with those which do not make irreducibility a necessary condition of final causality for Aristotle. Second, the phrase 'best possible' is included to cover those (recognized by Aristotle to be) frequent cases where an organ or action is not actually *necessary* for the organism's life or well-being, but is one of a set of which one is necessary, and the most efficient of that set. This raises a number of considerations outside the scope of this essay, but the phrase needs to be included for completeness. See *PA* I.1 640a33-b3 and *IA* 2 704b10-17 for two representative texts.

[The considerations just mentioned include:

(1) the relationship between explanation by hypothetical necessity and explanation by the principle that 'nature does nothing in vain but always for each thing the best from among what is possible';

(2) the epistemological status of the latter principle; and

(3) the relationship between explanations that appeal to 'the honorable' and those that appeal to advantage.

On (1), and on hypothetical necessity generally, see n. 32 below, Cooper 1987, Balme 1987c, and chapter 7 below, pp. 174-75. On (2) see chapter 7 below. On (3) see Balme 1987c, 277 n. 5, and the discussion in Lennox 1985b, 149-55. They argue that appeals to 'the honorable' are a subset of appeals to advantage and do not represent a separate principle of explanation. A similar case can be made out, I believe, for appeals to 'living well' (*to eu zēn*). (Cf. also n. 13 above—and now ch. 2 below.) Since a naturalistic account can thus be given of the notion of the good with which Aristotle operates in his biology, it seems to me that the fundamental account of the final cause need not make use of that notion. While it is true that accounts more 'familiar to us' start there, it is not the case (contra, e.g., Kahn 1985, 197-98)

It is a corollary of this four-part main thesis that Aristotle's teleology—his doctrine that the development, structure, and functioning of a living organism is for the sake of something—is fundamentally *empirical* in character, and not an a priori doctrine brought *to* his investigation of nature.

The balance of this essay will consist of arguments in behalf of this thesis and its corollary.[19]

that Aristotle (in effect, arbitrarily) designates as the aim of a process that stage which he independently wishes to count as good. It is rather that the capacities actually at work *are* capacities for the mature state (*akmē*), where the mature state is identifiable in terms of the presence of maximal powers of self-maintenance without reference to independent normative criteria, *and* that for (what we would call) meta-ethical reasons the good is defined by reference to this same mature state. This raises the question of how one determines which capacities are actually 'at work'. This is a large issue, with important metaphysical dimensions, but surely it is clear that *Physics* II.2's poet spoke ridiculously (194a30-3) for more than one reason: if a living thing's aim were death one could not understand the elaborate process of continuous physical articulation and continuously expanding powers we call its development (the self-maintaining powers at each stage the same as those at earlier ones only more efficacious, etc.). The only question is whether the decline to death that regularly follows development to maturity is to be seen as part of the *dunamis* which is actualized in maturity, or is rather to be attributed to the natures and potentials of the materials of which the organism is made. I take it there are arguments (or premises from which one can construct arguments) in *An., PN, GC*, and *Metaph.* H and *Θ* in favor of the latter view (though as I say this is a large issue). (For a good discussion of 'self-maintenance' in Aristotle, see Nussbaum 1978, 76-78.) See also the new portion of n. 38 and section I of 'Postscript 1986', below—and, now, on all of these issues, chapter 2 in the present volume.]

[19] There are two other very controversial corollaries of the main thesis which can only be mentioned here:

(1) All uses of 'for the sake of' to be found in the Aristotelian corpus *other* than to denote the relationship between (a stage in) a development and its outcome are definable—and were understood by Aristotle to be definable—in terms of this primary use. This includes the notions of a *part* of an organism being for the sake of the whole, mature organism (i.e., the notion of a part having a *function*), of anything in the realm of human action—practical or productive—being for the sake of something, and of the action of heavenly bodies being for the sake of something (cf. n. 13 above). [For discussion of this dependence in the case of parts, see now section III of 'Postscript 1986', below.]

(2) The natural motions and changes of the simple bodies (earth, water, air, fire) when outside a living organism are *not* for the sake of anything. While these motions and changes are to (*eis*) a place or quality—very infrequently called a *telos*—they are not, and are never said to be, for the sake of anything (*heneka tou*). The latter concept is reserved for those processes of complex entities which are not reducible to element-potentials. Being the actualization of a single element-potential, each elemental motion or change *is*, of course, reducible to a set of element-potential actualizations—viz., the set consisting of that one element-potential actualization! Both *PA* II.1 646b5-9 and *Meteor.* IV. 12 389b29ff. concern elements as constituents of living organisms. Insofar as 'the movement of each body to its place *is* motion towards its own form' (*Cael.* IV. 3 310a33-4), that movement may be thought of as being *for the sake of* reaching that place—in as derivative a sense of 'for the sake of' as that passage's 'form' is derivative of the full-blooded organic forms of *Metaph.* ZH*Θ*. No such use of *heneka* is found in the corpus, however. [*Added 2010*: On the limited 'teleology' of the elements, according to

VII

A full case for this four-part thesis would contain at least three components: (1) an examination of Aristotle's own account, in *Generation of Animals*, of the nature and 'mechanisms' of the generative process—in order to put flesh on the so far very skeletal notion of an 'irreducible potential for form' and to provide support for the claim that, for Aristotle, organic development can be explained only by reference to such a potential and not solely in terms of element-potentials; (2) an examination, as suggested earlier, of the arguments Aristotle gives for his doctrine that final causality is operative in nature—in the attempt to elicit whatever information we can about the precise conception of final causality which is in fact the subject of this doctrine, against which information the present interpretation can be tested; and (3) an examination of the various apparent statements of conditions necessary and/or sufficient for something's being or coming to be for the sake of something, as also suggested earlier—for the same purpose.

In this essay we will have to limit ourselves to the first two tasks, in order to give them (minimally) sufficient attention. I will begin with a sketch of the theory of generation in *GA*, and a discussion of its implications for the reducibility question and the interpretation of Aristotelian final causality in terms of irreducibility. This will be followed by an examination of arguments to be found in each of the three chapters which are our main sources for Aristotle's arguments for natural teleology. After some brief remarks contrasting the interpretation offered here with the main alternative traditions of interpretation, I will conclude with an argument for the corollary of our main thesis, the claim that Aristotle's teleological doctrine is fundamentally empirical in character.

VIII

The purpose Aristotle sets for himself in *Generation of Animals* is to explain how reproduction—the generation and development of an offspring one in form with its parents—is effected. Across the first book he develops his thesis in a general way, in reaction to common opinion and to the views of his scientific predecessors.

His thesis, as it applies to the higher animals, is that the semen of the male acts on a material produced by the female, causing it to 'take shape' in the appropriate way.

Aristotle rejects the preformationist-pangenesis theories of some of his predecessors, to the effect that semen comes from the whole body, parts of the semen

Aristotle, see also, in the next chapter, the briefly noted contrast between Aristotle and Newton on the form of the principles stating the basic nature of matter (p. 65). Johnson 2005 misses the point(s) of the present paragraph, and the later one on Newton, in his criticism of my position on element teleology. See Henry 2007b (quoted below, pp. 83-84 n. 63), who explains the issues at stake.]

deriving from, resembling in miniature, and being directly responsible for parts of the body, generation being the enlargement and articulation of this composite mini-organism. The semen, Aristotle argues, does not contribute any *material* to the offspring. Rather, it carries, embodied in a 'motion' or set of motions, an active 'potential' to act on material supplied by the *female*, in just such a way as is required to effect reproduction to type.[20]

As the artist's tools, while in use, convey in their motions the specific potential to shape the material to the form he intends, so, Aristotle explains, the semen is the tool of (the father's) nature, conveying, in something like a motion, the potential to shape organic material to form, i.e. to a mature adult one in form with its parent.[21]

In Book II Aristotle offers a more systematic and detailed exposition and defense of his thesis. In the main theoretical passage of *GA* (II.1 734b19-735a4) he lays down the fundamental principle of explanation that must be used, then uses it to track down the identity of the 'potential' and 'motion' carried by the semen.

According to 'our first principle',[22] both the external agent of generation (the father) and its internal transmitter (the semen) must be adequate to the product. The former must be (or possess) in actuality that very (aspect of the) effect of which it is to be the cause, and the latter must possess the appropriate 'motion'. What it is for the 'motion' to be appropriate is not stated explicitly, but it seems clear that the purpose of the second part of the passage is to give some clarification of this:

[20] At 729b4-9 Aristotle states his view in the form of a question: '. . . or is it that the body of the semen takes no part, but the "potential" (*dunamis*) and the "motion" (*kinēsis*) in it does, for this is what is active, whereas that which is formed, which gets shape, is the [useful] remainder of the female residue?' Throughout this essay I have translated *kinēsis* in this way, for lack of any better consistent rendering. But the reader is to be warned that it is not an accurate translation. Not only does it refer to various types of change other than locomotion (change in quality, change in quantity), but in the biological works especially it often refers to an internal 'activity'—as if boiling water just removed from the fire were said to still contain a 'boiling motion'. This becomes especially significant in Book II, where Aristotle identifies the 'motion' in the semen with a special kind of heat; we are to think of this heat, as we are of the heat of the boiling water, not simply as a quality of the semen, but as an essentially active constituent of it. In II.2 Aristotle argues that semen is a kind of foam, with tiny bubbles of heat-bearing air. We have to understand *kinēsis* in such a way that it makes sense to call this heat a *kinēsis*. [For a later, and perhaps more precise, statement of the relationship between the *kinēseis* and the heat in question, see chapter 4 below, pp. 93 n. 9, 107-109].

[21] Cf. 730b8-23. Conception and development require that the material supplied by the female be appropriate, i.e., possess a passive potential for such an outcome. (For a representative text see II.3 737a24-25.) [As David Balme has pointed out, it is also part of the *GA* theory from the beginning that the female material as well carries 'movements' of its own, which play a role in the generative process. These are the very movements which convert her food into more of herself but which, because of her lesser heat, are unable to produce a new organism. See the important n. 14 in Balme 1987d, 293-94.]

[22] 734b20.

Just as we would not say that fire alone produces an axe or any other instrument, neither <should we say this of> a foot or a hand. Nor, likewise, of flesh, for even this has a certain function. Accordingly, hard, soft, tough, brittle, and all other such qualities belonging to the parts having soul—heat and cold may very well produce these; but never the organization (*logos*) by which one thing is flesh and another bone: only the 'motion' from the generating parent who is in complete actuality what that out of which <the offspring> comes to be is potentially <can produce this>—just as it is with the things which come to be according to an art: heat and cold make the iron hard and soft, but the *sword* <is made by> the 'motion' *of the instruments*, <this 'motion'> having a definition corresponding to the art, <which is> the source *and form* of the product.[23]

The semen's 'motion' is analogous to the motions of the artist's tools. As the motions of the tools have a definition corresponding to the art, i.e. to the form in the mind of the artist, so the semen's 'motion' must have a definition corresponding to the nature, i.e. to the form, of the parent.[24] That is to say, the semen's 'motion' *must be identified by reference to the form it is transmitting*.

To grasp the significance of this, let us recall that for Aristotle any specific 'motion' (and 'motion' as such) is to be defined in terms of its outcome: it 'gets its name *rather* from that-to-which than from that-from-which' it proceeds.[25] If the respective outcomes of two 'motions' are different in kind, then the two 'motions' themselves are different in kind. By stressing that the outcome of the semen's 'motion' is different in kind from the outcome of fire's heating—viz., an organization (*logos*) and not just a quality or a set of qualities—Aristotle is asserting that the semen's 'motion' itself is different *in kind* from the quality-generating 'motions' of fire. The semen's 'motion' is to be defined by its outcome: it is the fulfillment of the potential to generate an animal of a certain form or *logos*, qua potential; the form or *logos* is an inescapable part of its very definition.

If this is so, then the 'potential' which is manifested in the semen's motion also is to be identified by reference to the form being transmitted: it is, essentially, a potential for form, a potential *distinct from* and *not reducible to* any sum of qualitative and locomotive potentials. For, if it were reducible, so would the 'motion' be, and then heat and cold *could*, in the proper sequence of actions, produce 'the *logos* by which one thing is flesh and another bone'.[26]

[23] 734b28-735a3.

[24] That this is the point of the analogy is suggested most strongly by the last sentence of the full passage: 'For the art is source and form of the product, but in *another*; the 'motion' of the nature is in [the generated natural thing] *itself*, being *from* another nature, one having the form in actuality' (735a2-4).

[25] *Ph.* V.1 224b7-8. On the definition and individuation of motions see all of *Ph.* V.1-4. For the general definition of 'motion' see *Ph.* III.1-3. [Waterlow 1982 has some important discussion of these issues and of their relation to Aristotle's teleological commitments.]

[26] 734b33-4. The whole matter of the philosophical implications of Aristotle's theory of generation—his view of the manner in which form is 'transmitted' in generation, the nature and

IX

There is further evidence in *GA*, and in related passages elsewhere, that Aristotle viewed the 'potential' the semen carries as an irreducible potential for form, in the manner specified in the formulation of the main thesis of this essay.

In *GA* II.2-3 Aristotle takes up the question of the physical nature of the bearer of the 'potential' for form. In II.2 he offers a chemical analysis, as it were, of semen, an identification of its qualitative properties. Semen is 'a combination of *pneuma* and water, and the *pneuma* is hot air.'[27] In II.3 he asserts that it is the heat in the *pneuma* that is responsible for generation, and compares that heat with the more familiar heats of fire and the sun.

> Now, the 'potential' of all soul seems to be associated with a body different from and more divine than the so-called elements, and as the souls differ from each other in value and lack of value, so too this sort of nature differs. For within the semen of everything there is present that very thing which makes the semen fertile, the so-called 'hot'. This is not fire or that sort of potential, but the *pneuma* enclosed within the semen, that is, within the foamy part, and more precisely the nature *in the pneuma*, being analogous to the element of the stars. This is why fire generates no animal, and none is seen to be constituted in things subjected to fire, whether wet things or dry. But the heat of the sun and the heat of animals <do generate>—not only the heat conveyed through the semen, but also if there is some other residue of their nature, even this contains a life-source. Such things make plain that this heat in animals neither is fire nor has its origin from fire.[28]

This passage deserves much more attention and space than it can be given here. Its highlights are (1) its stress on the *difference* in character between the 'potential' for soul, and the heat which bears it, on the one hand, and the potentials of the elements and the elemental heat of fire, on the other; and (2) its stress on the similarity of generative heat to the heat from the sun, an analogy or comparison which has puzzled scholars.[29]

The doctrine of this passage nicely focuses the irreducibility question. It makes clear that if there is to be an irreducible 'potential' for form, it will be the 'potential' borne by the heat in the *pneuma*. We know this heat must be such as to act on the female's material in just such a way as to produce an organism of the relevant form. If this 'potential' is to be reducible, there will have to be a way of specifying the series of heatings, coolings, and movings around of material in the developing

character of the 'potential' and motion by which it is accomplished, etc.—deserves more extended treatment. [See Balme 1987c and 1987d, esp. 281-82 and 292-93 respectively, and now chapter 4 below. There is much work yet to be done.]

[27] 735b37-736a1.

[28] 736b27-737a7.

[29] On this and related matters concerning Aristotle's theory of generation, see Balme 1972 [1992], 158-65 *ad* 736a24-737a34 and above n. 26.

embryo which this heat effects, without referring to the form. On the face of it, the absence of any sort of quantitative chemistry, and the simplicity of the descriptions of qualitative 'potentials' and interactions that Aristotle countenances, make it difficult to believe that he thinks such a specification possible, and there is no evidence in his works that he does.[30]

On the contrary, there is at least one passage that suggests the reverse. In *An.* II.4, Aristotle considers whether fire could be the cause of nourishment:

> Some think that it is the nature of fire which is the cause quite simply of nourishment and growth; for it appears that it alone of bodies is nourished and grows. For this reason one might suppose that in both plants and animals it is this which does the work. It is in a way a contributory cause, but not the cause simply; rather it is the soul which is this. For the growth of fire is unlimited while there is something to be burnt, but in all things which are naturally constituted there is a limit and a *logos* both for size and for growth; and these belong to soul, but not to fire, and to *logos* rather than to matter.[31]

[30] This also deserves fuller treatment, focusing on an analysis of Aristotle's conception of heat, its nature, potentials, and varieties. Balme 1972 [1992], 163-64 is helpful. Of interest is a little-noted passage in Theophrastus's *On Fire*, which clearly makes use of *GA* II.3 736b27-737a7, just quoted.

> Now the heat which is natural to animate bodies, being infused into a comparatively large number of creatures and in a rather special way, becomes in a sense alive and capable of generating similar creatures. Even more so the heat from the sun. It is able to create animals and plants. It is mixed, to be sure, with air (occurring rather in it), but by reason of its gentleness (*μαλακότητι*) and fineness (*λεπτότητι*) has a certain appropriateness for generating life; it is not, like the heat of fire, hard (*σκληρά*) and caustic (*περικαής*). For that reason seeds subjected to fire do not generate, but those which are warmed by the sun to excess (*ὑπερβολήν*) generate and germinate. (Coutant 1971, §44, 28-31)

There are suggestions in this work of an attempt by Theophrastus to formulate some generalizations pertaining to the varying effects on various materials of varying degrees of (fineness of) heat, but they are not developed enough to indicate clearly a reductionist sympathy on Theophrastus' part, nor *a fortiori* on Aristotle's.

It is sometimes suggested that the analogy of embryonic development to the operation of the 'automatic marvels' (734b10, 741b9; Balme 1972 [1992], 157; Nussbaum 1976, 146-52; Balme 1987a, 18) makes clear that Aristotle thought of embryonic development as the result of a 'causal mechanism' involving only element-potentials. But it establishes no such thing. Briefly, the analogy is meant to illustrate how the male parent may be the efficient cause of the generation even though not in contact with the embryo (734b10), and that the development is a smooth, uninterrupted process (741b9), and is not meant to suggest anything about the character of the potentials being actualized. The common feature underlying the analogy, as Aristotle notes each time, is a complex but smooth sequence of actualizings of potentials immediately upon a single contact from outside. The analogy is in no way weakened by the fact that in the case of embryonic development some of these potentials will be irreducibly for form (e.g., the potential of the semen's heat to solidify the female-supplied material in just the shape necessary for an organism of that type, and irreducibly so, as we have just seen in our discussion of II.1 734b19-735a4. [On this, see now also chapter 3 below, p. 81.]

[31] 416a9-19.

There is no mention of *pneuma* here, but readers of the two passages from *GA* just quoted and discussed will find it hard to resist supplying it, especially in view of Aristotle's identification of the nutritive and reproductive faculties.

That this distinction between element-potentials and potentials for form (soul, *logos*, etc.) is at the root of the distinction between explanation in terms of material-efficient causes and explanation in terms of final-formal causes will be argued in the next three sections, as we examine the arguments Aristotle offers for the necessity of employing the final cause in the study of organic nature.[32]

X

The need for employing the concept of final causality—of being for the sake of something—in the understanding of nature is asserted and defended in three main places in the Aristotelian corpus: *Metaph.* A.7 (with 3), *Phys.* II.8, and *PA* I.1. In each case, the conception whose employment is defended is the one attributed to Aristotle by our 'irreducible potential' interpretation.

[32] A fuller examination of the evidence of the biological works would require discussion of the well-known set of passages in which Aristotle states that some part of an embryo or organism comes to be 'on the one hand of necessity, on the other for the sake of something'. I think that the key to understanding these passages is provided (as might be expected given the theoretical centrality of the passage) by *GA* II.1 734b19-735a4, as interpreted above in section VIII. My suggestion is that throughout Aristotle's biological works certain (qualitative) aspects of the embryo or organism are explained by element-potentials ('of necessity') and certain (organizational, functional) aspects by a potential for form ('for the sake of something')—and that the same aspect (e.g., the solidity of the bones mentioned in II.6 743a36-b18) is said to be both of necessity *and* for the sake of something only when that aspect contributes to the constitution of an aspect which is not there of material necessity (e.g., the *logos*—the bone itself, qua bone—as in 734b19-735a4). The 'biochemical' basis for the distinction in the type of causality involved in the generation of the different aspects of the embryo is to be found in the different aspects of the semen's 'motion', i.e. of its heat. The qualitative properties of the embryo are explained by the element-potentials that the *pneuma*'s heat has qua heat, the organizational properties by the 'purity' or 'fineness' (n. 30 above, esp. Balme loc. cit.) unique to this sort of heat (which 'fineness' is specifiable—I am arguing—only as being a potential to produce an organism of a certain sort). [See, on hypothetical necessity, Cooper 1987 and Balme 1987c. I take Cooper's thesis regarding the operation of material (or 'Democritean') necessity in organic nature to include, roughly, the following proposition: certain organic outcomes do not come to be of material necessity; those that do, do so *only* conditionally upon the coming to be of those that don't. This way of putting it shows that Richard Sorabji's criticism (1980, 173-74) of the view expressed in this note was misguided. The deer's shedding of horns (*PA* 663b12ff) is for the sake not (as Sorabji suggests) of greater lightness *per se* but of the contribution (*heneka opheleias*: 663b13) such lightness can make to the life of the deer, and *that* good when achieved is not achieved of necessity. As Cooper points out (1987, 265), Aristotle explicitly denies in the theoretical passages (and never asserts in the biology) that (e.g.) individual deer come to be and continue to exist of necessity.]

Metaphysics *A*

At A.3 983a33-b6, Aristotle explains in advance the purpose of his historical survey of the types of causes that his predecessors have employed: 'we shall either find another kind of cause or be more convinced of the correctness of those which we now maintain.' What is important to see is that the discussions that follow constitute arguments for the need to employ the four types of causes. If attempts by the best thinkers to account for certain natural phenomena without a given kind of cause are unsuccessful, while attempts making use of it are successful, that is good reason to maintain that this type of causality *is* operative in nature.

The case for the final cause is made in two parts. First, in chapter 3, we are introduced to the phenomena which, according to Aristotle, material factors alone—i.e., the natures and potentials of the elements—cannot account for, and which (therefore) gave rise to an awareness of the efficient cause. Then, in chapter 7, we are shown that the account in terms of the efficient cause was really a misguided attempt to formulate and employ the final cause.

The insufficiency of explanation wholly in terms of material causes became clear fairly soon, Aristotle states:

> For it is not likely either that fire or earth or any such element should be the reason why things manifest goodness and beauty both in their being and in their coming to be, or that those thinkers should have supposed it was; nor again could it be right to entrust so great a matter to spontaneity and chance. When one man said, then, that mind was present—as in animals so throughout all of nature—as the cause of order and of all arrangement, he seemed like a sober man in contrast with the random talk of his predecessors.[33]

These later thinkers, however, did not clearly distinguish the final from the efficient cause and thus never clearly saw the need for the former to account for 'goodness and beauty, . . . order and all arrangement.'

> For those who speak of mind or friendship class these causes as goods; they do not speak, however, as if anything that exists either existed or came into being for the sake of these, but as if movements started from these. . . . Therefore it turns out that in a sense they both say and do not say the good is a cause; for they do not call it a cause qua good [i.e., qua that for the sake of which] but only incidentally.[34]

The structure of this two-part argument is clear. The phenomenon to be explained is the order, the arrangement, the beauty and the goodness to be found in nature.[35] This cannot be explained solely in terms of element-potentials—neither individu-

[33] 984b11-18.
[34] 988b8-16.
[35] Though Aristotle does not here say so, it is clear from similar language in *PA* that he means both the regularity of the heavenly motions and the organization of living organisms: cf. I.5 644b22-645a36.

ally ('fire or earth or any such element') nor in combination ('spontaneity and chance'); it is unreasonable (un-'sober') to think it could, Aristotle asserts.[36] The only reasonable account, when clearly articulated, is one which acknowledges that the process by which instances of order and beauty come to be, is essentially or inherently a process *to* order and beauty. But, given Aristotle's definition of 'motion' as the actualization of a potential ('as such'), a process, which is *essentially* to some end, is precisely a process which is the actualization of a potential essentially—and thus *irreducibly* for that end. This, then, is what it is for something to come to be for the sake of something, according to the argument of *Metaph.* A.

XI

Physics *II.8*

This notorious chapter is the only one in the entire corpus devoted completely and in detail to a defense of natural teleology. It opens with a clear statement of its purpose, sketches the alternative position, then offers a series of arguments and remarks in opposition to this alternative and in support of its own thesis.

The alternative to teleology sketched in the opening section of the chapter is precisely the view that the development of a living organism is the necessary outcome of a sum of actualizations of element-potentials.

> For everyone brings things back to this cause [*sc.* necessity: cf. 198b11] saying that because the hot is by nature such as to be thus, and similarly the cold and everything of that sort, therefore these things [*sc.* natural things: cf. 198b12] of necessity come to be and are. . . .
>
> The problem thus arises: why should we suppose that nature acts for the sake of something and because it is better? Why should not everything be like the rain? Zeus does not send the rain in order to make the corn grow: it comes to be of necessity. The stuff which has been drawn up is bound to cool, and having cooled, to turn to water and come down. It is merely concurrent that this having happened, the corn grows. . . . What, then, is to stop parts in nature too from being like this—the front teeth of necessity growing sharp and suitable for biting, and the back teeth broad and serviceable for chewing the food, not coming to be for the sake of this, but by coincidence? And similarly with the other parts in which the 'for the sake of something' seems to be present.[37]

[36] While Aristotle does not argue on behalf of this charge here, he would surely do so along the same lines as he does in rejecting fire as the cause of nutrition in *An.* II.4 (quoted and discussed in section IX above). See also n. 38 and my analysis of the first argument in *Phys.* II.8, in section XI below.

[37] 198b12-29.

Thus, when Aristotle announces in the lines immediately following these that this view, though plausible, *cannot* be true, it is the possibility of an account of development solely in terms of element-potentials that he is rejecting.[38]

While Aristotle here characterizes his own proposal only as the view that development is 'for the sake of something and because it is better', its nature seems clear. For one may ask how Aristotle could conceive an alternative *account* of development—given his general view of explanation sketched above—other than as one which holds the development to involve the actualization of an irreducible potential for form. If every process *is* the actualization of one or more potentials,[39] and organic development is *not* the actualization only of a sum of element-potentials, then it must be the actualization of a potential irreducibly for a mature organism of the relevant form. These two accounts are the only kinds of explanation available to Aristotle.[40]

Thus, the very way Aristotle poses the alternative he is rejecting in the name of final causality suggests his view of its nature and lends support to the 'irreducible potential' interpretation.

[38] 198b34. That this is so becomes certain if we consider how Aristotle could possibly characterize the alternative view as maintaining both that development is due to *necessity* and that it is due to *chance* (in the wider sense which encompasses chance and spontaneity). For a good discussion of this see Guthrie 1965, 163-64 and 414-19. [This language is nicely explained in Cooper 1987, 251. However, Cooper has maintained (1987, 250-53) that the line of argument outlined in this passage is independent of Aristotle's thesis that material natures are insufficient to explain the formation of precisely structured living outcomes. According to this line, Cooper claims, even if material natures *were* sufficient in that way, they still would not explain why these outcomes are *good* for the organism which possesses them; on the materialists' view, that they are beneficial would be a *coincidence*. But it is not clear that this is right. His point, I take it, is that even if material factors explained the regular production of, say, just this type of eye, and of just that type of eye-covering, they would not explain why the type of eye-covering that is in fact produced is just the kind needed for the successful functioning of just the type of eye produced. But, if the material natures were such as *regularly* to produce, by themselves, just such eyes *and* just such eye-coverings (etc.), then they would be such as to produce just such well-covered eyes (and just such well-organized living things); no *further* explanation would be needed. It is not as if they *could* have produced bad eye-coverings, or none, in this circumstance. Of material necessity, when there are these eyes, there are also those eye-coverings. Once one sees that the material natures are such as to produce such wholes, the only further question one could be asking would be why material things have the natures they do, and as Cooper rightly argues in his discussion of material necessity, this was not a question Aristotle thought one could ask. For this reason, I am still inclined to read this first argument in *Phys*. II.8 as presupposing the thesis that material natures are insufficient by themselves to generate living organisms or their parts. (On the role of the concept of 'the good' in Aristotle's teleology, see also the bracketed addition to n. 18 above, and section I of 'Postscript 1986' below—and now chapter 2 below.) James Lennox (1982) has argued that the contrast between sexual and *spontaneous* generation is central to understanding the contrast between teleological and non-teleological processes in Aristotle. I do not think that is right, and have discussed his paper in chapter 6 below.]

[39] In the broadened sense that includes natures, as above n. 17.

[40] Cf. Charlton 1970, 114-17.

So does the first argument Aristotle offers in support of his teleological account of organic development.[41] The argument may be summarized as follows:

Organic development is either for the sake of something or by chance; it is not by chance (since chance outcomes are irregular, organic outcomes regular); therefore organic development is for the sake of something.

More explicitly than in the opening statement of the problem, the available modes of explanation are said to be just two: explanation by element-potentials ('chance'[42]) and explanation by final cause ('that for the sake of which'). The case against the former is given in the parenthetical subargument: while the processes leading to a given chance outcome neither always nor for the most part issue in outcomes of the same type, the processes leading to the existence of a mature organism of some type always or for the most part do issue in an organism of that type. Thus the development of a living organism cannot be the result of a series of actualizations of element-potentials. Rather, it is a process for the sake of its outcome, which must mean, if our account of Aristotelian explanation is correct, that it involves the actualization of a potential irreducibly for an organism of that type.

This argument of Aristotle's has often been criticized. It is charged that he equivocates, switching senses of 'chance' from, roughly, 'mechanical sequence' to 'unusual sequence'. His argument is alleged actually to proceed: either for the sake of something or by chance (by 'mechanical' sequence); because usual not by chance (by unusual sequence); therefore, for the sake of something.[43]

I submit, however, that this is not an equivocation, because Aristotle's description of chance outcomes as 'unusual' is not ultimately a matter of language: what appears to be an appeal to ordinary language is in fact a factual claim.

W. D. Ross writes of this premise that, according to Aristotle,

it is of the nature of chance events to be the exception, while *everything* or almost everything in nature has the appearance of adaptation to purpose. That end-like results should be *constantly* produced in the absence of final causation would be too extraordinary a coincidence to be credible.[44]

[41] 198b34-199a7. That the subject of this argument is organic development, and not natural things as such, is argued successfully by Charlton 1970, 120-21. [David Furley has argued against Charlton on this matter in his 1985. In editorial comments on his penultimate draft, I proposed a simpler reading of 198b36, which if right defeats his argument. Furley summarized my argument in his n. 3, then, oddly, argued that my thesis must be wrong because it has the same problem Charlton's does, the very problem which my reading enables Charlton to avoid. See now the excellent discussion of this passage in Irwin 1988, 522 n. 18.]

[42] Interpreted as above, n. 38.

[43] The harshest such criticism is that of Cherniss 1935, 250-52; cf. Charlton 1970, 123.

[44] Ross 1936, 43.

Ross's last sentence might well have been intended as a summary of the argument for final causality in *Metaph. A*.3 and 7, and even a restatement of 984b11-15, where, as we recall, Aristotle writes that

> it is not likely that fire or earth or any such element should be the reason why things manifest goodness and beauty, both in their being and in their coming to be, or that those thinkers [*sc.* the early Presocratics] should have supposed it was; nor again could it be right to entrust so great a matter to spontaneity or chance.

The argument in *Phys.* II.8 is neither an equivocation nor an appeal to ordinary language. It is a restatement of the argument in *Metaph.* A.3, and has the same force. Given the simplicity of Aristotle's chemistry, he can only believe that the outcome of organic development is too complex, too orderly, possessing too much of limit, *logos*, and form, to be the result merely of the unlimited, relatively indefinite natural action and interaction of the elements. The development must be *for the sake of* its outcome—i.e., essentially and irreducibly a development *to* order—i.e., to form. The development, in short, must be the actualization of an irreducible potential for form.

XII

Parts of Animals *I.1*

This chapter is a lengthy and structurally complex one, which develops several themes pertaining to method in biological science.[45] One of its dominant themes is the importance of final causality for the study of the parts of animals. Though the subject of study is the structure and functioning of the parts of a mature, functioning animal, the argument for the necessity of employing final causality derives from the character of the coming to be of these parts. An examination of Aristotle's argument here should therefore be of value in determining his view of what it is to come to be for the sake of something.

The relevant conclusion is stated near the end of the chapter:

> There are then these two causes, the *for-the-sake-of-which* and the of-necessity. . . . That there are two modes of causation, then, and that we must at least attempt to state both, is now clear, as it is that all those who do not do this say virtually nothing 'about nature,' for the nature of a thing is more an origin than its matter. . . . The reason why our predecessors did not arrive at this method of procedure is that the what-it-is-to-be and the defining of the being did not exist.[46]

[45] Balme's masterly analysis (1972 [1992] *ad loc.*) of the structure of this chapter is invaluable here. [See now also Lennox 2001a *ad loc.*]

[46] 642a1-2, 13-27.

The position of those who spoke only of matter and necessity was described in some detail in an earlier passage.[47] These were the thinkers who searched 'for the material origin and that sort of cause', explaining everything from the origin of the universe to the formation of nostrils by reference to 'the underlying matter's having some definite nature by necessity, e.g., that of fire, hot, that of earth, cold, the one light, the other heavy.' Clearly, they attempted to explain everything in terms of element-potentials.

But, just as Empedocles did not realize that complex structures do not come about at random, but as the result of the actualization of a specific potential for a form that includes that structure,[48] so he and the others did not realize in general that:

> if man and the animals and their parts exist by nature, then we must have to say of each part—of flesh, bone, blood, and all uniform parts, and similarly of the non-uniform ones such as face, hand, foot—in virtue of what each of them is such as it is, and according to what sort of potential. For the 'out of which' is not enough . . . we have to speak also of . . . what sort of thing it is in respect of its form; for the nature in respect of form is of more fundamental importance than the material nature.[49]

Thus explanation solely in terms of element-potentials will not account for aspects of the form; this requires a second 'mode of causation'—an appeal to that for the sake of which these parts have come to be—which requires an awareness of the phenomenon of form and of the proper 'sort of potential.'[50]

The doctrine of *PA* I.1 in regard to final causality, then, is essentially the same as that of each of the other texts we have investigated—*GA* II, *Metaph. A*, and *Phys.* II. Processes for the sake of something are distinguished from those that are not by the presence in the one case, and the absence in the other, of a potential for form. Since reference to this potential is necessary, and mention only of element-potentials insufficient, this potential is evidently one which is *not* reducible to element-potentials. Thus, for a living organism of a certain form to come to be for the sake of something is precisely for it to result from a sum of actualizations of potentials, one of which—and the most explanatorily important of which—is an

[47] 640b4-28.

[48] Earlier at 640a19-27, quoted in the next note.

[49] 640b18-28. Cf. 640a19-27: 'So Empedocles was not right when he said that animals have many of the characteristics they do because "it just happened this way" in the process of coming to be—e.g., even the spine, he says, is such as it is because "it happened to get twisted and thus break". He was unaware, first, that the productive seed must have a specific (*toiautēn*) potential and, secondly, that the producing agent is prior, not only in *logos* but also in time—for a human begets a human, and therefore it is on account of the parent being of such a sort that the child's coming to be is such as it is.'

[50] Thus, 'the reason why our predecessors did not arrive at this method of procedure is that the what-it-is-to-be (*to ti ēn einai*) and the defining of the being (*to horisasthai tēn ousian*) did not exist' (642a24-27).

irreducible potential for an organism of that form, a potential (transmitted via the male parent's semen) to act on the material supplied by the female parent in just such a manner as to produce an organism one in form with the parents.[51]

XIII

Such is the case for the main thesis of this essay. The interpretation of Aristotle's conception of final causality presented here may be designated the 'irreducible potential' interpretation.

Most interpretations that have been offered, heretofore, fall into two main traditions. The first, which may be called the 'immaterial agency' interpretation, maintains that Aristotle understands natural teleology fundamentally on an analogy to human purposive action, in a way that implies that the developing embryo is (or embodies) some sort of conscious or quasi-conscious agent, directing the flow of materials, guiding its development to maturity.[52]

[51] The argument of these sections (and of this essay as a whole) suggests an account of Aristotle's four causes in terms of the concepts of potentiality and actuality. Every process is the actualization of a pair of potentials, active and passive. (A nature may be thought of as an internalized potential-pair.) The bearer of the active potential (the 'whence the source of motion') is the efficient cause. When the outcome of a process is so organized (has a *logos* such) that it has a distinctive manner of acting (an *ergon*) not reducible to the qualitative changes of its material constituents, then the active and passive potentials must be irreducibly potentials for form. This form, which must be specified in the identification of these potentials and their actualization (the 'what it is to be' both of the outcome and of its development), is the formal cause. And since the process, the development, is irreducibly *for* that form, that form ('that for the sake of which') is the final cause. Such a conception of causality presupposes, of course, the reality of natures and potentials. Aristotle's case against Hume here may in part be found in *Metaph.* *Θ*.3, but a fuller and stronger case can be constructed from other texts. [There is an excellent discussion of Aristotle's concept of 'the nature of a thing', and its role in his natural philosophy, by Sarah Waterlow Broadie in Waterlow 1982, esp. chs. 1-2. Professor Broadie does not discuss the implications of her analysis for our understanding of Aristotle's conception of a cause, but it would be well worth someone's trying to draw out those implications. Her analysis, for one thing, provides an explanation of why accounts of *aitia* in Aristotle simply in terms of necessary and/or sufficient conditions (as Sorabji 1980, ch. 2 argues) must fail, and why it does not follow that we must fall back on epistemologically oriented analyses (such as Sorabji offers) which explicate *aitia* in terms of explanation. (Cf. n. 2 above.) I hope to explore this issue elsewhere.]

[52] Advocates include Zeller (1897, I. 459-61) and Collingwood (1945, 83-85). I include in this category interpretations which speak of an 'unconscious desire' on the part of the embryo (e.g., Rist 1965), since 'unconscious desire', as psychologists use the term, is possible only to beings capable of conscious desire. Thus, as meant in its ascriptions to embryos, this characterization is actually not metaphorical and illuminating, but self-contradictory. [Robinson 1983 defends a form of the 'immaterial agency' view in the course of a critique of the contrary view in Nussbaum 1978. His argument rests, I think, on a confusion between soul as efficient cause and soul as final cause, and more generally between the *dunamis* which is efficient cause and its object (what, as we say, the *dunamis* is *for*) which is final cause (as per n. 51 above.]

Such a view has little, if any, textual plausibility; it rests heavily on Aristotle's (in fact, quite infrequent) use of the metaphors of striving and desiring, and a somewhat casual reading of the comparisons of a nature to an artisan in *Physics* II.8 and the biological works. While this sort of interpretation has the merit of taking Aristotle's teleology seriously and as a real alternative to the mechanism of his predecessors, its insensitive pressing of the nature/art analogy results in an Aristotelian mortal sin. Ultimately, the 'immaterial agency' interpretation makes nature a subcategory of art—i.e., of consciously directed, intentional action—thereby reversing the actual Aristotelian priority of nature to art, and thus rendering them both unintelligible.

The second, and more recent, interpretation may be designated the 'explanatory condition' interpretation. It maintains that the 'final cause' is in no sense actually a *cause*, though it plays a role in a certain type of explanation; and that its role in the explanation of organic development is to identify that for which the stages of development are necessary and (thus) that in terms of which they must be identified if they (and the development they constitute) are to be rendered 'intelligible'. The rooting of an acorn, for instance, is *for the sake of* the oak tree which results, according to this interpretation, if and only if the rooting is (1) a necessary condition of the existence of the oak tree and (2) 'intelligible'—fully 'understood'—only if identified by reference to the oak tree (e.g., as the rooting of a seed-for-an-oak-tree).[53]

Such an account works from a textual base that renders it initially plausible, but in viewing the specification of the end as necessary only to facilitate an (undefined) demand for 'understanding' or 'intelligibility', and not as demanded by the irreducible character of the potential actually possessed by the relevant 'seed', this interpretation appears to imply that the existence of final causality is compatible with the reducibility of the development to element-potentials. As a consequence, this interpretation seems to commit an Aristotelian mortal sin of its own: it appears to permit chance events to be for the sake of something. For instance, on this interpretation, it seems, Empedocles' human-headed bull[54] came to be for the sake of something: the coming together of the head and body were necessary for the existence of the bull, and these organic parts seem fully 'intelligible' only if reference to their ability to function in the calf is included in (or entailed by) their account.[55]

[53] Randall 1960 is often read this way (and not without warrant)—e.g., by Toulmin and Goodfield, who give an admirably clear statement of this interpretation in 1966, 83-85. Cf. Wieland 1970, sec. 16, 'Zum Teleologieproblem' (English translation in Wieland 1975).

[54] One of *ta bougenē androprōira* (*Phys*. II.8 198b32; cf. DK 31 B61).

[55] My hesitation in attributing this consequence to the interpretation is due to the vagueness of its notion of 'intelligibility'. If a process were taken to be 'intelligible' only in terms of its end if and only if the potential being actualized was irreducibly for that end, then the objection would not hold. Even in that case, however, the 'irreducible potential' interpretation would constitute a significant advance, as I go on to indicate. I am indebted to Richard Schuldenfrei for bringing this possibility to my attention.

Aristotelian teleology, in fact, is neither vitalist and mystical, nor 'as if' and mechanical. The notion of an irreducible potential for form supplies the proper content to the awareness that, for Aristotle, organic development is actually direct*ive*, without implying (as the 'immaterial agency' interpretation does) that it is direct*ed*; and it identifies the ontological basis of the awareness that the existence and stages of a development can be understood only in terms of its end—by establishing that the *identity* of the development is its being *irreducibly* a development to that end, irreducibly the actualization of a potential for form.

XIV

Aristotle's teleology—his thesis that the development, structure, and functioning of a living organism are for the sake of something—is a central tenet of his thought. It is a corollary of the 'irreducible potential' interpretation of his conception of final causality that this thesis is *factual* or *empirical* in character: it is a conclusion drawn from observation of nature and not a premise brought to it.

Philosophers of science today are in increasing agreement that the question of reduction is an empirical one; they insist that one cannot legislate the precise form of the laws in which our understanding of nature is expressed. Aristotle's attitude is similar: he does not attempt to legislate a priori the particular form which a successful account of the natures and potentials of living organisms must take. His arguments for his teleological doctrine make this clear. What he insists is that the facts as we have observed them, and the identifications of the natures and potentials of things which these observations have led us to, entail the irreducibility thesis which is at the core of the concept of final causality asserted to obtain in nature. Though the simplicity and the non-mathematical character of Aristotle's chemistry (and physics) eliminates for him any real possibility of a successful reduction to element-potentials of the complexities of the organic world, this makes his thesis no less empirical—for his view of the inanimate world is equally subject to revision. There is nothing in the fundamentals of Aristotle's philosophy, and nothing in his philosophical or scientific method, which would prohibit the adoption of a reducibility thesis, should the scientific evidence be judged to warrant it.[56]

[56] [In an important discussion of teleological explanation in Aristotle (Waterlow 1982, chs. 1-2), which I was delighted to find has much in common with my own, Sarah Waterlow Broadie takes me to task for the exaggeration involved in my 'empiric Aristotle' (91). She argues that the commitment to irreducibility of the sort I have argued here (and on which she has much to say that it highly illuminating) is bound up in the very notions of substance and the nature of a thing. Since these notions are surely among 'the fundamentals of [Aristotle's] philosophy', if teleology goes so go some fundamentals. (Johnson 2005, 183 n. 39 makes a similar point, although oddly he ignores what I said in the present note, first published in 1987, or in the last section of chapter 3 below, first published in 1997, and referred to at the end of this note.) It is not clear to me,

But Aristotle did not believe that the evidence warranted it. On the contrary, we have seen that he thought that a reduction of biology to chemistry could not be accomplished, and thus that organic development involves the actualization of an irreducible potential for form—which is to say, that it is a process *for the sake of* its end, irreducibility of potential for form being the core of Aristotle's conception of being *for the sake of something*.[57]

Postscript 1986

I

Though I would write this essay somewhat differently if I were writing it today, I still agree with virtually* all of its main claims. There are three that are crucial.

however, that reducibility of the sort Aristotle denies would render the notion of nature inapplicable at the elemental level or, more importantly, that there would not be other grounds on which the substantiality of living things or even their teleological character could be grounded. There are weaker sorts of teleology that we could imagine Aristotle legitimately retreating to, upon being faced with, and coming to accept, a more quantitative and structural chemistry. Such teleologies could certainly give no trouble to his concept of the nature of a thing, and would probably sustain his theory of substance. (The thesis 'T1' that Bradie and Miller [1984] describe as 'the core of Aristotle's teleology' [143] is an example of such a weaker teleology. Their mistake, as I see it, is in claiming that this is the thesis which Aristotle actually argues for, and not the stronger 'T2'. They seem to assume [cf. 142 bottom] that Aristotle wanted to leave open the possibility of there being a deeper level of matter to which potentials for form *were* reducible, but there is surely no evidence for this. What is puzzling is how, if that were Aristotle's position, it would still be classified as 'Irreducible Compatibilism', as Bradie and Miller correctly argue earlier it is, rather than (e.g.) the unwanted 'Supererogatory Compatibilism'. Though I must take issue with them here, I am gratified by their endorsement of many of the claims of this essay. [See now ch. 3 below, for further discussion of their interpretation.])]

The issues raised by Professor Broadie require further investigation. Though I stand by my original statement, I happily concede that in her very rich study she has shown the question more complicated and subtle than I had made it out to be.]

[57] [Some of the ideas developed in the Postscript and additional notes, as well as the main themes of this chapter, were presented to several meetings of a graduate course I gave with Professor J. L. Ackrill at Oxford University in Trinity Term 1984, on 'Substance and teleology: some issues in Aristotle's biological works'. I am grateful to all those who participated in discussions on that occasion, both inside and outside of class, and especially to Professor Ackrill and to David Charles, both of whom forced me to sharpen some formulations—and some thoughts. In addition, I have benefited over the years, since the original publication of this essay, from discussions of these ideas with more people than I can name, but I have benefited most, I think, from exchanges with David Balme, James Lennox, and (more recently especially with) David Charles. Warm thanks are due also to Richard Sorabji and Sarah Waterlow Broadie for discussing some of my views in print, especially to Sorabji, who was the first and with whom I had in addition some valuable correspondence.]

* Cf. n. 56 above. [This sentence, written in 1986, still holds true today, in 2010.]

(i) *Ontological irreducibility.* The development, structure, and functioning of living organisms cannot be wholly explained by—*because it is not wholly due to*—the simple natures and potentials of the elements which constitute these organisms. No sum of actualizations of what I have called 'element-potentials' is sufficient by itself for the production of those complex living structures and functionings for which Aristotle offers teleological explanation.

(By 'simple' natures and potentials I mean those whose essential specification does not make reference to the form or nature of the living organism as a whole. I do not mean to deny, and am inclined to affirm, that the elements have (irreducible) capacities to be worked up into such wholes, and that such capacities may be seen as part of their natures as the elements they are, on which cf. *Metaph. Z*.16 and *Meteor.* IV.12, and Balme 1987c, 284-85 and Kosman 1987, 389.)

(ii) *The dependence of teleological explanation on ontological irreducibility.* If some sum of actualizations of element-potentials *were* by itself sufficient for the production of some outcome, that outcome would *not* be subject to teleological explanation for Aristotle.

(iii) *The way ontological irreducibility generates and legitimates teleological explanation.* This is a two-part claim, involving (a) a thesis about the nature of explanation generally, and (b) a thesis about the form of a teleological explanation:

(a) Explanation, for Aristotle, works fundamentally by identifying the natures and potentials whose actualization actually constitutes, or is producing, the phenomenon being explained.
(b) A teleological explanation explains the presence of some phenomenon by showing it to be necessary for the presence of some complex end which a potential being actualized is irreducibly *for*.

(To be 'teleological', we will agree, an explanation must have some such form as '*A* is present/occurs because *A* is necessary or best for some end *B*'. Typically an 'end' is defined as a good outcome. While it will in fact always be true that an end is something good, this is not, on claim (iiib) here, part of Aristotle's concept or analysis of something's being an end. Rather to be an end is to be what a potential being actualized is actually and irreducibly for. This is a factual or objective matter and does not depend on imported normative notions. [These claims require, and will get, further explanation below, where I also show how (iiib) incorporates the 'best possible' clause.] As above, the potential is 'irreducibly' for some complex end when the production of that end is not due wholly to the actualization of element-potentials.)

Claim (i) is agreed to in one form or another by Waterlow (1982), Lennox (1982), Robinson (1983), Bradie and Miller (1984), Charlton (1985), Balme (1987c) and Cooper (1987), among others. It was disputed by Nussbaum (1978) and Sorabji (1980), who thus also rejected claim (ii). I discuss Nussbaum's views in Gotthelf 1980 and 1981/82, and examine Sorabji's in section II of this Postscript. The challenge for interpretations which jointly deny (i) and (ii) is

to show how teleological explanation could have any force as explanation if a reduction to element-potentials were in principle available. For, given Aristotle's realism, there will not be some merely *pragmatic* function that certain language can perform which other language for the very same aspect(s) of a phenomenon does not; and it seems to me that any authentic explanatory function which the teleological level would be thought to have could be performed instead by the corresponding account at the material level, if a reduction were available (cf., e.g., the new part of n. 38 above). These are, of course, only assertions on my part, and are best taken, as I say, as (friendly) challenges to other interpretations. (For the positions of Balme and Cooper [fellow contributors to the Teleology section of Gotthelf and Lennox 1987] in particular, on claim (ii), see Balme 1987c and Cooper 1987.)

My approach to the issue claim (iii) addresses has been to ask why the fact that something, *A*, is necessary for some end *B*, should explain the presence of *A*, and how, thus, *B* would be *responsible* for *A*. I start from claim (iiia)—that explanation, for Aristotle, is essentially by natures (*phuseis*) and potentials (*dunameis*). This seems clear to me both from the *Physics* and *Metaphysics* passages cited in n. 12 above, and from the pervasive use of these concepts in key explanatory passages throughout the scientific treatises, including, especially, *GA* and *PA* I, focused on in this chapter. This being so, we have to ask, for any phenomenon to be explained, which nature(s) and/or potential(s) are being actualized in the course of the phenomenon's generation or functioning. Now, the identity of a nature or potential is given in part by its object or end (i.e., by what it is irreducibly *for*), so we have to ask what that object or end is in each case. If, in accordance with claim (i), the production of a complex organic outcome is *not* the sum of actualizations of element-potentials, then the nature or potential being actualized must be a potential for that outcome (or for some larger end that includes that outcome), in other words: a potential for form. But *that* makes the explanation teleological, because it puts into the explanans an irreducible reference to an outcome for which the explanandum is antecedently necessary.

The use of teleological explanation in cases of complex organic outcomes is thus legitimated by the fact that those outcomes are the result of actualizations of potentials that are in fact for (and thus whose descriptions make inescapable reference to) complex living forms as such. On this picture, the fact that something, *A*, is necessary for some end, *B*, will *explain* the presence of that *A* because (i) a potential for *B* is being realized, and (ii) if a potential for *B* is being realized, anything necessary for *B* is also being realized. (That is part of what it *is* for a potential for *B* to be being realized.) If this account of how teleological explanation is legitimated is to be successful, however, two conditions will have to be satisfied. First, it will have to be true, in some objective way, to say that *B* is somehow *responsible* for *A*. Second, the fact that the potential for *B* is being realized will have

to be a basic fact, so far as explanation is concerned. Both conditions, I would like to argue, are in fact satisfied, on the picture I have sketched.

It might be said that the first condition is automatically satisfied if there is an explanation since an *aitia* just is that which explains, for Aristotle, but I have rejected this view in n. 51 above. Though I do not, as I have acknowledged in that note, have a good account of what an *aitia* is for Aristotle generally, it seems clear to me that when an (irreducible) potential for some end is being realized, that end is responsible for the process leading up to it as that which the process is (irreducibly) *for*. That is to say, the end is a sort of intentional object of the process, much as the object of a desire (or perhaps intention) is the object of the action aimed at satisfying that desire. The end has a real status as aim, and was the end of the process even if the process failed to reach that end. Objects that perform such real functions clearly deserve the label '*aitia*', according to Aristotle; in fact, it could be said to be a condition on any successful account of Aristotle's conception of 'being responsible for' that it make clear why it should be appropriate to view such objects (of potentials; of desires or intentions) as actually *responsible* for their effects. (This is not a demand to collapse the final into the efficient cause. It is the potential [or its bearer *qua* bearer of that potential] which is the efficient cause, while the final cause is the object of the potential, what, as we say, it is 'for', and this distinction must be maintained [cf. the new part of n. 52 above].) Note 51 above, with its bracketed addition, contains, I think, some pieces of such a general account of an Aristotelian cause, but I do not yet know how to put them together.

So much for the first condition my account of Aristotelian teleological explanation must satisfy if it is truly to count as explanation for Aristotle. As for the second condition, if *A*'s being necessary for *B* explains *A*'s presence because an irreducible potential for *B* (which brings *A* along, as it were) is being realized, I will need to show that the presence of an irreducible potential for form is basic so far as explanation is concerned. For, otherwise, whatever explains the presence of such a potential will be more basic, and will be in fact what grounds teleological explanation. (For a view that there is something more basic, see, in particular, John Cooper's interpretation, in Cooper 1987.) In arguing for irreducibility (claim (i)), I argued that the realization of *B* cannot be seen as the necessary consequence of the actualization of element-potentials alone, but I need also to show that my claim to the presence of an 'irreducible potential for form' is the most fundamental way to put the ontological consequences of irreducibility. That it is, is in part established, I think, by the argument for viewing natures and potentials as the fundamental explanatory concepts in Aristotle (as summarized two paragraphs above), but in part involves a crucial metaphysical claim—an ascription to Aristotle of a sort of ontological 'individualism'. The claim is, roughly, that the basic fact about the living world is the existence of individual living organisms with the capacity to produce other individuals like themselves. According to this view, other

facts at this level of generality which might be thought to ground teleological explanation (e.g., the permanence of species, or the pervasive seeking of the good), are to be seen as *consequences* of the existence of self-sustaining, reproducing individuals. Some such view is defended by David Balme in Balme 1987c and 1987d, and at least suggested by the arguments in Lennox 1985a and 1987b. If such a view can be made out, as I firmly think it can, then the fundamental analysis of teleological explanation will in fact be one in terms of 'irreducible potentials'.

Now, Charles Kahn (1985, 197-98 and n. 16) suggests that such a view gives only part of the picture, because one will need to 'build into the analysis of actualization the required normative component', and will need as part of one's analysis of teleological explanation an independent notion of the good. I have explained in the new portion of n. 18 above why I do not think this is right. I would like here to say just a little more on this issue. (My fullest discussion is now in chapter 2 below, though it does not entirely substitute for what follows.) Supporters of what we might call 'the normative analysis' of Aristotelian teleology suggest that the basic pattern of a teleological explanation is something like:

A is there because it is good that *A* be there.

This is generally said to divide into two alternatives:

(a) *A* is there because it is necessary for the presence of some good, *B*;
(b) *A* is there because it is good (better, best) for some good, *B* (where *A* is not necessary for *B*).

The good, according to this view, thus enters independently into the analysis at two places. I have argued above (n. 18) that the goodness of the end is *not* an independent constituent of the analysis, nor what centrally establishes that end as the end. Rather the process really is towards a fully developed state, specifiable independently of its goodness, and establishable as an end without reference to its goodness. That all such ends are good is a separate fact about the world, itself a consequence of a 'metaethical' analysis of the good that analyzes it in terms of ends (and not ends in terms of it).

This view can be made more plausible by performing a thought experiment, in which one rejects the standard Aristotelian analysis of the good, and asks if teleological explanation will still be applicable. Let us imagine that the biological world is just as it is now, except that successful life was in no way a good thing. Let us suppose (*per impossibile* perhaps) that the existence of complexity was intrinsically evil, and the destruction of living bodies therefore intrinsically good (and *not* because of the will of some non-material being). In such a world, living organisms would seem to develop and function for the sake of outcomes that were in no way good, and yet, we may ask, if the production of these outcomes could not be explained by element-potentials alone, would not Aristotle still wish to offer teleological explanations for such developings and functionings? The 'evil' lung,

for instance, forms because irreducible potentials for 'evil' viviparous land animals are being actualized, and such animals require lungs to function.

If the thought-experiment sits hard, it is because, as good Aristotelian ethical theorists, we cannot sustain this imaginary notion of the good. But *that* is because of something about the nature of the good, not something about the nature of ends as such. The 'normative analysis' of ends, then, which is perhaps 'first to us', is not 'first in nature'. 'First in nature' is an analysis in terms of potentials for complex living outcomes specifiable without reference to independent normative notions.

What, then, about pattern (b) above, where one explains *A*'s presence not because it is necessary for *B* but because it is the best of several things, one of which, but no particular one of which, is necessary for *B*? There are two points to make here. First, the operative notion of 'best for' in all cases here is something like 'greatest contribution to the life of', so that we do not have what I have been calling an independent notion of the good. (On this point, see above n. 18, with references.) Secondly, as others have pointed out (e.g., Sorabji 1980, 158–59), this pattern of explanation rests on the proposition, roughly, that 'nature always acts for the best'. I take this principle to state a basic fact about the sort of *ends* that exist in nature (and thus the sort of outcomes that the irreducible potentials are irreducible potentials *for*), viz., that in cases where there are options in the organization of living things, the ends aimed at are the 'best-possible organizations'. Both development and functioning are aimed at the realization and maintenance of an organism of maximum efficiency and capacity within what is possible to the basic nature of the organism in question. (That there is such a 'basic nature' against which such efficiency can be measured I argue in chapter 7 below; see also chapter 8.) In that way, pattern (b) has the same logical form as pattern (a). Explanations of the form '*A* is best for outcome *B*' are to be understood, at a deeper level, as being of the form '*A* is necessary for outcome *best-organized-B*', where 'best' has the fully naturalistic analysis I have indicated. That there are nonetheless *two* patterns of explanation derives, theoretically, from the fact that the second pattern requires an additional premise about nature, over and above the irreducibility premise needed for the first pattern, and practically, from the fact that the scientific work involved in producing explanations according to the different patterns is in some ways noticeably different. (For further support for my approach here, see chapter 2 below.)

Supporters of the 'normative analysis' of the form of Aristotelian teleological explanation point to Andrew Woodfield's analysis of teleology (Woodfield 1976) as one that captures important aspects of Aristotle's own analysis. For the reasons just given, I think rather that, so far as the basic form of analysis is concerned, Charles Taylor's account (cf. above, n. 10) is closer than Woodfield's. (On certain aspects, Larry Wright's [1976] account is even closer: cf. section III of this Postscript, below.)

II

In *Necessity, Cause, and Blame* (1980), Richard Sorabji argues that, according to Aristotle, a full material-level account of teleological processes is in principle available. One of the larger themes of his book is the relation between cause and necessity, and in that connection he explores the claim that the use of the final cause is compatible with the existence of necessitating causes. He thinks it is, and devotes one chapter to showing that, for the most part, Aristotle thought that individual outcomes in nature have necessitating (material) causes, and a second to showing that a proper understanding of how teleological explanations work reveals their compatibility with such causes.

In chapter 9 of *Necessity, Cause, and Blame*, Sorabji sets out very nicely the problem that has engaged scholars: in several theoretical passages Aristotle appears to deny that individual natural outcomes have necessitating causes, while Aristotle insists time and again in the biology that outcomes are both for the sake of something *and* of necessity. Sorabji rightly objects to the view presented in Balme 1972 [1992] that material necessity is a disguised hypothetical necessity, presaging some of the objections developed more fully by John Cooper (1987, 260-62), and concludes that we in fact have conflicting claims here. We can only, he says, attempt to offer an explanation for the conflict, and the one he proposes is that Aristotle has confused weaker claims, primarily that necessitating causes do not explain, with the stronger claim that they do not exist (150-52, 162, 173-74).

This explanation does not seem possible, however. For, in one of the theoretical passages Sorabji cites in which Aristotle denies that individual natural outcomes occur of unhypothetical necessity (*PA* 639b21-640a8), Aristotle appears quite clear on the difference: one reason he gives for there being no explanation of natural outcomes in terms of simple necessity alone is precisely that such necessity does not exist in nature. This is not an unconscious slide but a deliberate move, and it is from non-existence to non-explanation, not the other way.

Himself convinced that individual outcomes in nature have necessitating causes according to Aristotle, Sorabji attempts in his chapter 10 to show that this is fully compatible with their being for the sake of something. (Sorabji typically speaks of organs and processes having a 'purpose', a term I want to avoid for its [to me unavoidable] implication of design or intention.) Making use of the important *PA* 640a33ff., he finds three distinct patterns of teleological explanation, the first two of *parts* of animals (as necessary, given certain basic features of the organism, or as better, given such features), the third of *processes*, including organic development. In each case he seeks to show that the availability of a teleological explanation for an animal feature (part or process) does not preclude there being necessitating causes of that feature.

The first mode of teleological explanation, Sorabji argues, works according to the following generic pattern: Given x, it is only to be expected that y. He refers to

Aristotle's explanation of the camel's extra stomachs (*PA* 674a28-b15), writing that:

> The camel needs to eat tough and thorny food, and therefore it has an extra series of stomachs for digesting. . . . The explanation seems to work by taking the existence of the camel, together with certain characteristics, such as the thorny diet as given. Once these things are given, extra stomachs are *only to be expected*. (156, italics in original)

But there is nothing in such an explanation that precludes the existence of necessitating causes (162-63), and even when these causes are fully known 'in many contexts, and for many purposes, we shall always want teleological explanations' (165).

My own view, mentioned in n. 19 above, is that this pattern (and the second, of which Sorabji gives a similar account, adding as given that 'nature does nothing in vain' [158]), works only when, and only because, the generation of that part was itself teleological. 'Coming to be for the sake of', on this view, is logically prior to 'being for the sake of'. My arguments for this perhaps paradoxical-sounding thesis are now presented below, in section III of this Postscript. If successful, they show that Sorabji's first two patterns are not independent of the third. And since this third pattern works, in the case of organic development, only because such development is not the result of material necessity alone (as I have argued above), the first pattern is *not* compatible with the existence of necessitating causes.

Sorabji himself thinks, however, that the third pattern *is* compatible with the existence of necessitating causes. He accepts, with his typical generous acknowledgement, the account of this pattern presented in the present chapter. As he puts it, to say that the development of an organism, for instance, is for the sake of the mature organism that issues from it is to *identify* which of the various possible *dunameis* (of the whole organism, of the materials) is the one at work (171-72). But having said this, he soon qualifies it, in my view fatally. It is not that the material *dunameis* are not operative and necessitating, he says; it is that they are not considered explanatory (174). But that way of putting it is incompatible with his own formulation of my account of how these explanations work. If the outcome is of material necessity, then the material capacities, in sum, are sufficient, when actualized, to produce such an outcome, and in this case *have been actualized*. But this is just to say that *they* are the *dunameis* at work, and that the *dunamis* of the whole organism *is not*. My account of the *dunamis* of the whole allows for *dunameis* of the materials to be at work—anything hypothetically necessitated by the actualization of the *dunamis* for the form of the whole will be so necessitated only *given* the basic natures and potentials of the elements; but it does not allow that they be *sufficient* for the outcome. If they *are* sufficient, then there is simply no place for a *dunamis* of the whole.

Sorabji could modify my view to say that explanation here consists in selecting not which *dunameis* are *at work* but which are *explanatory*. But the result would

largely be trivial. In fact, this exposes what I find to be another weakness in Sorabji's overall account of the relation of teleology and necessity. He says much about how outcomes might be the result of material necessity yet not be explained in that way but only teleologically. But he does little to show what features would make the one explanatory and the other not. Surely if an outcome is known to be of material necessity, then given the antecedents, it is 'only to be expected' that the outcome will occur. Why should that be sufficient for explanation in the case of parts, but not here? Sorabji refers several times to the relativity of explanation to the purposes of the questioner, but to many this will seem an un-Aristotelian thesis, and he mentions no passages which require it. (Cf. 11, 29-31, 56, 58-59, 158, listed in his index, s.v. 'explanation: . . . relative to the question asked'; also 165-66.)

What, then, of the reservations Sorabji expressed (172-74) to my own interpretation of these matters? Following David Hamlyn, Sorabji objects first to calling the relevant *dunamis* by itself the explanation, since 'if anything explains, it is rather the whole *complex* of facts into which the [relevant] *dunamis* fits' (172). But I never denied this or implied the opposite. As Sorabji observes there, Aristotle himself is happy to call the relevant *dunamis* the efficient cause; the mistake would be in equating *cause* with *explanation*, which Sorabji does here probably because of the arguments to that effect which he has given earlier (40-42 and chapter 2 generally). The full explanation (*logos* or *apodeixis*, not *aitia*) would certainly involve more than just the efficient cause. As I have argued elsewhere, Aristotle views the various causes here as factors in one explanation, not as distinct explanations (cf. Gotthelf 1980, 373-74).

Sorabji then (173) objects to my thesis just mentioned that teleological explanation of parts is derivative from teleological explanation of development, and offers a counterargument. I deal with this in section III below.

Finally, he objects to my treating the absence of a full material-level account as central to Aristotelian teleology, on grounds of his earlier argument that necessitating material causes *are* present even if not explanatory. Even this latter claim must be tempered, he observes, since 'Indeed, Aristotle uses a tattoo of words implying that the necessitating causes which he cites for biological arrangements really do explain them' (174, with nn. 62, 63). In the bracketed addition to n. 32 above, I responded to Sorabji's earlier claim that the pervasive language of 'both for the sake of . . . and of necessity' implies the existence of material-level causes sufficient to necessitate biological arrangements, referring to discussions in Cooper 1987 and Balme 1987c. Sorabji himself provides, several chapters back (1980, 51, n. 24), the basis on which the explanatory language he points to here can be understood:

> The denials [of explanatory value to material causes] are themselves sometimes nuanced: e.g., at *GA* v 8, 789b20, the word 'through' (*dia*) seems to allow physiological causes explanatory value in producing biological parts in those cases where the parts serve no

purpose; and even when the causes produce useful parts, they can be called explanations of the material kind (*hôs hulê aitia*, 789b8). Cf. *Phys*. II.9, 200a6, a9-10: things do not occur 'through' (*dia*) material causes, 'except in the sense of occurring through matter' (*plên hôs di' hulên*) . . .

To be explanatory as matter is to be explanatory as that which, given its elemental natures and potentials, is necessary *if* some end not itself necessary is to be achieved—i.e., if some potential for form, not reducible to element-potentials, is to be actualized. This is a hypothetical, not a simple, necessity, and does nothing to imply that material factors explain (or even necessitate) *by themselves*.

III

Hence we should if possible say that because this is what it is to be a man, therefore he has these things; for he cannot be without these parts. Failing that, we should get as near as possible to it: we should either say altogether that it cannot be otherwise, or that it is at least good thus. And these follow. And because he is such a thing, his coming-to-be necessarily happens so and is such. And that is why this part comes to be first, and then this. And this is the way we should speak of everything that is composed naturally. (*PA* I.1 640a33-b4, tr. Balme)

In this well-known passage Aristotle describes the various patterns of explanation of animals' parts which a truly educated man should expect to find in a properly developed natural philosophy (cf. 639a1-15). The basic distinction is between (three types of) explanation of the being of parts—their being present in or possessed by certain animal kinds—and explanation of their coming to be, i.e., of the process by which they come to be present in or possessed by these animal kinds. Such explanations are teleological, establishing, respectively, that the part *is* or *came to be* for the sake of something.

Elsewhere, Aristotle speaks as if he recognizes that distinction. He concludes his first argument in support of the use of teleological explanation in *Physics* II.8, for instance, with the words: 'The "for the sake of something", then, is present in things which by nature come to be and are' (199a7-8). In *GA* V.1 he excludes non-universal *pathē* from such explanation by writing that:

Whatever features do not belong to the nature <of an animal generally> nor are peculiar (*idia*) to any particular <animal> kind—of features of this sort none either are or come to be for the sake of anything. (778a30-2)

Of those things which do either belong to the nature of an animal generally or are peculiar to some animal kind, Aristotle says a few lines later that:

Each one, then, is for the sake of something, and yet comes to be both on account of this cause and on account of the others [*sc.* material and moving causes: b9] . . . (b10-12; for more on the opening methodological passage of *GA* V.1, see now chapter 5 below)

And the division of labor between *PA* and *GA* pretty much mirrors this distinction, *PA* explaining the presence of parts teleologically, *GA* explaining their formation.**

In n. 19 above I suggested that *being for the sake of* was thought by Aristotle to be definable in terms of *coming to be for the sake of*, and I have repeated this claim in section II of this Postscript. I want here to give my reasons. The idea has struck some people as peculiar, on grounds that Richard Sorabji well expresses, referring to my suggestion:

> This seems to me to *reverse* Aristotle's order of priorities. In the passage with which this chapter starts (*PA* 1 1, 640a10-b4), reference to a *dunamis* occurs only in explaining processes, and the passage in question makes the explanation of processes *subordinate* to the explanation of why man has the parts he has. (Sorabji 1980, 173)

Now, in the passage quoted above Aristotle says explicitly that it is 'because he is such a thing [that] his coming to be necessarily happens so and is such', so in one sense Sorabji is surely right. But that is only part of the story, and a part, I shall argue, which already *presupposes* that coming to be is for the sake of something.

The thesis I wish to defend is that a part, *A, is* for the sake of doing something, *B*, if, and only if, *A* in fact does *B, and* has *come to be* for the sake of doing *B*. Since coming to be for the sake of is explicated on my account without reference to being for the sake of (above, p. 12), one can say, as I have, that the latter is defined in terms of the former.

Perhaps it should be stressed that this account is meant to hold only in those cases where giving what *A* is for the sake of is meant to give an *aitia*, and thus an

** This is not to say that *PA* is unconcerned with generation. *PA* is concerned with why animals have the parts they do, and animals have the parts they do *partly* because some such parts are needed (or are best) for the functioning of the whole and *partly* because the available materials permit those parts: *tēi men heneka tou . . . tēi de ex anangkēs*. *PA* will thus have things to say about the 'necessary natures' of the available materials, and the constraints these natures place on what parts could be formed to fulfill a needed function, but it will not focus on the generative process as such, and its timing and stages, and how these are necessitated by the nature of the result to be produced: those are the focus of *GA*, and *GA*'s initial focus is not so much the final cause of generation but its efficient cause: what antecedent movements (as it were) produce offspring one in form with their parents and how they do it. (Cf. *GA* I.1 715a11-18, II.1 733b23-32, etc.) Since the movements Aristotle identifies are those borne by the heat transmitted from the father, and involve, in addition to low-level material *dunameis*, a *dunamis* for form, teleological explanation will be inevitable, the end being the object of the *dunamis* that is the efficient cause, what, as we say, that *dunamis* is 'for'. And teleological explanation does appear in *GA*, both for generation as such and its general features (II.1 731b18-732a11, 6 742a16-b17, 743a36-b3), and for particular formations, timings, and sequences (743b3-18, 744a35-b9, etc.). But it is introduced selectively and is not the primary focus of the work. Still, insofar as they are concerned with for-the-sake-of relationships, *PA* is primarily concerned with *being* for the sake of, *GA* with *coming to be* for the sake of. (For more on *PA* as just described, see Lennox 1997b; for more on *GA*, chapter 4 below.)

explanation. When Aristotle says early in *Phys.* II.5 that 'among things which are neither necessary nor for the most part there are some to which it can belong to be for the sake of something' (196b19-21, after Charlton), and when he says of the tripod that fell open accidentally so as to be ready for sitting on that 'it was for the sake of sitting, but it did not fall for the sake of sitting' (196b17-18), one might wish to interpret him to be using a purely *descriptive* sense of 'is for the sake of' which merely labels some doing or capacity of the thing as useful in some way, without implying that that is why it is there. I think myself that these passages are to be read differently (cf. Gotthelf 1975, 62-72, 285, n. 119), but in any case I want to make it clear that it is only explanatory uses of 'for the sake of' that are at issue here.

In fact, it is the chance cases that first bring out the plausibility of this thesis. One needs to ask whether, in cases where a part did something which contributed to life or well-being but had not come to be for the sake of doing so, Aristotle would be willing to say that the part *is for the sake of* that contribution, and thereby *explains* its presence in the organism. It seems not. To see this we might consider Empedocles' human-headed bull (n. 54 above). If, for instance, the neck muscles of the torso of the animal were strong enough (and the only muscles strong enough) to support the head that on the theory it accidentally joined up with, would Aristotle say that those muscles *are* in the animal *for the sake of* supporting the head? If one puts oneself in Aristotle's place, one is likely to say 'No'.

Aristotle himself seems to say not. In the well-known first argument of *Phys.* II.8 (above sec. XI), he generalizes from the case of teeth which arise by chance so as to be serviceable in some way, to all the parts in which 'the "for the sake of something" seems to be present' (198b27-29) but on this view would not. Now Aristotle's focus is on coming to be, and this sentence might well be speaking only of coming to be for the sake of. But it is perhaps more natural to read it as speaking of parts which appear to *be* for the sake of something, and in that case Aristotle (and his opponents, as he characterizes them) would seem to be assuming that, on the view under consideration, these parts cannot be said to *be* for the sake of something, precisely because they have not come to be for the sake of that but rather by chance.

Aristotle's use here (198b28) of *huparchein* ('to be present') suggests this, as does the way Aristotle states the conclusion of his refutation of the opponents' view, at 199a7-8, the one place here where he explicitly mentions *being* for the sake of something:

> The 'for the sake of something', then, is present in things which by nature come to be and are.

That is to say, the argument presented here establishes, and is apparently *needed* to establish, that things in nature *are* for the sake of something as well as come to be for the sake of something. Without the part's having *come* to be for the sake of something it simply isn't a candidate for *being* for the sake of anything.

But, *PA* II–IV is full of arguments that conclude to some part's being for the sake of some function. Do these arguments refer to their parts having come to be for the sake of anything? On the face of it, no. Aristotle either takes as common knowledge, or argues to, the contribution a part makes to life or well-being, and from that concludes directly that the part is for the sake of making that contribution. He speaks, as noted, of the materially necessary factors in the part's coming to be but not of its having come to be for the sake of anything.

However, *PA* II–IV is a study of animals, not of explanation. The theory of explanation which is at work in those books is itself developed, among other places, in *PA* I.1, and in that chapter, I would like to argue, Aristotle makes the dependence we have been discussing clear.

Much of I.1 is devoted to the final cause, in one way or another, and there is much argument in its behalf. It is striking that all of this argument, and most of this discussion, is devoted to the causes of *coming to be* and the notion of *coming to be* for the sake of. Richard Sorabji once suggested in correspondence that this can be explained by the preoccupation of Aristotle's opponents with coming to be and his concern to respond to them. But I think there is a deeper explanation, captured in the priority thesis I have been arguing for here. For, in the passage quoted at the head of this section, in which Aristotle presents the proper method for explaining parts, observe the 'hence' (*dio*). That this is the way to explain parts follows from something—from what?

As Balme notes, '"Hence" resumes the argument from a26' (1972 [1992], 87 *ad* 640a33; on a27-33 as parenthetical, cf. 86 *ad loc.*). The argument begins at a15 in defense of an answer Aristotle gives to the question (a10-12) whether one should describe first an animal's coming to be, explaining the character of its being by reference to that, or the reverse. Aristotle's answer is, of course, the latter.

> For in house-building too it is more the case that *these* things take place because the form of the house is *such*, than that the house is such because it comes to be in this way. For coming-to-be is for the sake of being, not being for the sake of coming-to-be. Hence Empedocles was wrong in saying that many attributes belong to animals because it happened so in their coming-to-be, for instance that their backbone is such because it happened to get broken by bending. He failed to recognize, first, that the seed previously constituted must already possess this sort of capability (*toiautēn dunamin*), and secondly that its producer was prior not only in definition but in time; for it is the man that generates a man, and therefore it is because *that* man is such that *this* man's coming-to-be happens so. (a15-26, tr. Balme)
>
> *Hence* we should if possible say that because this is what it is to be a man, therefore he has these things; . . . (a33ff., my emphasis)

The appropriateness of teleological explanation of the presence of parts by reference to the animal's form or essence clearly derives from the appropriateness of teleological explanation of their coming to be. If parts came to be of material necessity (and thus animals were as they were because of the way they came to

be—the force of the rejected alternative, 'being for the sake of coming to be'), teleological explanation of the presence of these parts by reference to their contribution to the being of the animals of which they are a part would not be warranted. Given that they *come to be* for the sake of such a contribution, their *being* can be *explained* by reference to that contribution.

Two questions, perhaps, arise at this point. First, what difference is there, then, between teleological explanation of the being or presence of a part and teleological explanation of its coming to be? And second, if the relationship is as I say, why does Aristotle speak so insistently in this context of the priority of being over coming to be?

The answer to the first question has been covered in my note above (p. 39) on the difference of focus between *PA* and *GA*. A teleological explanation of the being of a part will make reference only to its current contribution to the being of the animal of which it is a part, and not to the stages by which that part is formed. As noted there, such an explanation may make reference to constraints on the character of the part that derive from the available matter, but you will not attempt to explain why, for instance, 'this part comes to be first, and then this' (b2-3). Teleological explanation of coming to be will do that, and as noted, there are numerous such explanations in *GA*.

As for the second question, it is important to note that Aristotle's remarks about the priority of being over coming to be all have to do with the proper explanation of the *coming to be* of animals and their parts. The explanation of the parts' *being* is not involved at all. (*That* is what comes in the 'hence' passage.) To explain coming to be teleologically is to explain it by reference to (the needs of) the formed organism, and thus by reference to the organism's being. Since 'coming to be *is* for the sake of being, not being for the sake of coming to be', such teleological explanation is proper, and grasping the animal's being will be prior to engaging in such explanation.

Now, of course, one can show that a certain sort of animal must have a certain part, if it is to exist at all, or to exist well, without having shown that the coming to be of the animal is for the sake of something. And particular teleological explanations of coming to be will, as Aristotle says in the passage with which we began, build on such analyses. But it is important to see that such an analysis will not be a *teleological* explanation (or any other sort of *explanation*) of the part's presence, *if* the part has not come to be for the sake of the contribution the analysis shows it to make.

We can perhaps best see this by returning to Sorabji's account of these matters, quoted just above, and in particular to his rendering of the working of Aristotle's explanation of the additional stomachs in the camel (quoted in section II above, p. 36). 'The explanation seems to work by taking the existence of the camel, together with certain characteristics, such as the thorny diet, as given. Once these things are given, extra stomachs are *only to be expected*' (Sorabji 1980: 156; emphasis

in original). The last sentence by itself is true enough. But why should it count as an *explanation*? If stalactites always produced stalagmites, and stalactites if they existed at all always existed, then given the existence of stalactites, it would be only be expected that there would be stalagmites. But what does the explaining is not the fact of universal correlation (compare Sorabji's barometer at 1980, 155), but our understanding of the *process* by which the one produces the other. Similarly with Aristotle's animals, it is the *process* by which the part comes to be that explains its presence; but *for him that process is irreducibly for an end*. The identity of the process is given by the capacity of which it is the actualization, and that capacity is an irreducible capacity for the production of an entity of the relevant kind, thus necessitating the relevant parts. Given that the process *is* irreducibly for the end, one is entitled to see the analysis of what parts are needed by that end as an *explanation* of the presence of those parts, and of course as a *teleological* explanation. Being for the sake of is thus to be defined in terms of coming to be for the sake of.

(The argument at 640a10-26 seems partly the basis for, and partly summarized in, the brief, difficult discussion of method at 645b14-28 in chapter 5. It is at an important stage in that later discussion that Aristotle makes what may be the most explicit statement of the thesis I am here ascribing to him. In Balme's translation:

> Consequently the body too is in a way for the sake of the soul, and the parts are for the sake of the functions in relation to which each has naturally grown (*pros ha pephuken hekaston*). (b19-20)

However, I cannot make sense of the argument of which this is an intermediate conclusion, and thus am not entirely sure how to take this statement.)

(Spontaneously generated organisms might appear to provide a counterexample to the thesis I have been arguing for in this section: their coming to be would seem to be of material necessity and not for the sake of anything, yet the presence of at least some of their parts seems to get teleological explanation in *PA* IV. I discuss this matter in chapter 6 below.)

There is an interesting parallel between this analysis of 'being for the sake of' and a popular (and generally very plausible) contemporary analysis of the notion of the function of something. (Aristotle's notion of what something is for the sake of is pretty much equivalent to our notion of the function of something; 'is for the sake of' does more theoretical work in the biology than *ergon* does, though the latter is certainly present.) According to Wright's definition, 'The function of *X* is *Z iff*: (i) *Z* is a consequence (result) of *X*'s being there, and (ii) *X* is there because it does (results in) *Z*.' (Wright 1976, 81; cf. his 1973, 161.) Clause (ii) captures the distinction, important for the notion of a thing's function, between the function and anything the thing might do by accident. As we have seen, a similar distinction is important to Aristotle as well, and for him too, the function of *X* is *Z* only if '*X* is there because it does (results in) *Z*'. (Cf. chapter 7 below, p. 168 n. 42.)

While Wright elucidates the 'there because' in that condition in terms of natural selection, Aristotle, with his non-evolutionary perspective, can only speak of what 'the nature does' in embryonic development. He elucidates the 'there because' in the definition of function, as I have been arguing, in terms of another (and thus prior) teleological notion, that of 'coming to be for the sake of': the function of *X* is *Z* for Aristotle *iff* (i) *Z* is a consequence (result) of *X*'s being there, and (ii) *X* came to be for the sake of doing (making possible, etc.) *Z*. Identifying the contribution to self-maintenance an organ makes thus identifies its function (and explains its presence) *only* on the condition that the organ came to be for the sake of making that contribution.

Since only individuals can come to be, the thesis defended in this section makes the individual prior to the species for purposes of explanation.*** This appears to be in harmony with David Balme's analysis of the general relation of individual to species, in his important 1987d (cf. above, sec. I of this Postscript, pp. 32-33), and perhaps provides additional support for that analysis.

*** I owe this characterization of my position to David Furley (in comments he provided on a portion of my dissertation, in the mid-1970s).