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Aristotle and the Functions of Reproduction

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Aristotle and the Functions of Reproduction

I.

Aristotle draws a fundamental distinction between objects which always and necessarily exist and those which come to be and pass away.¹ But he is sometimes aware that this way of distinguishing between the objects studied by the sciences misses an important feature possessed by some of the objects in the perishable class. No individual porpoise, for example, can exist forever, and yet there are always porpoises. Remarkably, Aristotle noted, while every porpoise comes to be and then perishes, porpoises don't. This is so, he realized, because (to paraphrase) "a porpoise generates a porpoise".

Like most all-pervasive features of the world, this apparent fact seems obvious once explicitly stated, and goes unnoticed by nearly everyone the rest of the time.

Aristotle however, can't be accused of ignoring it. I believe that the paramount place given to organisms in his ontology is in part due to an ability they possess to perpetuate an εἶδος beyond any instance of it. In addition, it is this fact which underwrites the extension of teleological explanations and ends/means necessitation to the natural domain.²

The importance of the project of the Generation of Animals then, may very well extend beyond finding explanations for the patterns of regularity observed with respect to the organs of generation, their capacities, and their effects. It is a study which will set the legitimate boundaries for certain sorts of scientific explanations,³ and will give us an understanding of the way in which the εἶδος of a natural kind is perpetuated. Understanding this, in turn, as Meta. 2.8. argues, makes separate forms unnecessary in accounting for the existence of organisms, which

are *μάλιστα οὐσίαι*.

Aristotle argues, in PA II,⁴ for the primacy of explanations which answer the question 'For the sake of what?' in the biological realm. In accordance with this methodological principle, we are given teleological explanations of why biological reproduction takes place (De An. II 4 415a22ff); and why male and female capacities sometimes exist in separate organisms. (GA II 1 731b24ff).

These explanations must be distinguished from explanations of individual cases of generation, where the goal of the generative process, the form of the individual which is coming to be, explains the process leading to it. Here Aristotle is concerned with the reproductive capacity as such. What is its function for the organisms that possess it? This is the teleological question addressed in the passages before us.

I shall argue that the function of the reproductive capacity is, not to perpetuate the kind (or species), but to allow the individual reproducer to be eternal: not eternal without qualification, but in a way. The basic premise in the arguments which establish this conclusion distinguishes between things which are numerically eternal and those which are formally eternal. Things of this latter sort must be members of an everlasting series of individuals which are one-in-form (*ἐν εἶδει*, in Aristotle's usage). The full understanding of these passages, therefore, requires a proper interpretation of the distinction between numerical and formal unity. With this distinction clarified, and with a better understanding of Aristotle's teleological explanations of reproduction and sex, I close by suggesting another 'function' of reproduction -- eliminating forms as independent paradigms for natural substances.

II.

GA II 1 731b21-732a7.

This passage introduces the pivotal second book of the Generation of Animals. As Balme indicates, it is a continuation of the argument of the first book,⁵ for it continues the discussion of why the capacities of male and female are found in distinct entities in some cases. This topic has been a central theme of Book I, but comes especially into focus once Aristotle begins to consider the relative contributions of each to the production of a new organism (GA I 17 721a30ff). Near the end of GA I, Aristotle considers why the sexual capacities are combined in one organism in plants, yet found in different organisms which are identical in form (ἢ ἔτι εἶδεν ταῦτόν, 730bb35) in higher organisms (GA I 23). He argues that if organisms have no function other than the production of seed (ἢ τοῦ σπέρματος γένεσις, 731a25-26), the separation of the sexual capacities into distinct organisms is pointless, and claims plants have only this one function or activity.⁶ And while he goes on to note that higher animals have other (cognitive) functions, he does not tell us what advantage having the sexual functions in separate organisms has in higher animals.

The opening argument of GA II is intended to answer this question. How the interactions of efficient causes and material produce males and females will be discussed as part of the general discussion of organic development (cf. esp. GA IV 1-3). But he intends to tell us immediately,

...how it is due to the better and the cause for
the sake of something...(GA II 1 731b23-24).

The argument actually consists of three hierarchically related teleological explanations. First, Aristotle wishes to establish why the various kinds of organisms there are always exist (731b24-732a1). Next he

asserts that the male and the female exist for the sake of there being those various kinds of organisms (732a3-4). Finally, he argues that it is better, where possible, that the two capacities be separated (732a4-7). And while I am ultimately only concerned with the first argument, it will be important to understanding it to know it is a preliminary step toward another conclusion. Balme's translation of the passages reads as follows:

731b24 For since some existing things are eternal and
divine, while others are capable of being and not
being, and since the good and the divine is always
according to its own nature a cause of the better
in things that are capable, while the non-eternal
is capable both of being and of partaking in both
the worse and the better, and since soul is a
better thing than body, and the ensouled than the
soulless because of (δ/α) the soul, and being than
731b31 not being, and living than not living, -- for these
reasons there is a generation of animals. For
since the nature of such a kind cannot be eternal,
that which comes into being is eternal in the way
possible for it. Now it is not possible in number
(for the being of existing things is in the
particular, and if these were such it would be
732a1 eternal) but it is possible in form. That is why
there is always a kind -- of men and of animals and
of plants (Balme trans., 731b24-732a2).

Before analyzing this argument, let me comment on an important terminological point. The word Balme has translated 'kind' at 731b33 and

732a2 is γένος . It gives us a clue to Aristotle's explanation, once we take it to bear the first meaning given for γένος in Meta. V 28, i.e., "a continuous generation (γένεσις) of things which have the same form".

...for example, we say "as long as the human kind exists", which means, "as long as the generation of men continues" (1024a29-31).

In our passage, the link between reproduction, being formally eternal, and the eternal existence of various γένη is made much clearer once the meaning of γένη is taken in this manner.

I believe this argument has been misunderstood because its context has too often been ignored. The argument from 731b24-30 is intended to establish a special status for the soul, the organism's capacities for life. Because it is in the causal basis for contingent entities being in a better state, it is a good and divine thing. This conclusion is made use of, not immediately, but at 732a5-9, when Aristotle wants to argue that the male capacity, which is the agency of the logos and εἶδος, is "better and more divine in nature than the matter" and should therefore be separated from the female capacity where possible.

From 731b31-732a4, there is an auxiliary argument. The male and female, being the source of the perpetuation of the kinds of plants, animals and humans (τούτων, 732a1) exist for the sake of generation (ἕνεκα τῆς γενέσεως). But why does generation take place at all -- i.e., what is Aristotle referring to at 731b31 when he says διὰ ταύτας τὰς αὐτίκας γένεσις ζώων ἐστίν?

Aristotle's answer is, so that the thing which comes to be (τὸ γιγνώμενον, 731b33) can be eternal insofar as this is possible.

Because the nature or being ($\epsilon\phi\upsilon\sigma\iota\varsigma$, 1.32; $\epsilon\omicron\upsilon\sigma\iota\alpha$, 1.34) of generated things is "in" the particular, if the things which come to be were numerically eternal, so would their nature be,⁷ and were this so, they would not come to be at all. But we see that they do. If, however, organisms can pass on their natures to other materials, they can be formally eternal. That is, there will always be something that has the form they have, if reproduction occurs. David Balme attempted to tie this argument directly to what precedes it in the following manner:

Granted that it is better to have a soul..., what is the connection between having a soul and being as eternal as possible? Aristotle does not explain this step, but presumably the connection is that soul makes reproduction possible, as he will presently argue.⁸

The connection, rather, is that the soul is the form of the organism, and it is because reproduction ensures an endless series of identical forms that the organism can be eternal. It is in virtue of one's soul (i.e., one's form) that one is identical with things which exist at any and every time. To be eternal $\epsilon\iota\delta\omega\varsigma$ is, in fact, to be eternal $\psi\upsilon\chi\eta$.

This passage supplies us with no explicit $\omicron\delta\ \epsilon\upsilon\epsilon\lambda\alpha$ of generation. But it is clear that Aristotle is not explaining the consequences of reproductive generation by it; rather he is explaining reproduction by citing one of its consequences. He has, in elliptical fashion, argued that if the nature of perishable organisms is to be at all eternal, reproduction must take place. In addition, he has shown that such natures (i.e., souls) are good and divine things. Thus the $\alpha\lambda\tau\epsilon\lambda\epsilon$ of generation referred to at 731b31 would appear to be consequences of reproduction that explain why it takes place.

Typically, Aristotle seeks to account for the capacities and structures organisms have in part either by showing that they are necessary given the organism's nature, or that the organism's life is better because of them.⁹ What is puzzling about reproduction is that it does not appear to contribute to the being or well-being of each organism that performs it -- the value appears to be for the offspring, not for the reproducer. Thus people have been inclined to read Aristotle as claiming that the reproductive capacity exists for the good of the species, that it is a case of certain organisms acting for the sake of others.

This is not, of course, what he says. It would be nice if one could see how Aristotle could see reproduction being necessary for the members of a species qua reproducers rather than qua reproduced. I think there is direct textual evidence that he did believe this, in the opening remarks of his Politics. Aristotle is characterizing the natural origins of political association. He begins,

First it is necessary to join together those who are unable to exist without one another, as a female and a male for the sake of generation

(Τῶν γυναικῶν ἕνεκεν).

(Pol. I 1 1252a26-28).

But why, we might fairly ask, can a male or a female not exist without one another? The answer to this, and to the way in which reproduction is necessary for reproducing organisms qua reproducers, is that no member of a reproducing species would exist if each member of that species did not reproduce. Thus, while the particular outcome of my act of reproducing is another organism, my life, as well as my daughter's, depends on organisms of the kind that we are always reproducing. The evidence that Aristotle accepts

this principle is again quite straightforward. It comes in the midst of an argument, early in GA I, explaining why it is reasonable that spontaneously generated organisms don't make replicas of themselves.

For if those that do not come from animals went on to produce animals themselves by coupling, then if the offspring were of the same kind the parents must also have been produced like this in the first place (this is a reasonable claim, for it is what we see happening in the other animals...) (715a8-12, Baime trans.).

This argument is odd, for it immediately takes back its initial assumption. But it shows clearly that Aristotle held that if one knows that an organism is a reproduced replica of its parents, one has enough information to infer an everlasting series of such productions.

In turn, this is closely tied to a principle that functions as an axiom throughout his biological work. To quote GA II,

To understand how each thing comes to be it is necessary to grasp the following, making it a first principle that whatever comes to be by nature or art comes to be by something which is actually from what is potentially such (734b19-22).¹⁰

If one puts these two principles together, so that each product of a natural generation presupposes a cause identical in form with it, and that any such cause must, by virtue of this identity, be a replica of its cause, Aristotle has the premises to generate a belief about an everlasting series of individuals identical in form.

As we shall see, an important assumption involved in each of these passages, which is utterly undefended, is that when the organisms under

consideration generate new organisms, they are identical in form with the generators. Aristotle didn't believe this was universally the case. Two clear cut exceptions were certain organisms which produced spontaneously in turn producing offspring which were formally unlike themselves (715b5-7), and fertile crosses which produce hybrids which for an indefinite number of generations are unlike the original parents (cf. GA II 7, 746a28ff). Unless reproduction is true to type, however, it will not guarantee the reproducer's nature will exist eternally. That end is achieved only if the reproducer is a member of a causal series of organisms of the same form. This requirement is much clearer in a well known passage of the De Anima.

III.

De An II 4 establishes a certain methodological constraint on thinking about psychic capacities, and then uses that methodology to understand the nutritive capacity of organisms. Because this capacity includes reproduction,¹¹ the chapter includes a specimen explanation of reproduction.

The methodological constraint De An. II 4 seeks to establish is that to understand a capacity we must first understand its operation, and understanding this requires a prior understanding of its 'opposing' objects (τὰ ἀντικείμενα).¹² In the cases of nutrition and the various levels of cognition, this involves understanding the nature of the nutrients or the objects of awareness for various sorts of organisms and how such organisms "internalize" these objects. But, as a number of the Greek commentators note,¹³ the capacity to reproduce is not parallel to these other capacities. It has no independently existing opposing object which it is to assimilate.

Aristotle nonetheless sees the goal of the reproductive capacity, what it is for, as the correlate of the objects of perception or nutrition in this

case.¹⁴ That is, he takes the form of the organism which is reproduced as the reproductive capacity's object. This results in reproduction being of a form just as perception and intelligence are of forms.

The passage we are immediately concerned with comes directly after the methodological discussion. A translation follows.

For the production of another like itself is a most natural function for living things which are complete and neither deformed nor generated spontaneously, an animal producing an animal, a plant a plant, in order that (*ὅτι*) they may partake of the everlasting and divine so far as is possible. For each of them desires this, and does whatever it does by nature for the sake of this. (That for the sake of which is of two sorts, the of which, and for which.) Now since it is impossible to share in the everlasting and divine in a continuous way, due to perishable things not being able to persist the same and numerically one, each shares in it insofar as it is able to participate, some more, some less, i.e., it does not persist but what is like it; <what persists> is not one in number, but is one in form. (415b7).¹⁵

Organisms, then, reproduce for the sake of participating in what is everlasting and divine. As at GA II 1, the fact that organisms come to be and perish rules out their participating by each of them being everlasting. But if they reproduce, the form characteristic of the kind of organism they are does remain. Aristotle assumes that this guarantees that they will share

in (*κονομῆσιν*) or participate as far as possible in (*μετέχειν*) something everlasting and divine. I suggest that reproduction guarantees this result, because it guarantees an everlasting reproductive series, and that each member of that series will be one in a certain respect with all the members of that series.

That this is a consequence of reproduction we may grant, but what reason have we to suppose reproduction takes place for the sake of this? Beyond establishing a result as a natural consequence of an activity, what else must be established to treat that consequence as responsible for the activity's taking place? As I argued previously, Aristotle insists that it must also be shown that that consequence is either necessary for the organism's life, or that it makes the organism's life better than if some alternative capacity were present. And as I also argued, Aristotle held that any reproducing organism's existence is dependent on its being the sort of organism that is reproduced, i.e., on being a member of an eternal reproductive series.

The assertion that reproduction allows the generated thing to be eternal in a way (GA II 1 731b33-34) and that reproduction allows the reproducer to participate¹⁶ in what is everlasting and divine (De An. II 4 415a29-415b1) are somewhat cryptic statements referring to the same fact about organisms. Reproductive activity insures both that there will be a *γένος* of organisms, and that each member of this series will be one and the same in form. Aristotle believes that this is sufficient to predicate terms such as 'eternal' and 'divine' of such organisms. What each organism is, a cat or a human, always exists.

These teleological explanations of reproduction rely crucially on the premise that the members of a reproductive series are in a way one (i.e., in

form), though obviously not composed of numerically one organism.¹⁷ The ascription of a qualified eternity to each member of such a series is based on just this premise in each case. We need to know what such unity consists in.

Two possibilities come immediately to mind. (1) Aristotle might hold that while a reproductive series is composed of an unlimited number of individuals, there is numerically one form common to the many particulars which is at the basis of the members of the series being one in form. (2) On the other hand, he may hold a doctrine of irreducibly distinct sorts of unity, one of these being formal unity. This unity is not a matter of numerically many things bearing a special relation to numerically one thing. Rather it is a unity based on a relationship the many things bear to one another.

I shall argue that Aristotle held the second position. And of course it is plausible that he would. The Parmenides made a lasting impression on Plato's colleagues, and one lesson of that dialogue is that the attempt to account for the unity of the many in the manner sketched in (1) above is riddled with paradox. Aristotle's carefully delineation of four distinct ways in which particulars may be one is in part an attempt to avoid these difficulties.

To understand the meaning of Aristotle's doctrine that the function of reproduction is to allow reproducing organisms to be formally eternal, we need to understand what it means for all of the members of a reproducing species to be one in form (or, as I prefer, formally one). For this purpose, I digress into Meta. V 6, and Meta. X 1-2, to examine the distinction between numerical and formal unity.

IV.

The Metaphysics has two extended discussions of unity, in V 6 and X. 1,2.¹⁸ I shall be focussed on the nature of, and relationship between, numerical unity (ἓν ἀριθμῶ) and formal unity (ἓν εἶδους).

As with many of Aristotle's key concepts, unity (τὸ ἓν) is applied differently in different contexts. Like 'being', the concept is applicable to items in every category [cf. Metaph. X 2 1053b25-1054a10]. The common denominator among entities to which the concept properly applies is that each be -- in some sense -- indivisible (ἀδιαίρετον -1052a36). As we will see, it is the nature of the indivisibility which characterizes them that distinguishes numerical and formal units.

In a way, any spacially continuous quantity is a numerical unit,¹⁹

...but in a way not, unless it is a sort of whole.

And this is not the case unless the form it has is

one (1016b13-14) [cf. 1052a22-23].

Certain continuous parcels of material are not merely 'heaps'²⁰, but have an inherent source of their own continuity (1052a23-26), which Aristotle identifies as their form. Aristotle thus argues that true numerical units are also one in form.²¹

There are at least two philosophical motivations behind Aristotle's insistence that "whatever is numerically one is formally one" (1016b36). First, as Montgomery Furth has argued²², the identity of a single individual through time and through an array of coincidental changes requires that it be formally identical through that time and those changes, that it be identifiable as one and the same thing. Now heaps are homoiomerous, which means one can divide them without altering their nature. Only things with an organized structure will be, insofar as their nature is defined by that structure, indivisible -- i.e., natural units. That is, no natural object with a characteristic functional organization can remain what it essentially

is while undergoing division.²³

Second, Aristotle has his eye on the mathematical function of numerical units.²⁴ He asserts that "the one is most of all the primary measure of each kind".²⁵ But for anything to serve this function it must be like what it measures. To consider a numerical unit as the measure of a kind is implicitly to view it as one among a plurality of things, all identical in some identifiable respect. Indeed, Aristotle argues that "not everything one in form is one in number" (1016b36); i.e., some things which are numerically many are one in form.

There is no doubt that Aristotle drew this implication. He characterizes a plurality as a quantity of matter divided ~~κετα το εἶδος~~ (1017a4-5). But to understand this definition we need to know what it means to be formally, but not numerically, one. For we recall that for anything to be one in any way at all requires that it be indivisible. In what sense are a number of discontinuous material objects going to fulfill this minimal requirement for being one? A number of discontinuous physical objects would seem to be paradigmatic of what is divisible, and thus not one, but many.

Aristotle clearly has such a worry in mind, for he tells us (a) things are formally one if their account is one, and (b) the account is indivisible in an important respect.

...the account saying what it is to be is
indivisible relative to another <account> which
reveals the thing (for just by itself any account
is divisible) (1016a33-35).²⁶

This passage asserts or implies three related claims:

- 1) There is an account which states the essence of something.

- 2) That account cannot be further divided so as to yield another one which states the essence of that thing.
- 3) Without considering whether an account is a statement of the essence, any account can be further divided into other accounts.

The notion of division here is a descendant of that found in a number of Plato's later dialogues, and akin to that discussed in De Partibus Animalium I. 2-3 and Metaphysics Z. 12 [cf. 1037b28]. Aristotle may have held different conceptions of its operation as his thinking on the subject evolved, and he was certainly critical of certain ways of conceiving the method of division.²⁷ Nonetheless, division was always viewed, both by Aristotle²⁸ and the Academy²⁹ as a means of determining a thing's essence. By properly dividing a genus into its proximate kinds, and then further dividing these, one would eventually arrive at a true account of the essence of the infimae species.

Now Aristotle here tells us that such accounts cannot be further divided to give us an account more revealing of the essence (if we could so divide, the original account would not have been truly of the essence).³⁰ He also tells us that, if we could ignore the requirement that tells us that the account reveals the thing's essence, we could always further divide it to get a new account.

Suppose having applied the method of division to some genus, we arrive at an account which is common to a number of organisms which says they all possess certain functional capacities of specific organ systems (p,q,r). Now the embodiments of these capacities may vary with respect to size, color (or new), texture, or location.³¹ Thus, we could certainly sub-divide this account, giving different accounts of organisms that have p,q,r embodied in organs of different sizes, news, textures, and locales.

Nonetheless, Aristotle insists that, for the purposes of natural

science, certain accounts are ground floor -- indivisible.³² It is what is stated in these accounts which reveals to us the form with respect to which the many individuals of a species are one. No further division will increase our understanding of what it is to be one of these organisms.

How do we know when we have reached this taxonomic level? In Aristotle's mature practice, division begins with certain universal features (*αὐτῶν διαφορῶν*) of high level taxa (*μεγίστα γένη*)³³ and proceeds by noting at each level how these universal features are determined or differentiated³⁴ in various sub-genera or species. Why should one not proceed in noting determinations until one has an account which is true only of Socrates or David Balme? After all, while this might not increase our knowledge of Man, will it not increase our knowledge of each of these men?

Aristotle's answer to this question is most clearly observed in his biological practice. At some point in the division, which cannot be determined a priori but only in the context of an organism's living conditions, any further division of a differentiating feature will reveal nothing of importance to the individual's being, i.e., to its life.³⁵ That Socrates has bulging eyes, a snub nose, or a shorter than average femur is existentially unimportant to Socrates the human. That he has a certain sort of eye, nose, and leg is crucially important.³⁶ Given that certain capacities are necessary for survival in a certain environment, the physical characteristics of the organs which perform those capacities will have to fall within specific ranges. Within those ranges, the variation that occurs is scientifically uninformative.³⁷ While the example I just gave is biological, it is clearly in line with certain passages in the Metaphysics. While in the Categories Aristotle gave as a mark of substances that they did not admit of "the more and the less"³⁷, the Metaphysics tells a more

complex story.

And just as the number does not have the more and less, neither does the substance in virtue of the form; but if <the substance allows of the more and the less> it is the substance with the matter [1044a9-11].

[Things are] alike if they are not the same without qualification, nor undifferentiated according to the composite substance, but are the same in virtue of the form, as the larger and smaller triangle are alike...[I 3 1054b3-6].³⁹

Notice that like things are not undifferentiated as composites. The implication, not explicitly stated here, is that they are undifferentiated in virtue of their form.

Aristotle pictures many ways in which spatio-temporally distinct objects may be one (i.e., in virtue of analogies, generically, formally, numerically). The analogical level of characterization raises special difficulties because the features in virtue of which two objects are said to be one by analogy don't have a name which specifies their functional identity. But from the highest generic level down these levels of unity can be viewed in the following way. Choosing a single organism, I may describe its main features at a very general level so that the description is the same for the organism I am describing and all mammals. There is a more or less continuous series of such descriptions, each more detailed, and each referring to a more delimited group of organisms. In principle I could describe each feature so that the description would be peculiar to the one organism before me. It is Aristotle's belief that one such logos, at a

particular level, gives us information of an especially valuable kind -- and, by no means coincidentally, implies the higher level descriptions.⁴⁰ This is the *logos* of the organism's being, and it is a logos common to many organisms. It is the most determinate account of an organism's features which remains an account of what that organism must be for it to function as it does. As an account which reveals the essence of an organism it is indivisible. For many organisms to share an account of this kind is for them to be formally one. A description of the functional features of an organism at just that level is an account of the form.

A mistake which a metaphysician might make at this point would be to treat the unity of things which are formally identical as a special sort of numerical unity. Instead of seeing irreducibly different sorts of unity, one of which consists in many numerically different things being indistinguishable with respect to those features which are crucial to their being what they are, he would see numerical unity at different levels. This metaphysician might argue that members of a species are one by virtue of their being numerically one form related to each of them. The expression "having the same form" is ambiguous in a way which might foster such a mistake. But we know that Aristotle was exposed to the difficulties inherent in the strategy suggested here. It seems plausible to see Aristotle's notion of irreducibly different sorts of unity as an attempt to avoid problems of "the one over the many."⁴¹ The expression ἓν εἶδος, using the dative to denote the manner or respect in which many numerically distinct individuals are one is not ambiguous in the way ἔχοντα τὴν αὐτὴν εἶδον is.

Aristotle does not, it seems, hold there is numerically one form in virtue of which numerically many particulars are one. Rather, the account which specifies the functional features of an organism, and which relates

them to the requirements of its existence at the most determinate level, applies indifferently to many organisms. Aristotle takes this to show they are formally one.

Now an obvious conclusion to draw from this, if one believes that the members of an everlasting reproductive series are one in this way, is to say that the kind is eternal, though none of its members is. But I believe this begs assumptions that are not Aristotle's, for it seems to again insist that only numerical unity will do. Aristotle insists that, because every member of such a series is identical with respect to their form, and because it is this form which makes each of them what they are rather than some other thing, what makes them what they are always exists. This does not imply that numerically one thing always exists, however. It means that what each numerical thing is always exists (though not as the organization of numerically the same organism).

It is in this sense, then, that reproduction allows for the individual organism to be eternal. It does so by ensuring that those features which make it what it is are always features of some organism. The members of a reproductive series are eternal because what they are is always instantiated.

V.

The argument I have been alleging as Aristotle's requires two controversial metaphysical theses.

- (1) The form characteristic of paradigmatic natural substances, organisms, is common to an unlimited series of causally related individuals.
- (2) Such forms are always instantiated in some parcel of material or other.

For his position, as I see it, is as follows:

For any everlasting reproductive series, if each member of that series is one in form, then the form common to each member of the series always exists.

The way Aristotle understands (1) and (2) above is, I shall now conclude by arguing, structured, at least in part, by his account of biological reproduction. I wish to test this claim by indicating the way in which it provides a plausible reading for Meta. Z.8.

Meta. Z.7,8. are concerned with developing a satisfying account of generation which indicates useful parallels, but also makes the relevant distinctions between artistic, natural, and spontaneous generations. Two basic propositions of chapter seven play the role of starting points for the arguments in chapter eight: the claim that all generated things come to be by something, from something and come to be something (1032a13-14; repeated at 1033a24-26); and the assumption that "the by-which" and the outcome of a natural generation are alike in form (1032a23-25).

As G.E.L. Owen has recently suggested, the examples which exemplify the something that comes to be are referentially ambiguous. It is sometimes assumed that the terms "an animal", "a plant", and "a human" are to be taken as referring to some particular animal or plant. Owen suggests another

alternative:

...a seed in the process of becoming a tree is not becoming a particular tree, even if a particular tree is the end product. ...yet what the seed is becoming...is indeed a tree...; we do not produce the Universal Statue or Tree.⁴²

The dialectical direction of chapter eight is dictated by the fact that Aristotle realizes that χ γίγνεται τι could be taken in three ways:

- (i) Socrates is coming to be.
- (ii) Something of the kind man is coming to be.
- (iii) The kind, Man, is coming to be.

The chapter argues that (i) and (iii) are inappropriate characterizations of what is coming to be. (i) is appropriate only once generation is completed.

...and when something has been generated ($\tau\epsilon\nu\eta\theta\eta$) it is a this sort of thing. The complete this, Kallias or Socrates, is like the bronze sphere here, but the man and the animal are like a bronze sphere in general (1033b24-26; cf. 1033b16-17).

On the other hand (iii) is just incoherent, if you accept Aristotle's account of generation.

For if a craftsman produces, he does so from some other thing; for this has been established ($\delta\upsilon\tau\acute{\epsilon}\kappa\epsilon\lambda\tau\omicron$). For example, he makes a bronze sphere. But this must be understood in the following way: from this, which is bronze, he

makes this, which is a sphere. And if now he produces this itself, it is clear that he will make it in the same manner, and the generations will extend back without limit (1033a32-1033b5).

This argument supposes that the form which characterizes what is coming to be itself comes to be. It then notes that everything that comes to be comes to be something from something. That means that the form itself must also come to be something from something -- i.e., it will be a case of certain materials becoming informed. But before this can take place, this form likewise must be produced and so on. The regress is vicious because it prevents coming to be from ever actually taking place.

Aristotle therefore insists, in an extended argument down to 1033b19, that "...the form...does not come to be, nor is there a generation of it, nor of the what is to be" (1033b5-7). Rather it is something of that kind which comes to be, and coming to be is essentially reinstantiation of the form of a kind.

Using the evidence of this passage alone, it might be thought that Aristotle is making a purely semantic point about what sorts of things are appropriate substitutions for the variable in the sentence "X is coming to be". To say the form doesn't come to be is like saying colors can't be heard. That Aristotle means more than this, however, is clear from 1034b8-19, for there he defends his claim that neither the form nor the matter comes to be by noting that they must pre-exist any case of coming to be. The passage concludes:

But it is possible to grasp a peculiar feature of substance from these things, that another substance must pre-exist (*προϋστάνειν*) being in

actuality what it produces, e.g., an animal, if an animal comes to be (1034b17).

To say the form does not come to be is to indicate that, in substantial generation, something's coming to be, e.g., a porpoise, presupposes the actual existence of a porpoise.

From 1033b19-1034a8 Aristotle considers a possible inference that could be drawn from the claim that the form doesn't come to be. Perhaps, then, it is some distinct thing apart from the things that come to be and perish. Aristotle rejects this inference -- the form is not a this. It picks out the sort or kind ($\tau\omicron\delta\ \tau\omicron\lambda\omicron\nu\delta\epsilon$). It is what something else comes to be.

...a craftsman produces and a parent generates a sort from this; and when it has been generated, it is this sort of thing ($\tau\omicron\delta\epsilon\ \tau\omicron\lambda\omicron\nu\delta\epsilon$) (1033b22-24).

This is unsatisfying. Aristotle has insisted that the form does not come to be, that the form signifies the sort, and that parents generate sorts from thises. By what slight of hand, we might ask, can he avoid the consequence that whenever some individual comes to be, the form which that individual comes to be also comes to be? It is to respond to this dissatisfaction (not stated in the text) that biological generation is brought in.

Certainly in some cases it is apparent that the generator is such as the generated thing, not the same certainly, nor one in number, but one in form, e.g., in the natural cases (for a man generates a man)...(1033b26-32).

So it is apparent that it is unnecessary to invent a form as a paradigm (for we should seek

them most of all in these cases, for these are most of all substances), but the generator is sufficient to produce and be a cause of the form in the matter (1034a1-5).

The ability of a matter/form composite to replicate its form in other materials makes it possible to simultaneously deny that the form of a kind comes to be and to assert that the form comes to be in another.⁴³ For any case of some material coming to be some sort of thing, that sort of thing must already exist. His model of substantial generation rules out the evolutionary option.⁴⁴ In order for it to be possible to say 'The form of porpoise came to be', it would have to be possible for something that wasn't a porpoise to produce a porpoise.

We see, then, that Z.8. is an extended argument intended to establish that the form of a natural kind does not come to be or pass away. The sort of thing a porpoise is doesn't come to be, though every porpoise comes to be and perishes. The very model of generation which Aristotle treats as his starting point makes the generation of an individual of some kind dependent on the form of that kind of thing already actually existing.

Yet, though the form of the kind always exists while its instances come to be and perish, the existence of that kind is dependent on the reproductive ability of its instances. Aristotle was able to salvage certain features of the form of a kind that were part of the Platonic program, while reversing the dependency relationship between forms and instances which Plato had defended. Reproduction thus plays a metaphysical role in Aristotle's philosophical struggle with his mentor's ideas.

Forms are the organized capacities of individual organisms. One of these capacities is to organize materials into organisms with the same organized capacities. If reproduction takes place, such forms will always exist. It is significant that Aristotle does say that species forms do not come to be and pass away, and that individual organisms are eternal ^{ἄβητοι} ~~ἄβητοι~~, but does not say forms are eternal. Two principles would block such a move. First, the continuous existence of the form which is identical in each species member is hypothetically necessitated, i.e., it is dependent on reproduction. But it is "the things which exist necessarily that are without qualification eternal".⁴⁴ Second, the form that is reproduced and makes individuals what they are is the basis of the unity that members of a reproducing species have, and this unity is the grounds for predicating eternality of individual species members. But what sort of eternality would a form have? Would it be eternal in virtue of being numerically one? Then it would be a particular, and familiar problems emerge. But then is the form itself formally one? This route leads directly to a regress, for the only sense I can make of such a notion is that the form is identical in form with its instances. Forms are neither numerically nor formally one -- material substances are.

There is one last 'function' of reproduction worth mentioning. The objects of study in biology, the functional capacities of kinds and the structures necessary if those capacities are to be realized, are vindicated as true subjects of episteme. While a species at first glance is an everchanging stream of individuals which are unique in their variations and of short duration, the capacity which preserves the being (^{ἡ ἀναπαραγωγή τοῦ σώματος} - DA II 4 415b14) of the adult also "is productive of a generation not of that which is nourished, but like that which is nourished" (416a16-17). What could be better than to have biology vindicate itself as a

suitable subject of scientific study. The metaphysical and epistemological consequences of reproduction must have pleased the father of systematic biology enormously.

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Notes

1. E.g., at Meta XII 1 1069a31ff; PA I 5 644b23-25; GA II 1 731b24-26.
2. That is, the directionality of a process (say, biological development) is determined by the form toward which the process moves — but only if that form initiated the process. For a defense of this claim, cf. my paper "Teleology, Chance, and Aristotle's Theory of Spontaneous Generation" (forthcoming in the Journal of the History of Philosophy, July, 1982).
3. For example, I believe it can be shown that certain forms of animal generation that Aristotle believed occurred turn out not to have the requisite properties for the application of teleological explanations.
4. PA I 1 639b13-21.
5. Balme, D. M., Aristotle's De Partibus Animalium I and De Generatione Animalium, Oxford, 1972, p. 155 (hereafter, Balme).
6. *της μὲν γὰρ τῶν βουτῶν οὐσίας οὐθέν ἐστὶν
ἄλλο ἔργον οὐδὲ πρᾶξι οὐδεμίᾳ πλὴν ἴ
τῶ σπέρματος γένεσις ; GA 731a25-27.*
7. The Greek here is utterly ambiguous. The line reads, *τοιοῦτον
δ' εἴπερ ἦν, ἀέδιον ἂν ἦν.*

Balme suggests the argument is as follows:

1. All beings either are eternal or come into being;
2. What a thing is, it is as a particular;
Therefore if a thing is eternal in number, i.e., as a particular, it is an eternal.
3. But things that come into being are not eternal;
Therefore things that come into being are not eternal in number.

I am supposing the verbs have different subjects, and that Aristotle is drawing an inference about the status of the nature or being of organisms from the assumption that particular organisms are numerically eternal. Balme's reading gives Aristotle's argument a tight logical structure, but at the cost of making it trivial.

8. Balme, p. 156.
9. PA I 1 640a33-63.
10. Compare Meta. VII 7 1032a25-27; Meta. IX 8 1049b20-30.
11. ἔπειδ' αὐτῆς δυνάμεις τῆς ψυχῆς θρεπτικῆς καὶ γεννητικῆς . De An. II 4 416a19. I indicate one reason for this identification very briefly on pp. 24-25 of this paper. The story is a complicated and interesting one.
12. De An. II 4 415a15-22.
13. Simplicius In De An. 109.32-35; Philoponus, In De An. 265.22-28.
14. Philoponus, In De An. 266.25, 266.34-267.2.
15. Some notes on the text of 415a26-415b7. (1) The notion of desire (ὀρέγεται) at 415b1 is not to be taken literally -- plants are clearly under discussion (415a29), and Aristotle does not grant desires to anything which lacks locomotion and perception (414a33-414b6). Here, as in a few other texts, the term is roughly a stand in for a tendency to realize various ends. Thus the καὶ at 415b1 could be taken explicatively. (2) One of the small number of texts (e.g., PH. II 2, 194b1, Meta. XII 7 1072b2-4, De An. II 4 415b20-21) distinguishing two sorts of τὸ οὐ ἕνεκα occurs here (at 415b2-3). The commenators, ancient and modern, have taken the genitive and dative relative pronouns to distinguish the goal or end of a process or structure and the beneficiary of the achievement of that goal (PH. II 2

194b1-2 is helpful here). I shall accept this way of taking these references, although I think a fresh look at all of them is needed.

16. Aristotle defines participation at Topics IV 1 121a11-12 as:
"the account of that which is being partaken in".
17. Gen. and Corr. II 11 notes that "men and criminals do not return (*ἡ*
ἀνακρίμναι) to themselves so that the same thing comes
to be again" (338b8-10) but that they make a return formally but not
numerically (338b12-19).
18. The latter passage makes clear reference to the former (at 1052a15-16);
and while many issues are dealt with in Meta. X on which V.6 is mute the
discussions are in general agreement.
19. Compare 1016b12-14 with 1016b33, 1017a4-6, 1021a10, 1052a19-20, 1054b14.
I will be focussed on elemental materials and organisms, but it is
important to note that the characterization of "minimal unity" given
here is such that continuous changes and stretches of time can be called
one. Physics IV-VI indicates that the definition was intended to be
broad enough to include units of change and time.
20. *σῶρος* - cf. Met. VII 17 1041b-12, VIII 3, 1044a5.
21. At this point I wish to note a common use of the 'one in form/one in
number' distinction that I will not be directly focussed on. It is not
unusual for Aristotle, in discussing an object that can be described in
different ways, to say that it is one in number but two (or more) in
form or logos (*ἀριθμῶ ἓν, εἶσε δύο*). For example, at Physics I 7
(190b23-26), Aristotle notes that what is undergoing a change can be
described (e.g.) as *τὸ ἄμοιον* or as *ὁ ἀνθρώπος*. 'Form',
as used in these passages, refers not only to defining properties of a
subject, but also to the various accidental properties of a subject as

well.

22. Furth, Montgomery, "Transtemporal Stability of Aristotelian Substances", Journal of Philosophy, LXXV, No. 11. 1978, pp. 624-646., cf. N.P. White, "Aristotle on Sameness and Oneness", Phil. Rev. XLIII (1971), p. 192. At 1054a34 Aristotle argues that for something to remain the same in number both its matter and its form must be one.
23. This is one difference between 'tissues' and 'organs'; cf. PA II 2 647b17-21.
24. Cf. Meta. V 6 1015b35-36; Meta. XIII 1017a18ff; Phys. IV 12 220b20.
25. Meta. X 1 1052b18; cf. 1052b24, 31-32; 1052a20.
26. Note the contrast between two sorts of indivisibility at Meta. X 1 1052a33.
27. PA I 2-3.
28. Cf. An. Po. II 13 96b15ff; Meta. VII 12 1037b228-30.
29. Plato, Sophist 221c6, 265a5, 267b6; ;Statesman 267a5,d1; Phaedrus 265d-266e.
30. As he notes at PA. I 3 643a8-12.
31. Note the account of things which are *ὅμοιοι* at Meta. X 1054b4-8.
32. Cf. Meta. VII 8 1034a5; 12 1038a18ff; PA I 3 624a7-20; 4 644a24-26.
33. Cf. HA I 4 490b6; PA I 3 642a25-26, 4 644a17; However note the use of *μέγιστα τένη* at PA 683b25-27 where it refers to four *τένη* of crustaceans.
34. Cf. Furth, p. 644; Balme, pp. 103-105; Granger, H., "Aristotle and the Genus-Species Relation", The Southern Journal of Philosophy, XVIII, no. 1, 1980, pp. 37-50 Lennox, J. G., "Aristotle on Genera, Species, and 'The More and the Less'", Journal of the History of Biology, Vol. 13,

- No. 2, 1980, pp. 321-346.
35. Lennox, pp. 341-344; Balme, D. M., "Aristotle's Biology is not Essentialist" Archiv für Geschichte der Philosophie, Vol. 69, 1980, pp. 1-12.
 36. Cf. GA V 1.
 37. One of the most significant changes wrought by Darwin on biology was shifting attention to those small variations exhibited within species. To the extent that Aristotle's conception of scientific understanding counsels ignoring such differences, it is radically out of step with the "population thinking" of contemporary biology. One needs some reason to think such variation is significant however; Aristotle had every reason to suspect that it was not adaptively significant.
 38. Cat. 3b33ff.
 39. Compare 1055a3.
 40. Cf. Meta. VII 12 1038a20-33.
 41. Cf. Meta. VII 14 1039a27; Fine, Gail, "The One Over Many", Philosophical Review, XXXIX, No. 2, (1980), pp. 197-240, esp. 210-212; White, pp. 189-91.
 42. Oxford Zeta Notes, p. 45, "Particular and General", Presidential Address, Proceedings of the Aristotelian Society (1978-9), pp. 20-21.
 43. So the rather paradoxical statement: "Therefore it is apparent that the form...does not come to be, nor is there a generation of it...; for this is what comes to be in another either by art, nature, or power". (1033b5-8).
 44. It is an open question whether the model was so constructed because he had no reason to suppose the form of a species could begin or cease to exist (as Balme, pp. 97-98, suggests), or whether he had philosophical

reasons for maintaining this thesis which were independent of his ideas about species change. Balme notes that Aristotle argued for the existence of fertile hybrids (p. 97, referring to GA II 476a30). But at 738b28 he argues that as time goes on there is a reversion of the hybrid offspring to the form of the female parent (κατὰ τὸ θῆλυ τὴν μορφήν--738b34). And it was important for him to treat such crosses as replication of the genus, if not the species (thus the odd aside on Mules in Meta. VII 3 1034a1-2). It is important to recall that the mule's sterility had nothing to do with its being a hybrid as far as Aristotle was concerned. GA II 7-8 argues that hybrids which are alike in form and have identical gestation periods can produce fertile hybrids, and that mules are the exception.

45. That forms of substances do not come to be or pass away is asserted also at 1034b8-19; 1039b22-31; 1043b17; 1059b35. NE VI 3 1139b21-24 notes that eternal things do not come to be or pass away, but does not claim that whatever does not come to be or pass away is eternal.