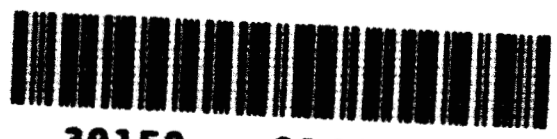


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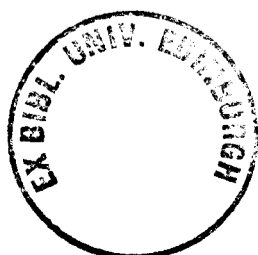
**Aristotle's Use of "Genus" in Logic, Philosophy and Science**

**Thesis submitted to the Faculty of Arts in fulfilment of the requirements  
for the degree of Doctor of Philosophy.**

1997

Jeffrey Carr

University of Edinburgh



# Aristotle's Use of "Genus" in Logic, Philosophy and Science

## Abstract

In *Metaphysics*  $\Delta$ .28, Aristotle provides four uses of the term "genus", which he then summarises in three separate accounts. The purpose of this dissertation is first, to explain each of the uses given by Aristotle, second, to explain how his summary of the four uses by three accounts is justified, and third, to examine some philosophical applications of each use. I will relate the different uses to each other as far as entailments can be established, and show that the focal, if not the most common sense of genus, is the view that genus is the substratum of differentiae, given in Aristotle's summary as the view that the genus is the matter. In the role of substratum, the genus is fundamental to Aristotle's account of the unity of an organic substance and grounds a profound metaphysical truth: the proximate genus is a necessary constituent in the nature and persistence of material objects.

In loving memory of David W. M. Carr  
(1932-1980)

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Finally, I would like to thank Maggie, Maeve and Mikhail for providing a purpose for my work.

This dissertation has been written entirely by me and is my own work.

A handwritten signature in black ink, appearing to be 'J. K.', with a long horizontal line extending to the right.

## Introduction

In *Metaphysics*  $\Delta$ .28, Aristotle provides four uses of the term "genus", which he then summarises in three separate accounts. The purpose of this dissertation is first, to explain each of the senses given by Aristotle, second, to explain how his summary of the four uses by three accounts is justified, and third, to put these positions to philosophical use. The manner in which Aristotle's theory of genus can be used to address philosophical issues will be presented throughout the dissertation. However, I will examine the four ways in which Aristotle lists the uses of "genus" in the order that they appear in  $\Delta$ .28, following Aristotle's sequence. I will relate the different uses to each other as far as entailments can be established, and show that the focal, if not the most common sense of genus, is the view that genus is the substratum of differentiae, given in Aristotle's summary as the view that the genus is the matter. In the role of substratum, the 'genus is matter' thesis is fundamental to Aristotle's account of the unity of an organic substance and expresses a profound metaphysical truth: at the foundation of a metaphysical scheme the proximate genus/matter is a necessary contributor to the nature of a material object.

Aristotle's account of the uses of "genus" as found in *Metaphysics*  $\Delta$ .28 is the following:

We speak of a genus [1] either if the coming to be of the things possessing the same form is continuous, as for instance 'so long as the genus of men is' means 'while their coming to be is continuous'; or [2] if people [stem] from someone who first brought them into existence; for in this way some are called Hellenes by genus and others Ionians, from their [stemming] from Hellen and Ion who first begot them; and more especially from the begetter than from the matter (for people *are* called by genus from the female too, as some are from Pyrrha); again, [3] as the plane is the genus of solid figures that are plane, and the solid of those that are solid; for each of the figures is either a plane of such and such a kind or a solid of such and such a kind, that being the subject of its differentiae; again, [4] as the first constituent in formulae which is stated in [answer to the question] what a thing is; for this is the genus (and its qualities are called differentiae).

These, then, are all the ways in which a genus is so called: in respect of the continuous coming to be of the same form; in respect of the first thing, having the same form, to effect change in a thing; and as matter -- for what differentiae and qualities are *of* is their subject, which we call the matter.(1024a29-b8; Kirwan, trans.<sup>1</sup>)

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<sup>1</sup>Translations used in this dissertation will be those of the Oxford *Works of Aristotle Translated into English*, and Jowett's 4th edition of the works of Plato, unless noted. The Oxford and Jowett translators' names are listed in the *Bibliography*. Square brackets within quotations signify my alterations, unless noted.

## Introduction

*Prima facie*, these versions of how genus is used have *for us* ontological presuppositions: of the reality of becoming and hence change, as we read in the first two definitions; of the reality of families of things into which individuals have been grouped, particularly in the second account; of the existence of subjects of essentialist predication as in the third and fourth accounts; and of the components of definition, again from the third and fourth accounts.

In the sequence of chapters which follows, I will explain the theories used by Aristotle to justify these presuppositions. Further in the way of preliminaries, attention must be given to the conventional understanding of the term 'genus' for the ancient Hellenes.

### i. The Common Hellenic Meaning of Genus

Aristotle's second meaning of genus is the one his Hellenic readers would have been most familiar with, because it is the political use by which each individual belonged to a *family* composed of the male citizen, his blood relatives, slaves, animals and land. Aristotle says a genus spoken of in this way is so-called because of a common ancestor, usually male but occasionally female, as in the case of the people of Pyrrha<sup>2</sup>. This notion was historically important because of kinship relations, particularly concerning the inheritance of property. One's genus included some families and not others, so ideally the genus would keep its possessions among blood relatives, by intermarriage within the genus. One's genus was important for supplying criteria of identification, in something of the role of a proper name: for example, Alcibiades is said to belong to the Eupatridae, one of the wealthy classes of ancient Athens<sup>3</sup>. Yet this notion

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<sup>2</sup>Theodore J. Cadeux defines 'γένος' in the *Oxford Classical Dictionary* as "a group of persons claiming descent in the male line from a single ancestor", which is the subdivision of a *phratry*, and composed of *oikoi* (households) (p.461).

<sup>3</sup>A controversy surrounds the exact specification and role of the *genos* in ancient Greek or Athenian lives: in his *Alcibiades*, Walter Ellis takes issue with the thesis that the Eupatridae constituted a *genos* rather than a class, summarizing a debate between many scholars about which of the two the Eupatridae represented. Although my own opinion is that the role of the *genos* changed, (so that it could have meant either a class or family), nothing I say depends on the outcome of that debate. Socrates occurs in official registers as "Socrates son of Sophroniscus of Alopeke", i.e. according to his father's forename and his deme, rather than one of the broader divisions of the population -- he wasn't wealthy enough to have been of the Eupatridae. Yet Ellis quotes another text used to identify Andocides as being of the genus of Kerykes, to which Socrates could belong, too. The view I defend is that the use of the term was subject to the convention of the particular eras, with which each of these views is consistent. The genera structure was changed by Cleisthenes,

## Introduction

is also conventional<sup>4</sup> because blood ties are not necessary: slaves and animals could be 'adopted' into the genus. (For this reason, less emphasis will be put on this use of genus than the others, although we will have reason to recall it in the chapters which follow).

Yet Aristotle continues his description by mentioning that those who take the name of the genus derive it from the first begetter of their genus, in the way that if the biblical passage were true, we would all be Adamians. The begetter is implicitly identified with the form as the usual source of the name, although it is occasionally taken from the matter: by form and matter, Aristotle is here drawing upon his account of the generation of living things, which requires a father for the structure of a generated thing, and the mother for the stuff to be given structure.

Thus it is implicit in this use that there are causal chains connecting later generations with earlier generations, a notion made explicit in the first use of genus, according to which there is continuous generation of things which have a common form. Kirwan comments that this is an "awkward definition of the everyday sense in which 'genos' means 'family' or 'clan'" (p.177). I disagree (for the historical reasons noted) that this is the everyday Greek sense of a family: rather, this is the focal sense of a 'family', whose members are identified by blood relations. Instead, the use of genus to mean "those whose origins lie in a common ancestor" was the more commonly used because the identity criteria of membership are widened to embrace more than those who are called members of a genus because of blood relations.<sup>5</sup>

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dividing the four genera into ten tribes or *phylai*, each with three areas of settlement (coast, city and country). See Kenyon, F. G. (1891, p. 39) and Weil (1977, p. 204).

<sup>4</sup>Many of the ancient Hellenic thinkers were impressed by the distinction between nature and convention. We might say that the description of something as natural is appropriate when some A is B because of 'the way things are', or that it is *de re*. Aristotle would say that the description fits because A is B because of certain principles of A responsible for it to be B. Correspondingly, we might say that the description of something as conventional is appropriate when some C is D because of human intervention beyond principles inherent in C: for example, a cat is called '*ailouros*' (later '*katta*') by Attic writers because of convention, *de dicto*, not because there is anything necessary feline about the name.

<sup>5</sup>Neither Kirwan nor Ross seem to have appreciated this point, I think, because of the tendency to see genera as divisible into species, such as Ross's 1929 translation of '*γένος*' at 1024a29 as meaning things of the same 'type,' revised in the Barnes (1984) edition to read 'sort' at 1024b6. Yet Liddell and Scott (8th ed, 1901) list as the first translation of '*γένος*' the "*race, stock, family, whether by blood or by nationality*", noting in their third entry that from Herodotus onwards, '*γένος*' was used particularly as a race or tribe, a subdivision of the *phratia* or *ethnos*.

## Introduction

### ii. The *Pollachos Legomena* (or Things Said in Many Ways)

The notion of the *pollachos legomena* (term said in a number of ways) occurs frequently in the Aristotelian corpus, and *Metaphysics* Δ is an account of some of the terms which are each used in a number of ways. The example of a *pollachos legomenon* which has received the most attention in recent Aristotelian scholarship is 'being' (τὸ ὄν), which Aristotle discusses in *Metaphysics* Z.1. He argues that "On the one hand it signifies what a thing is [τὸ τί ἐστὶ] and a this [τόδε τι], and on the other a quality or quantity or any of the other things thus predicated" (1028a12-14; Bostock, trans.). This recalls the presumably earlier<sup>6</sup> distinction between the types of things which can be referred to singly, from the *Categories*. Aristotle claims there that

Of things said without any combination, each signifies either substance or quantity or qualification or a relative or where or when or being-in-a-position or having or doing or being-affected" (1b25; Ackrill, trans.).

Combining the *Metaphysics* Z and *Categories* passages, it follows that 'being' signifies members of each of these categories, yet Aristotle qualifies this in the *Categories* that only the combination of these terms comprises an affirmative statement (2a4): because only substance is neither predicable of a subject nor inheres in another substance,<sup>7</sup> while all of the other genera of expressions require a subject<sup>8</sup>, the other predicates must be said of substances to produce an affirmative statement. Thus, understanding the nature of anything other than substance requires us to see it in its metaphysical context of belonging to substance.

Since the publication of Owen (1960), a considerable amount of attention has been given to the feature of Aristotle's thought which gives priority to substance. Owen's particular thesis does not interest us here,<sup>9</sup> but the notion of '*pros hen*' applications of an expression<sup>10</sup> (or 'focal

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<sup>6</sup>Nowhere in this dissertation will I provide arguments for the ordering of texts. Instead, I will adopt the view of the vaguely defined consensus that the *Organon* is from the earlier part of Aristotle's career, the works of natural philosophy or science also being earlier than the biological works which presuppose the observations made by Aristotle in Ionia after the death of Plato. The *De Anima* and *Metaphysics* are thought to be later, although the latter shows signs of having been written throughout Aristotle's career.

<sup>7</sup>Cf. *Metaphysics* Z.1 1028a10-15, Z.3 1029a22-7. The notions of predication and inherence will be examined in chapter III §2.

<sup>8</sup>Theophrastus raises the *aporia* why "while we assert being of all things, there is no likeness to one another in them, as there is between white things and black things" (*Metaphysics* 8b2-4; Ross and Fobes, trans.)

<sup>9</sup>His thesis is that Aristotle's renewed interest in the science of "being *qua* being" marks a return to 'Platonism' rather than a departure from it.

<sup>10</sup>Sometimes these are referred to as cases of 'homonymy', although Aristotle says in Γ.2 of the *Metaphysics* that the cases of 'being' are not used homonymously.

## Introduction

meaning') which he introduces must be mentioned. If the being of substance is the primary sense of 'being' and the other senses presuppose it, then 'being' is a term '*pros hen*' as *relative to* that *one* sense of being, as the sense which must feature in the account of the other senses.<sup>11</sup> The notion of the term said '*pros hen*' was crucial in allowing Aristotle to say that it is possible for metaphysics to be a science of being, for if 'being' were simply homonymous, i.e. said in many ways, then there would have to be a science for each of the types of being. As Barnes (1995 p.88-9 cf.76-7) has commented, the appeal to focal meaning is identified by Aristotle as a method of non-eliminative reduction for saving metaphysics from being a class of different sciences (referring to *Metaphysics* Γ.2 1003b5-16).

Homonymy is defined by Aristotle in *Categories* 1, in contrast to synonymy and paronymy. He says "When things have only a name in common and the definition of being which corresponds to the name is different, they are called homonymous." (1a1-3; Ackrill, trans.) The example he gives is the genus 'animal' said of a man and of a picture. In contrast, two things are synonymous /univocal when they have both the name and the definition in common, (1a6-7) again using the genus 'animal' but this time of a man and an ox, as examples; things are paronymous if their names are derived from the name of something else, with a change of ending, such as the formation of an adjective from a noun (1a12-15).

Now genus is given in Δ.28 as a term which is said in many ways, which suggests that it is an homonymous term. As Owen has claimed,

If a word is *pollachos legomenon* then it is a case of homonymy, requiring different definitions in different uses (*Topics* 106a1-8): the only *pollachos legomena* which are not cases of homonymy are not words but ambiguous phrases (106b6-111a7). (p. 15 n5)

But the question this dissertation will endeavour to address is whether 'genus' has *pros hen* equivocity, i.e. does it have focal meaning? Indeed in *Topics* I.15 to which Owen refers, Aristotle gives criteria for determining whether a term has a single or multiple meanings. Theophrastus is clear that *pollachos legomena* do not have focal meaning, claiming that "it is not possible to get anything universal and common in the case of terms that are used in more than one sense" (*Metaphysics* 9a27-b1). Yet even Aristotle himself could be taken to agree with this, in the context of distinguishing the forms of a genus saying that the genus is

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<sup>11</sup>It must feature in the account because it is prior, as I shall explain in chapter IV, §1.

## Introduction

spoken of, *not in the sense* of the Heraclidae, but in the sense of a part of the nature of something (1058a23-5). This implies (but does not entail) that the senses of genus cannot be reduced to a fundamental sense.

Another example of the irreducibly *pollachos legomena* thesis is that the four *aitia* ("causes", to some) are not reducible to one another, nor to a focal *aition*. In his commentary on the *Physics*, Charlton has argued that things Aristotle would call cases of the four *aitia* are one of the four *aitia*, "not because they have something in common, or because they conform to a single definite idea, but by analogy"(1970, p.103, cf. p. 55). The *aitia* "can be reduced to four"(1970, p.99). While not saying it explicitly, Charlton's analysis seems to imply that the things called *aitia* cannot be reduced to one type, accountable by one 'sense'<sup>12</sup>: he argues that

The Greek word *aition* (connected with the verb 'to blame' 'hold accountable') is used *considerably more widely* than the English 'cause'. X is called an *aition* in respect of Y, if it is responsible for Y in any way whatever, if Y can for any reason be set down or ascribed to it.(1970 p.98)

Aristotle could defend this view on grounds of the plurality required for change to occur at all (see chapter I §ii) or on grounds of the fundamental opposition required if there is to be more than one thing in the universe (see chapter VII §ii). But for the sake of argument about the possibility of a focal sense of a *pollachos legomenon* we note that at least in a few passages, Aristotle claims that the principles can be co-extensive: he argues that sometimes the formal *aition* and the final *aition* are the same<sup>13</sup>. These are the explanations in terms of the form to be realized and that for the sake of which as end. The other two cases are the material 'that out of which', and the efficient cause or source of a thing's changing or staying the same: these are particularly relevant in circumstances where change occurs according to human agency, because the production of artefacts will be a primary example used in the analysis of substance. The final cause is the end "for the sake of which" change occurs. In defending the "final cause", Aristotle is advocating the use of teleological explanation, believing as he did that an account of substances and their parts requires an explanation in terms of an end or good. The good of the substance or its part supervenes on the other types of cause as towards that good. In the case of such substances, the final cause will express the function of that

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<sup>12</sup>See also Charlton 1970, p.55 on 'ways in which a thing may be said': Charlton provides *pros hen homonymy* as one of four ways in which the same expression can be used for different things.

<sup>13</sup>Hypothesized at *Metaphysics* H.4, 1044b1 and Λ.4 1070b32; stated at GA I.2 715a8, GC II.9 335b6, *Physics* II.7 198a24.

## Introduction

substance as a whole, or of its parts in relation to the whole (*PA* I.5 645b14-21, *GA* I.1 715a1): when the final cause has been determined, it will be expressed in the definition of the object, being in some cases part of the essence (*Metaphysics* Z.17 1041a27-31).

Thus we begin an examination of Aristotle on genus, and the presuppositions he makes in order to justify his views. In the first chapter, we will examine the background to Aristotle's theory of change.

**Chapter I**  
**Genus in the Explanation of Change:**  
**the Subject/Substratum Principle**

The first sense of a genus given by Aristotle in *Metaphysics* Δ.28 is the sense according to which classes of generated things are called a genus because the coming to be of these things possessing the same form is continuous (1024a29). To understand this use of genus, we need to understand change as the actual instantiation of a quality or essence where it has been absent previously, for it is coming to be in the changed thing. Aristotle argues in his theory of change that the agent of change possesses a certain form that it transmits to the recipient of change; the recipient of change had the form *potentially* prior to the change, but comes to have it actually by the process of change, change being the actualization of that potentiality<sup>1</sup>. We can talk about a genus of things, then, when it is clear that there is such a thing as change, allowing the generation in one thing of a form had by another thing.

Now Aristotle's account of change may sound to some like little more than a predecessor of so-called "Cambridge" changes, according to which at different times, a predicate is falsely then truly applied to a subject. Yet Aristotelian genera are important in this regard because in accidental change, the same form is transferred from the agent to the recipient, so that they will both belong to the same genus, such as "warm things"; in substantial generation, the thing which changes must belong to the same type as the agent of the change, "for man begets man" (*Metaphysics* Z.7 1032a24). The *central problem* is how to explain change *at all*: what is change? This question is thorny because it is at the foundation of ontology -- we perceive changes, but exactly what we are perceiving is difficult to explain, causing some to deny to change any *real* existence at all. Aristotle's theory of change and the role in it of genera also prepared the way for analyses in terms of thought-experiments, or possible-world semantics, in analyses such as the impossibility of an infinite sequence of changes. The goal of this chapter is to explain the principles of this use of genus. Crucial to the account of genus that is being given here are a set of terms relating to the explanations of change and generation. In this chapter I will provide an account of the principles

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<sup>1</sup>The controversy surrounding this definition will be the topic of chapter II.

## Chapter I

used in Aristotle's theory of change; in the next, we will examine his definition of change; in the third, the topic is the special details about change and the type of change which is generation: I will relate these theories to the use of genus given above. It will be explained that the genus of the thing which is generated, and of the thing by which it is generated, is needed to partially explain the change according to which the form is said to be generated.

### **i. To What is Aristotle's Theory of Change a Response? The PreSocratic and Platonic Background**

If we are to properly understand the *aporia* or problem which Aristotle faced, we must review the thought of his teacher, which requires us in turn to see the antitheses for which Plato thought that he had supplied a solution. In this section, we will examine the views of Heraclitus, Parmenides and Plato on change and becoming, in the former two cases presenting the received views of the thinkers so as to have models of possible extreme cases -- running the risk of oversimplification, no doubt -- in order to emphasise the philosophical positions which can be taken about change. Plato attempted to provide a balance between the Heraclitean outlook in which change is all that there is, and the Parmenidean outlook in which changes are apparent rather than real, and reality is unchanging. Plato's solution was to give change and stability their own separate domains: in the course of defending this, he made an important contribution to philosophy and science by introducing the subject of change.

Heraclitus of Ephesus is thought to argue that changes are all that there is, being the only continuous reality. This interpretation is brought by scholars out of the famous image of a river: "Upon those that step into the same rivers different and different waters flow .... It scatters and ... gathers ... it comes together and flows away ... approaches and departs"(fr. 12 + 91; KR §217).<sup>2</sup> Plato emphasised that this is the view that everything is in process (*chôrei*) (*Cratylus* 402a). This thesis is based on the transformation of opposites, one opposite A giving way to its opposite B

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<sup>2</sup>Like many of the views of the Pre-Socratic philosophers, this fragment is taken from a doxographic source, the problems with which are noted in Barnes, (1987), Introduction. The source of this statement is Arius Didymus *ap. Eusebium P.E.* xv, 20 and fr. 91, Plutarch *de E* 18, 392B. See also Barnes (1987 p.116). "KR" will denote the section of the Kirk and Raven text from which quotations are taken, where appropriate.

## Chapter I

according to the machinations of strife (*ton polemon*), possibly represented by fire, which is the ultimate cause of change<sup>3</sup>.

Parmenides of Elea adopted the opposite thesis, that rather than all being in a flux of changes, instead true being is stable and unchanging. Parmenides thought that one who pursues truth must accept that "coming into being and perishing [*γίγνεσθαί τε καί ὄλλυσθαι*], being and not being, change of place [*τόπον ἀλλάσσειν*] and variation of bright colour"(fr. 8, l. 40-1; KR §352) are mere names (*onomata*), but not names for anything in reality because to think (*noein*) requires that static reality exists, rather than a changing reality (*ibid*, l.34)<sup>4</sup>. If reality underwent changes, Parmenides argues, these changes would have to "arise .. from what is not"(fr. 8, l. 7; KR §347), as opposites. However, "from that which is not" is not allowed by Parmenides as a significant utterance, because such a notion is unthinkable<sup>5</sup>. Nor does "what is" (i.e. reality) change into something, for if it is to become something, then it cannot exist prior to coming-to-be: "for if it came into being, it is not, nor if it is going to be in the future"(fr. 8, l. 20-1; KR §347). Whether reality is thought to come into being, or to become something else, is reduced to absurdity. Thus, "what is is uncreated and imperishable, for it is entire, immovable and without end"(ibid, ll. 3-4), and any changes that we experience are phenomenal, restricted to appearances rather than realities: we can have opinions about such things, but we cannot regard these utterances to be utterances of truths, because truths only pertain to realities.

Faced with precedents that everything is in a state of change, and that no real things change, Plato set out to provide an argument allowing for some but not all real things to change. Solutions to a variety of problems had to be provided in order to fulfil this possibility. Kirk and

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<sup>3</sup>See Burnet, p. 48, §42. Scholarly controversy exists about the domain over which flux is thought to occur according to the view of the historical Heraclitus: Lloyd argues that the "famous dictum *panta rhei*, 'everything flows', cannot definitely be ascribed to Heraclitus, and even if it could, this would not solve the problem, since the point at issue is whether this dictum is to be taken literally."(1970, p. 37). Kirk and Raven (197) comment that Heraclitus's reliance on the senses would have prevented him from allowing the doctrine of change to be taken too broadly -- he is reputed to have made statements that dispute the evidence of the senses, e.g. the "real constitution of things is accustomed to hide itself"(fr. 123, KR §211 from Themistitus *Or.* 5, p. 69d), or cf. fr. 107, KR 201-- but also he is reported to have said that "the things of which there is seeing and hearing and perception, these do I prefer"(fr. 55, Hippolytus *Ref. IX, t, 5* KR §200). Questions about the scope and historical accuracy of the dictum are beyond the goals of this dissertation because our concern is how the view (whatever it was) was received by Plato and Aristotle.

<sup>4</sup>From Simplicius *On Aristotle's Physics* 1467 ll 7ff

<sup>5</sup>See Burnet (p.53).

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Raven comment that Parmenides's legacy included the canons that "Being, in the first place, must not be allowed to spring from Not-being: anything that was claimed as real must also be ultimate"<sup>6</sup> and that "motion must no longer be simply taken for granted, an explanation must be given of its existence -- which involved also an explanation and justification of sense-perception"(1957, p.319). Burnet argues that the Parmenidean conclusions could only be avoided on two conditions: "the belief that all that *is* is one ... must be given up" and "some account must be given of the origin or source of the motion which had hitherto been taken for granted as something inherent in the nature of body"(1968, §50, p.55).

Plato argues in the *Sophist* that change has to be admitted as something which exists. The argument he gives is a dilemma, using *modus tollens*. The argument is given by the Eleatic Stranger within an argument in which he argues that anything which truly exists must have some power to affect something else, or be affected by something else. The Stranger starts with the premiss that the Friends of the Forms

will allow that if to know is active, then, of course, to be known is passive. And on this view being, in so far as it is known, is acted upon by knowledge, and is therefore in motion; for that which is in a state of rest cannot be acted upon, as we affirm.(248d9)

According to this argument, being and becoming are co-occurrent phenomena covering parallel domains. This is confirmed in the subsequent lines, in which Theaetetus approves that motion, life, soul and mind co-occur with being (249a1)<sup>7</sup>. In particular, if being has mind, it must also have life, and if so, soul as well, which also entails that it has motion (κίνησιν) (249a5-b3). Each of these entailments seems plausible enough, given the common ancient views of the soul: if there is thought, the thinking thing must be; but the thinking by the thing entails that the thing can act; and if it acts, it possesses an an internal principle of movement<sup>8</sup> and thus motion occurs.

The Stranger then cashes in: if no motion occurs, there is no mind (249b5-6). Yet at the same time, if all things are in motion, there could be

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<sup>6</sup>Cf. Peck (1952).

<sup>7</sup>Professor Frede examines passages in the *Timaeus* (and elsewhere) in which he finds a sense of "becoming" which includes "being", thus allowing a bridge between the supposed gulf between the two worlds of Heraclitus and Parmenides. His suggestion in light of the *Theaetetus* is that "to become" means "'to temporarily take on, or display, or be made to display the outward character or marks of an F, to come to give or to give the appearance of an F'."(1988; p. 43).

<sup>8</sup>Cf. *De Anima* II.2 414a12-14 and II.4

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no mind, either (249b8-9), because a principle of rest is required in order for the condition and action and subject to allow thought. That is, if all were in flux, it would be impossible to know anything as a stable reference point for thought. With these arguments the Stranger refutes the arguments of Parmenides and Heraclitus on change, because of the dilemma which they present. The dilemma is as follows: if everything does not change, then mind is impossible because to know is an activity; but if everything is in change then mind is impossible because to know requires that there is a principle of rest or stability which allows the same subject, in the same condition, doing the same action. The assumptions are that there is a mind, and acts of knowing, which accordingly disprove the theses that nothing or everything is changing, by *modus tollens*.

Later in the *Sophist*, Plato confirms his commitment to the reality of change by including it in one of the great classes of being: the "most important of all the genera are those which we were just now mentioning -- being and rest and motion." (254d4-5). Thus the stance which Plato takes with regard to change is that it is one of the *megista gene* of being. But rest and motion will not mix (254d7-8), although "being surely has communion with both of them" because both exist (254d10). Yet the Stranger adds the important attribution that "each of them is other than the remaining two, but the same with itself."<sup>9</sup>

In the *Theaetetus*, Plato divided the of types of change, taking up the question of how many kinds of motion (*kineseos*) can be found, and whether they presuppose each other. Socrates distinguishes between changing place and change "of another kind", which is qualitative change or alteration (181c4-d3). Using this distinction, Socrates again faces the view that *everything* is motion, to ask whether things can move in only one of these ways. Socrates argues that things are moved in both ways, otherwise the flux theorists "would have to say that the same things are in motion and at rest [e.g. the qualitatively changing thing being at rest while it moves], and there would be no more truth in saying that all things are in motion, than that all things are at rest" (181e5).

Socrates also examines the flux theorists' explanation of the generation (*genesin*) of qualities in a thing, according to which the quality "is moving between the agent and the patient, together with a perception, and that the patient ceases to be a perceiving power and becomes a

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<sup>9</sup>See Taylor (1948, p.388)

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percipient, and the agent a quale instead of a quality"(182a5-9; cf. *Theaetetus* 157). The agent exists as the particular aesthetic impression which the patient perceives, and the patient is simply the perceiver. Socrates emphasises that "neither the agent nor patient have any absolute existence, but when they come together and generate sensations and their objects"(182b3-5), their nature comes from their role in the communication of aesthetic impressions. But then, how can the advocates of this view hold that all things are in motion/flux? If all things are not both altering and moving in place, then they must be altering or moving in some qualified way: however, Socrates asks whether since not even white continues to flow white, and whiteness itself is a flux or change which is passing into another colour, and is never to be caught standing still, can the name of any colour be rightly used at all? (182d1)

Surely not, he argues, Socrates's interlocutor Theodorus agreeing that *ex hypothesi* "either in the case of this or of any other quality ... while we are using the word the object is escaping in the flux"(182d6). What, then, are the particular mechanics of Platonic change? In the *Phaedo*, Plato defends the thesis that change occurs between opposites, a view we are familiar with from his predecessors. The particular case which Plato examines is the change between larger and smaller, of which Plato says (and Cebes agrees) that all things come to be as "opposites from opposites" (71a10; Gallop, trans.). Between these, there are two separate processes, increasing and decreasing (71b3-4; Gallop, trans.). But crucial to the role of opposites in change is that the opposites are opposite *forms*, Plato's name for universal objects of reference which are imitated by the objects of experience, thus giving a nature to those objects we perceive. An instance of how this putative ontological relation works is given later in the *Phaedo*, in the discussion of the change from largeness (*megethos*) to smallness (*simkrotêta*). The interlocutors have agreed with Socrates that the ideas exist and that experienced things participate in them, deriving their names from the forms, and they have reached a problem because Simmias is both greater than Socrates and smaller than Phaedo. This requires saying that Simmias is both greater and smaller, participating in both the forms of the great and the small, which would presumably rule each other out as opposite attributes (102b4-6). Simmias is not greater than Socrates because of anything about Simmias in himself, but because of his size, and the same criterion establishes his comparison to Phaedo.

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If the comparison is established in this way, then it is the size of the characters which determines the descriptions appropriately said of Socrates, Simmias and Phaedo. Thus it is possible to argue

not only that absolute greatness will never be great and also small, but that greatness in us or in the concrete will never admit the small or admit of being exceeded: instead of this, one of two things will happen-either the greater will fly or retire before the opposite, which is the less, or at the advance of the less will cease to exist (102d6-e2).

Thus Simmias remains as he is, but in the comparison of size to Socrates then Phaedo, the form used to describe Simmias changes from greatness to smallness as the form of greatness retreats into oblivion when the relation to the other individuals changes. For example, in relation to Socrates, Simmias is larger, and Simmias is an instance of something participating in the form of largeness. The form of largeness does not become small, because no opposite can become its opposite; instead, it "goes away *or* it perishes"(103a1-2; Gallop, trans.).

Thus criteria are established about the change between opposite ideas used to describe the objects of experience. One aspect of the replacement of opposites which is emphasised earlier in the *Phaedo* is the "perpetual reciprocity in coming to be". Plato says that:

If there were not perpetual reciprocity in coming to be, between one set of things and another, revolving in a circle, as it were -- if, instead, coming-to-be were a linear process from one thing into its opposite only, without any bending back in the other direction or reversal, do you realize that all things would ultimately have the same form? (72a12-b5; Gallop, trans.).

Plato says that if perpetual reciprocity is not the case, coming to be would stop because the same fate would come to all types of coming-to-be things. There is an apparent fallacy of composition in this argument, because Plato hastily generalizes from one case of a kind to say that it would hold true of all cases, as in the examples of everything going to sleep if there were no reverse process of waking up; but why must all things change in this way? Certainly some changes are suffered by all things, but the career of each individual overlaps with the careers of the other individuals. Socrates particularly reaps the benefits of this argument for the sake of the conclusion he is defending in the *Phaedo* that there is an afterlife: if perpetual reciprocity is not true, all things would ultimately be dead (72b8-c3). Yet the overlap has so far allowed that not all things are dead at the same time.

In the *Timaeus*, Plato brings these various strands together to provide an explanation of generation and change. Early in the dialogue, Timaeus states the question he wants pursued: "What is that which

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always is and has no becoming; and what is that which is always becoming and never is?"(27d5-28a1) Timaeus argues that everything which becomes requires a cause, or it could not become. But then, the things which become will differ according to whether the maker fashioned them after the unchangeable Forms, or after created things, which are forms in the objects of experience which participate in the eternal forms. But was the world created? It must have been, because it is sensible and tangible, having a body.<sup>10</sup> Such things "are apprehended by opinion and sense and are in a process of creation and created"(28a1-4). Because the world was created, Timaeus asks whether this occurred on the pattern of the unchangeable forms, or the created forms. Because creation is good, and the creator of the world is the best creator, the pattern of the world must have been the unchangeable forms, for they are more perfect than the changeable forms.

And having been created in this way, the world has been framed in the likeness of that which is apprehended by reason and mind and is unchangeable, and must therefore of necessity, if this is admitted, be a copy of something (29a5-b1).

Thus we have it that the transcendent Forms are a model for the creation of the world, and the world imitates them.

Timaeus then argues that significance needs to be placed on the fact that the beginning (*arxasthai*) of creation should be caused according to nature (*kata phusin*) (29b2-3), and thus he insists that the account (or "words" by Jowett for "λόγος") must capture the things described. That is, the account made through the use of the forms is unchangeable, since they are objects of intelligence; but the account of the objects of experience is only probabilistic and by analogy (29b7-c2). For analogous relations hold: as "being is to becoming, so is truth to belief (29c3).

Later in the *Timaeus*, the speaker decides that not only the intelligible objects and the objects of experience populate the world, but there is also a third type (genus<sup>11</sup>) of thing. This new type of being has the nature which Socrates calls the "receptacle, and in a manner the nurse, of all generation"(49a4-b1). Plato argues tht this nature is needed because it is required to distinguish the fundamental elements (fire, earth, air and water) from each other, because of their cyclical transformations.

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<sup>10</sup>This issue arises again in Aristotle's theory of generation, according to which a generated object must be composed of material and formal parts; this topic is an issue of chapter III.

<sup>11</sup>"Genus" designates a kind in this text, but Plato calls the other two kinds "*eidê*" in the same sentence (48e3-4).

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Thus, then, as the several elements never present themselves in the same form, how can any one have the assurance to assert positively that any of them, whatever it may be, is one thing rather than another? No one can.(49c7-d3)

So Plato argues that instead of using the sortal language by which we designate individuals as a "this [τόδε]" or "that [τοῦτο]", we must speak of elemental stuff as a "such [τοιοῦτον]", i.e. of such a nature (49d4-e2). We must refer to such things in this way because "they are too volatile to be detained in any such expressions as 'this,' or 'that,' or 'relative to this,' or any other mode of speaking which represents them as permanent."(49e2-4)<sup>12</sup>. Yet there is something in which the elements grow up, which can be called a "this" or "that": Plato is here speaking of the thing underlying the elements and their cyclic changes, which is their receptacle. G.E.R. Lloyd comments that Plato's "most notable contribution to the physics of his day lies in his doctrine of the ultimate constituents of matter. ... He distinguishes *what* comes to be from that *in which* it comes to be, calling the latter the 'receptacle' of becoming.(1970, p. 74) Not only does the receptacle underlie the cyclical changes of the elements, but also it underlies all changes: Plato refers to it as the "universal nature which receives all bodies [τῆς τὰ πάντα δεχομένης σώματα φύσεως]", which is always the same so as not to affect the nature of the forms which she receives (50b6). These forms are copies (50c4-5) of the Forms we examined from the *Phaedo*, the eternal realities of which empirical objects are an imitation. Thus Plato argues that we must admit three natures, the generated material thing, the receptacle in which the generation takes place, and the Form which is a pattern for the generated thing.

Thus we have examined the antitheses faced by Plato and the synthesis which he provided to the problem of change. In the next section, we will explore the principles Aristotle defends for the study of nature in general, and the science of change in particular. We will find in his theories developments of the Pre-Socratic and Platonic theories, particularly of the theories of opposites, and the need for a subject of change in the posits of the theory, which can take on the opposite qualities which the change is between.

### ii. Change: the Principles of Nature in *Physics I*

Aristotle develops his philosophy of nature in the *Physics*, introducing the study with an explanation of how he will proceed: we

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<sup>12</sup>See Skemp 1986.

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must find the principles according to which natural philosophy is to be undertaken. He says:

In all disciplines in which there is systematic knowledge of things with principles, causes, or elements, it arises from a grasp of those: we think we have knowledge of a thing when we have found its primary causes and principles, and followed it back to its elements. Clearly, then, systematic knowledge of nature must start with an attempt to settle questions about principles (184a10; Charlton, trans.).

The Philosopher then proceeds to scrutinise the principles according to which his predecessors have studied nature, agreeing with them that some sense of opposition is necessary, (188a19)<sup>13</sup> in order to explain how things are acted upon (189b19). But the question of the number of principles is still difficult, because numerous questions arise about the number of principles; and whatever the result, about how the principles encompass the opposition needed for becoming.

Aristotle starts his own solution to the number of principles in *Physics* I.7. In order to identify the principles by which natural things are explained, Aristotle insists on first distinguishing different types of 'things coming-to-be [ $\gamma\epsilon\nu\acute{\epsilon}\sigma\epsilon\omega\varsigma$ ]': the thing which comes-to-be can be either simple or compound. The three examples given are that "A man can come to be knowing music, and also the not knowing music can come to be knowing music, or the not knowing music man a man knowing music"(189b34-189a1; Charlton, trans.). Of these, the first two pairs each contain simple coming-to-be things and things which come to be, which are the subjects and the results of coming-to-be. However, the pair contained in the third example are compounds. Apparently, the distinction is based upon whether the *prima facie* descriptions are terms taken singly or in combination.

In these cases we have changes between contrary attributes. Yet Aristotle points out that in some but not all cases we say that the thing which comes-to-be arises *out of* something else, "for instance, knowing music comes to be out of not knowing music"(190a6-7; Charlton, trans.). But in other cases more detail is required to explain coming-to-be. For example, a man comes to know music, but knowing music does not come to be a man. These accounts apparently mark a change in Aristotle's theory, because we must note that a privation/negative term is what is given as the thing out of which the change arises: Aristotle said in

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<sup>13</sup>This view is often repeated, e.g. "for opposition is always the source of change"(On Length and Shortness of Life, 465b18).

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*Categories* 10 that "change occurs from possession to privation but from privation to possession it is impossible; one who has gone blind does not recover sight nor does a bald man regain his hair nor does a toothless man grow teeth"(13a32-6; Ackrill, trans.)<sup>14</sup>. The discrepancy is explainable, however, by appeal to a distinction made earlier in *Categories* 10, according to which Aristotle says that "with contraries it is possible (while the thing capable of receiving them is there) for change into one another to occur, unless the one belongs to something by nature as being hot does to fire" (13a19-21; Ackrill, trans.). That is, one can preserve the consistency by arguing that one who has gone blind, which is from a possession to a privation, cannot regain their sight *by nature*. Instead, the case of "knowing music" (or being educated) comes out of "not knowing music" (or being uneducated) because these are called "contraries"<sup>15</sup>, which are opposites said of something else as subject (11b33), of which at least one must be true of the subject (11b38). However, the case is different for possessions and privations: one of the pair must be true of the subject "at the time when it is natural for it to have them"(12a301-3; Ackrill, trans.). There is no natural schedule for knowing music in the way that there is a natural tendency to be hairy or sighted; nor is there an intermediate the possession of which allows the subject to be neither bald nor hairy/blind nor sighted. Yet they can be neither musical or unmusical (although they are likely to be one or the other). Thus the discrepancy is solved by distinguishing the types of opposites (*ton antikeimonon* of 13a32-6): between some opposites, such as privation and possession, generation is impossible; between others, such as contraries, generation is common.

Aristotle concludes the earlier discussion from the *Physics* that in all cases of coming-to-be there is a subject (something underlying -- *hupokeisthai*) which comes to be, which is not one in form (*eidei*) or account (*logôi*).<sup>16</sup> For each 'coming to be', that is, we will find that its nature is compound, although in some cases we speak of the changes as

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<sup>14</sup>It is logically possible that such a change could occur if there is generation from an intermediate, as (Aristotle argues) vinegar does not come from wine, but from the water into which the wine decays. This issue will arise, below, in the discussion of substantial generation, and the birth of humans from the seed and *katamenia*; and in the issue of genus as matter of the differentiae.

<sup>15</sup>They are not affirmations or denials because these are statements, and "none of the things underlying an affirmation or negation is a statement"(12b8; Ackrill, trans.).

<sup>16</sup>See Scaltsas (1994), ch. 3; and ch.5, p. 108.

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simple becomings. In an amplification of this Aristotle explains that when a man becomes educated (or "musical"), both the underlying thing, i.e. man, and the man's ignorance, undergo a change: however, the man remains after the change, and the ignorance does not (190a19). Rather, the ignorance is given up in favour of or replaced by educatedness; similarly, the ignorant man does not remain (190a21). This is explained by the fact that the subject which undergoes change is not only the stuff which suffers the change, but the subject is also of a nature (190b17, 191a8-12) which is deprived of the quality which the change makes it have. These two characteristics entail that the subject is not one in form (*eidei*) or account (190a15-17; 190b12; 190b22-3). They are not one in form because giving an account of the man is different from the account of the lack of education in a man: the lack is something added on.

This leads directly into a controversy in the interpretation of Aristotle's theory of change and philosophy of nature, concerning the persistence of the underlying thing through change. As mentioned, Aristotle at lines 190a5-7 says that in some but not all cases there is something out of which the natural thing comes to be: the counterexample is that educatedness does not come to be out of man, although a man becomes educated. However, the main conclusion thus far is that there must always be a subject that comes to be and persists through the change. We are faced with an antinomy between a subject which does not endure, and the persistence of the subject. Charlton argues that the subsequent passage shows that the subject need not persist: the usual (*mallon*) meaning of change is between opposing predicates, such as becoming educated from being uneducated (190a22ff). However, "we sometimes speak thus about things that do remain: we say that a statue comes to be out of bronze, not that bronze comes to be a statue"(190a24-6; Charlton, trans.). And of the compounds, Aristotle says that we speak similarly, e.g. that a man who is uneducated becomes a man who is educated. This does not require us to say that there is a persisting subject in all cases, but does require us to say that sometimes there is a persisting subject. Charlton offers three main counter arguments to the thesis that something always remains through a change: first, it conflicts with Aristotle's argument in *On Generation and Corruption* I.4 319b21-31, that if anything did remain in all cases, there would be no such thing as 'coming into existence' (or generation), but only qualitative alteration

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(1972, p.75-7). Second, Aristotle could have relied on the resources introduced in the *Physics* to deny universal persistence: at I.5 188b3-6 he argued that things pass away into their opposites, only later becoming qualified in some other way; substances only pass away, because they don't have opposites. Third, the mystery of the identity of the thing *out of which* the change arises is not solved in *Physics* I.7, but is solved elsewhere: not only in the *Physics* (VII.3 245b9-246a4<sup>17</sup>) but in the *Metaphysics* Aristotle argues that "what a thing comes into being from should change, and not remain" which leads the Greek speakers to say not that the statue is wood, but that the statue is *of* (in the sense of "out of") wood (Z.7 1033a16-23; Bostock, trans.)<sup>18</sup>.

Bostock, on the other hand, argues that "there is always something that persists through any change, and it seems to me that the text is quite unambiguous on this point"(1982, p. 188). Appealing to 190a13-21, he argues that "*Qua* underlying thing it [the object which changes] persists throughout the change, in the sense that we have the same man at the end as we had at the beginning, but it can now be described rather as a musical thing"(1982, p. 184). To justify his reading of *Physics* I.7, Bostock offers an *a priori* argument from the nature of being a composite: Aristotle says that whatever comes into being is a composite; of the elements of the composite, one must persist which is the underlying subject, while the other element is the acquired form; if this were not so, reasons could not be found for calling the result a composite.<sup>19</sup> Bostock points out that the text upon which he bases his own interpretation follows immediately upon the discussion of substantial generation, which is one of the disputable points in relation to the passage from *On Generation and Corruption*, mentioned above.

To settle the question, we will examine the argument about generation from *Physics* I.7. The discussion of substantial generation in particular starts at 190a31, in which Aristotle says that the only things that are properly said to come to be simply are substances.<sup>20</sup> "In the case of other [τᾶλλα] things", Aristotle says, "it is plain that there must be

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<sup>17</sup>Referred to by Charlton (1972, p. 74-5).

<sup>18</sup>Charlton notes that the opinion which he is opposing is also common to scholars who argue in favor of an Aristotelian prime matter, i.e. a completely indeterminate stuff (1972, p.77). We will return to this topic in a later chapter. Mary Louise Gill refers to James Lennox's emphasis on the "bronzen" locution used to describe a statue (1989, 121n22).

<sup>19</sup>Cf. GC I.10.

<sup>20</sup>Aristotle states that "becoming [γίγνεσθαι]" is another "πολλαχῶς λεγόμενον"(190b31).

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something underlying which is the coming-to-be thing"(190a33-4): for the coming to be of any item in a category other than substance, an underlying subject is required, because only substances are not predicable of anything else. However, substances come to be out of subjects, too: Aristotle gives the example of the seed from which plants and animals come to be, and describes the various types of changes which occur to the seed to provide the results. Bostock's interpretation that Aristotle's argument for a pre-existing subject is empirical, is correct; the list of types of changes which give rise to substances is as follows:

Type of Change	Example
change of shape	a statue
change by addition	things which grow
change by subtraction	as a Hermes comes to be out of the stone
change by composition	a house
change by alteration	things which change in respect of their matter

What can be concluded from this? The examples are examples of the results of change, providing us with organic substances in the second case (and the fifth case, as we shall see in a later section), and providing us with artefacts in the other cases. Like plants and animals coming from seed, we are explicitly given the subject in the third case (and possibly the fifth). Aristotle's conclusion, as mentioned by Bostock, is that "From what has been said, then, it is clear that that which comes to be is always composite" (190b10) but does it follow that an identical<sup>21</sup> subject persists throughout the change? My reasons for thinking this isn't so are three. First, at 190a33-4, the modifier "τᾶλλα" suggests that a contrast is being drawn between things which come to be (i.e. substances) and things which come to possess an attribute, which he proceeds to examine: the latter group are the only ones that he says must have a persisting subject. Second, the "things which come to be something" seem to be the only ones governed by the modal operator "ἀνάγκη", i.e. the things which necessarily have an underlying subject which is the coming to be thing. Finally, in no case does Aristotle say that the subject persists in all cases, but only that a subject of change as *terminus a quo* is required in all cases. Thus, my interpretation is consistent with that of Charlton, according to which there is a subject of change but not always a subject which persists through the change.

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<sup>21</sup>Bostock states that it is "the same" (1982, p.184).

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Thus, the most that we can conclude from this is that for any change, there is a *hupokeimenon* from which the change occurs, whose privation of a positive characteristic results in the possession of that positive characteristic at the end of the change. Rather than a 'nurse of all generation', we find Aristotle's subject of change to be the grounding of all qualitative changes. We cannot conclude from his description that this nature is indeterminate; on the contrary, it is at least a principle operative in the natural world.

In the next section, we will explore Aristotle's further characterisations of these factors as matter and form.<sup>22</sup>

### iii. A First Mention of Matter and Form

Aristotle continues *Physics* I.7 with the summary that in the circumstance of a change, "there is one thing which comes to be, and another which comes to be this, and the latter is twofold: either the underlying thing [ὑποκείμενον], or the thing which is opposed"(190b10-13; Charlton, trans.) Aristotle distinguishes between types of thing that come to be the outcome of the change, as he does in the *Metaphysics*, because of the types of change involved, giving a man and bronze as examples of underlying things, and uneducatedness, or generally formlessness, as opposites from which the change occurs. Now in *Physics* I.7, Aristotle is attempting to give an account of the number and nature of explanatory principles, for these are required by the natural scientist/philosopher. His first answer to the number of principles is that "if there are causes and principles of things which are due to nature, ... each as we say when we give its *reality* [οὐσίαν], everything comes to be out of the underlying thing and the *form* [μορφῆς]"(190b17-20; Charlton, trans.). These are the *prima facie* principles, because the thing we are attempting to explain displays them to us as the aspects of its reality which are in need of explanation<sup>23</sup>. Aristotle's example is the educated man, who is composed of man and educatedness: the natural scientist must be able to explain their co-presence in the same object.

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<sup>22</sup>How could the subject persist? M. L. Gill argues that the elements exist as part of the substance in potentiality (1989); evidence for this includes 414b28. This topic will be examined in Chapter 6.

<sup>23</sup>We will examine the Z.6 argument that the matter and form are a unity in Chapter VI §iii.

## Chapter I

Yet Aristotle immediately qualifies the "two-principle" thesis according to the research examined above: the subject, i.e. man, is one in number, but two in *form* (*eidei*) (190b24). Here a distinction is needed between on the one hand the matter (*hulê*), which is "more of a this thing here [τόδε γάρ τι μᾶλλον]"(190b25-6; Charlton, trans.)<sup>24</sup>, and on the other hand the privation, lack or opposition, "which is supervenient". The latter is the component which does not remain, and is replaced by the positive form, which is a unity: Aristotle says that "it is the arrangement, or the knowledge of music, or some other thing said of something in the same way"(190b29-30; Charlton, trans.). The material subject is enformed in some respect, which is deficient in what it is to become; but this deficiency is lost through change by the addition of the opposite of the privation: for example, my (I) reading of Aristotle's *Topics* causes a change between my (I) being ignorant of dialectics (II) to my (I) being knowledgeable about dialectics (III): a change from (I & II) to (I & III).

Thus Aristotle revises the count of principles: in one sense, they are the opposites, i.e. the privation and the form. But Aristotle notes that they cannot, as opposites, act upon one another (190b33). Thus, they are insufficient to explain change<sup>25</sup>. However, in another sense, the principles are three. Incorporating the opposites, plus the material subject which he has previously introduced, Aristotle has the technical model with which to explain the change of natural things<sup>26</sup>. The material subject provides the missing component because it is something other than the opposites, but provides the basis according to which the opposites are explanatory. Recall Aristotle's argument that a distinction is needed between simple and compound subjects: by treating the compound subject as the material object with a privation -- the two not being identical (191a1-3) -- change is explained as the phenomenon in which the privation is lost

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<sup>24</sup>Emphasis must be placed on the "more of a" locution in this phrase, because Aristotle will commonly say that the matter is less determinate than the thing, knowable best on an analogy with artefacts, as we shall see. This opposes the Platonic principle from the *Timaeus* according to which the subject or receptacle is referred to as a "this"(*tode*).

<sup>25</sup>This is an important argument against the physicists and the view of the world's construction given by Plato, who said that opposites *give way* to opposites; important is whether they are thought to encounter one another, which seems to be what Aristotle denies. The 'receptacle' is thought to be a later development in Plato's theory. A variation on the same theme will be addressed more thoroughly in Chapter VII, in relation to the possibility of reductionism. See also Mary Louise Gill's "horizontal" paradox in Gill (1989).

<sup>26</sup>See also Code (1976), Cohen (1984), Dancy (1978), Gill (1989) and Miller (1978) about the introduction of matter as a natural principle, and its persistence through change.

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in favour of its opposite, as occurs when the pages of my book change from flat to dog-eared. Indeed, Aristotle notes that one of the opposites is all that is needed to "effect the change"(191a6-7), plausibly because the privation is part of the subject, the new qualification or form being added as a result of the change.

We are then given some guiding principles to aid the understanding of subjecthood. Aristotle argues that the "underlying nature", call it "UN" must be grasped by analogy with man-made artefacts:

AS bronze	is to a	statue
wood	is to a	bed
preformed matter	is to a	thing with a form
the formless thing	is to a	thing with a form, SO
this UN	is to a	reality/substance
this UN	is to a	this thing here
this UN	is to	what is (τὸ ὄν) (191a8-12)

The principle according to which these things are analogous is that each exemplifies how the substantial individual is related to its component stuff, as abstract parts into which the substance can be analysed. For example, the statue is *wooden*, as noted above. Apparent from the table is that the underlying nature is not identified with substance. This is stated in the text which follows the analogy: the subject "neither is, nor is one, in the same way as a this thing here"(191a12-3; Charlton, trans.), while being enformed it is more of a 'this thing here' than the privation.

The statement is also made that "another principle is that of which we give the account", which is the principle of the form: it is generated in the subject with the privation. The underlying thing *becomes* the subject with the form, or becomes the form itself, as we shall see in cases of generated organic substances: the actual occurrence of a form is transferred to the recipient of the change. The dual nature of the privation and the opposite form is the explanation why Aristotle says the subject is "two in form"(190b24; see above). In a change, an explanation is required for the subject's possession of a form, when prior to the change there was a subject -- not necessarily the same subject, but at least an enformed material as argued above -- with the lack or privation of that property. The co-presence of the acquired form and the subject is to be explained by the principles thus enumerated: the actual form in the agent is transferred to the patient, who was potentially able to take on that form.

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Yet we must also be careful to distinguish the possibilities which the underlying thing presents to us: in one sense, it is the substratum of change, which could survive the change to the possession of a new quality. For example, in the change from Theaetetus standing to Theaetetus flying, Theaetetus remains as the constant subject of the change, to which the change is predicated as an accidental unity. Yet in the change of the underlying thing to a new generated thing, the substratum is the grounds of generation which disappears with the generation of the new thing. Henceforth, I will systematically distinguish these uses of 'ὑποκείμενον' by translating them differently: the 'ὑποκείμενον' of a change which does not persist is the substratum, whereas the 'ὑποκείμενον' of a change which does persist is the subject. Aristotle draws precisely this distinction in *Metaphysics* Z.13, in which he argues that the ὑποκείμενον underlies in two senses: "either being a this (as the animal underlies its attributes), or as matter underlies the actuality"(1038b5-8). By the 'this', Aristotle means the particular substance which takes on new forms as accidents; the 'actuality' is the substance which as composite requires the matter as the potentiality it fulfils. This distinction proves most important because of the types of description which can be given to the results of a change: an accidental change is said of the subject, such as the tarnishing of a non-tarnished bronze statue; whereas the generation of a substance will occur from a substratum as matter, such as the generation of an oak from an acorn -- and for the purposes of this treatise, the generation of a substance will occur from the potentialities of a genus, as will be demonstrated, below.

Aristotle concludes *Physics* I.7 with the summary that: "Whether the form or the underlying thing has the better claim to be called the reality, is still obscure; but that the principles are three, and how, and what the manner of them is, is clear"(191a19-22; Charlton, trans.). Aristotle is treating the nature of substance as an open question, at this point, because other principles are needed for an explanation of this; as we read, Aristotle says that the subject is not a "this thing here", which under the name of "τὸ τὸδε τι", "particular substance", or "this something", is elsewhere taken to be a criterion and designation of substance. For example, the primary examples of substance in *Categories* 5 are the individual man and the individual horse, and each of these things "is neither said of a subject nor in a subject"(2a12-13; Ackrill, trans.). Rather, they "signify a certain

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'this'"(3b10; Ackrill, trans.). Yet Aristotle argues that it "seems most distinctive of substance that what is numerically one and the same is able to receive contraries", which fits exactly the notion of subjecthood which we have been examining (4a10; Ackrill, trans.). Aristotle will continue to leave open the question whether the subject is substance, addressing the issue in *Metaphysics* Z: the criteria of separability and being a "this something" are defended in Z.1, and a problem for the candidacy for substance of the substratum is raised in Z.3 because matter is indeterminate.

Thus we have examined Aristotle's defence of the principles required for explanation in natural philosophy. The principles are the underlying thing, privation and the form. By underlying thing Aristotle means a material subject. The lack of a certain quality by the subject is the privation, a lack which is removed by the presence in the subject of the opposite of the privation, a form, which it has as a result of the change. In the next section we will examine directly the account of change in terms of these principles which Aristotle provides in *Physics* III.1, with an important additional distinction, that between actuality and potentiality.

**Chapter II**  
**Genus in the Explanation of Change: The Definition of Change**

Change is something difficult to define: attempts to define it, to narrow it down to a thing, property or event often seem intuitively implausible, and they seldom hold up to logical scrutiny. The problem arises not only because change seems to be one of the most basic things confronting the perceptual observer, an abstract class encompassing everything from the sequence of different coloured patches confronting my retinas, to the differences in my affective response to the *Sex Pistols* over a period of years. The so-called "Cambridge" theory of change has it that change is the difference in truth values holding of propositions which ascribe a predicate to a subject: if at one time, it is true that  $p$ , say, that Gollum has the ring, and if at another time, it is false that  $p$ , because it is not the case that Gollum has the ring, then a change has occurred (*Principles of Mathematics* §442). We can accept that if the antecedent is true, then the consequent of this explanatory scheme follows; but as an explanatory scheme, it doesn't seem to capture what one is after. The explanation of change in terms of truth values takes the truth values to be more fundamental than change -- at least if the definition is to work -- which renders the description more aptly one of "logical change" than the changes one would like to see in one's lifestyle, standard of living, etc., i.e. dynamic occurrences which result in a different state of affairs, explained in a way which preserves the dynamism.

**i. Aristotle's Definition of Change: Physics III.1**

At least two reasons can be given for Aristotle's interest in explaining change. As examined in the first chapter, Aristotle thinks that in natural philosophy, the enquirer must provide her first principles, and the views which had been provided by Aristotle's predecessors and contemporaries had it that change was impossible -- the view of Parmenides -- or that change was a first principle, the (arguably) Heracleitian view. So one requirement for Aristotle as a scientist was to defend his principles against these others. Yet because his principles were different, he was also philosophically obliged to explain the conditions under which change occurs.

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Clearing away the monist view that the true principle is one and unchangeable, Aristotle provides an argument which appeals to the possibility of a science. He offers an analogy:

Just as the geometer has nothing left to say to the man who does away with the principles of geometry, but must refer him to a student of something else, or of what is common to all studies, so it is when we are inquiring into principles: there will be no principles left if what is is one thing only, and one in this way (184b26; Charlton, trans.).

The Eleatic monists argued that change is only apparent, and as such, the true principles are unchangeable. But if so, according to Aristotle's argument, they have no contribution to make in natural philosophy, for which the domain is things which change. Thus it proved necessary for a different conception of change to be formulated, according to the proper first principles. This is what Aristotle endeavours to provide in the *Physics*. He states that "For ourselves, we may take as a basic assumption, clear from a survey of particular cases, that natural things are some or all of them subject to change."(185a11; Charlton, trans.)

In *Physics* III.1, Aristotle states and subsequently repeats his definition of "κίνησις", translated as both "change" and "motion"<sup>1</sup>, as follows: "ἡ τοῦ δυνάμει ὄντος ἐντελέχεια, ἣ τοιοῦτον, κίνησις ἐστίν"(201a10-11). The meaning of this sentence has been the subject of controversy for millennia, largely because of the ambiguity surrounding the term "*entelecheia*", which can mean "actuality" or "actualisation". In the outcome of each particular interpretation, the scholar must address whether the term that "*kinêsis*" means to us refers to a state or to the product of a process, (the actuality) or to the process itself, (the actualisation). Thus we find different translations being given of the same passage, among the standard editions of the *Physics*: Ross translates the phrase that motion is "the actualisation of that which is potentially, as such"(1964, p. 81); Hussey translates the passage that "the actuality of that which potentially is, *qua* such, is change"(1983); Hope gives us the following translation: "the functioning of what is potential as potential, that is 'being in movement'"; similarly, Hardie and Gaye in the Oxford Translation render the sentence as "The fulfilment of what exists potentially, in so far as it exists potentially, is motion". Apparent from these sources is the fact that a tremendous controversy surrounds the interpretation of Aristotle's theory of change.

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<sup>1</sup>(Waterlow) Broadie points out that "μεταβολή" is Aristotle's most general word for 'change', which he distinguishes from "κίνησις" in *Physics* V.1.

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Before providing my interpretation of this definition, and of the theory of change in general, it is worthwhile to mention the stakes of the debate. First, if one interprets the "*entelecheia*" to mean 'actualisation', which is a process, then Aristotle's definition is putatively circular. A definition of 'change' as 'actualisation-process' is question-begging because the term defined and (at least one term in) its definition both denote processes, change being the process from one state to another. For example, one could argue that the notion of 'potentiality' presupposes the ability to change, so cannot be used to define change. Yet the definition of change in terms of its products seems susceptible to problems of its own. If we define 'housebuilding' in terms of the house which is the result, we don't have a definition of the change because the change is *what results in* the result: Aristotle apparently agrees with this, saying "when the house is, the buildable no longer is"(201b11). Similarly, if we regard change to be not a process, but a circumstance or state, i.e. one form of actuality, we seem to have missed the mark: change is not 'static', but 'dynamic', involving a difference of something, rather than simply a stable condition. This would seem to solve the problem of defining a process by another process, but would then misrepresent the initial term to be defined. And the same problem would arise if the *entelecheia* as product was defined by another product or end state. We would seem to be talking about something other than change. So it seems that Aristotle's definition is either circular, if one adopts the process view; or static, if one does not accept the process view. In this section, I will defend the process interpretation; in the next, the circularity objections.

In the argument preceding Aristotle's definition of "*kinêsis*", he establishes the context in which he discusses change. First, of things there are, some are only "*τὸ ἐντελεχία*", some are both "*τὸ δυνάμει καὶ ἐντελεχία*".(200b26)<sup>2</sup> (These terms will have to remain untranslated as long as possible, although I will introduce a variation of the potential/actual distinction which is important to Aristotle's philosophy). Things which can be described thus fall under all of the categories of being: Aristotle mentions the 'this' (*to tode ti*), quantity (*to tosonde*), and the

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<sup>2</sup>With Kostman, we must note that in the *Metaphysics*, Aristotle says that there is something which is only in potentiality, i.e. the infinite (p.8; see *Physics* 206a9-b20). Also, the soul (*De Anima* II.1) and Prime Mover are described in this way.(Cf. *Metaphysics* Λ). Yet in *De Anima* III, Aristotle switches to describing at least parts of the intellect as *energeiai*.

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kinds of qualification (*to toionde*). The categories are called genera of being in *De Anima* II.1 (412a6, although not listed by name). Yet we note the dependency of the other categories on substance, whether abstractly as properties which could hold of secondary substances like "man" or particulars holding of individuals like Archytas.

Noting that change in the category of 'the relative' poses a difficulty, Aristotle provides three examples: change between excess and deficiency, active and passive, and of "that which is productive of change and that which is changeable"(200b30). Here the "that which" locution is important: rather than providing an "obscure"<sup>3</sup> point, Aristotle is affirming that the relations hold between *things* which stand in relations, of which at least one of the items standing in a relation must be an *entelecheia*.<sup>4</sup> Thus, change will be defined in the context of the *dunamis* and *entelecheia* distinction, but governing all of the categories.

That items falling under the categories are the exclusive class forming the domain covered by the definition of change is proved by the subsequent argument, the conclusion of which is that "There is no change apart from actual things"(200b32). Aristotle offers two reasons for this: first, alteration (*metaballei*) is always of some respect, either "of substance, or of quantity, or of qualification, or of place"(200b33). This is the positive thesis. Yet from the opposite point of view, there is no common type of change which is not *of* something else which belongs to the categories: that is, there is no universal *kinêsis* standing outside the categories. According to Aristotle, "nothing is, apart from" the categories (201a2). Thus the definition of change will cover the domain of the categories, not existing outside of them as a separate entity or type of entity. We find thus a fundamental difference between Aristotle's theory of change and the Heraclitean theory of change, which is the theory that flux is the basic constituent of reality, and the Platonic thesis that change forms a class of things with a formal nature existing beyond particular material objects.

As mentioned, the list of categories in which change occurs is revised in *Physics* V.2. Hussey comments that the restricted list refers to the primary changes, for which Aristotle argues in *Physics* V.2 that

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<sup>3</sup>Hussey 1983, p. 58.

<sup>4</sup>In Ch. 7 of the *Categories*, Aristotle argues for the conclusion that "if someone knows any relative definitely he will also know definitely that in relation to which it is spoken of" (8a35; Ackrill, trans.).

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changes in the other categories presuppose changes in these categories (1983, p.57)<sup>5</sup>. Aristotle argues as follows:

In respect of Substance there is no motion (κίνησις), because Substance has no contrary among things that are<sup>6</sup>. Nor is there motion in respect of Relation: for it may happen that when one correlative changes, the other, although this does not itself change, is no longer applicable, so that in these cases the motion is accidental. Nor is there motion in respect of Agent and Patient -- in fact there can never be motion of mover and moved, because there cannot be motion of motion or becoming of becoming or in general change of change.(225b10)

Motion and change occur to things for which there are contraries, which Aristotle enumerates later in V.2. Motion in respect of quality is called alteration which occurs in the respects in which the thing can be acted upon, although Aristotle stipulates that he does not mean alteration of the properties called *idia* which are peculiar to a substance. Motion in respect of quantity is called increase or decrease, both of these covering the magnitude of a changeable thing. Motion in respect of Place is generally called locomotion. Aristotle summarises that it is only in these respects that motion or change properly occurs, the other cases being coincidental upon changes in these respects.<sup>7</sup>

Thus far, we have a reaffirmation of the view of the categories as the things which are, of which change is not one. However, Aristotle introduces change into the scheme by means of the further distinction, that between form (or "shape"; *morphê*) and privation (*sterêsis*), which was examined above. He argues that each item from the categories is attributable to things in both of these ways: for any item in the categories, either that item, or its lack, is to be found in the object. The distinction is more suitable for items outside the category of substance, so Aristotle's examples include: white and black are the form and privation (of light) in the category of qualification; complete and incomplete are the form and privation (of number) in the category of quantity; above and below are relative form and privation in the class of place, etc. Based on the examination of the principles, above, we know that Aristotle agrees that change involves the passage between the privation and the form -- in texts as early as the *Categories*, Aristotle argued that "with contraries it is possible (while the thing capable of receiving them is there) for change

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<sup>5</sup>In *Physics* VI.10 Aristotle presents his argument that a change is definite.

<sup>6</sup>This statement behooves Aristotle to provide for us an account of substantial generation and destruction, which we will examine in chapter III.

<sup>7</sup>Indeed, in *Physics* VIII.7, Aristotle argued that change of place is the most fundamental, 'primary', type of change (260a26-260b14); repeated at *On Generation and Corruption*, II.10 336a18-19.

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into one another to occur, unless the one belongs to something by nature as being hot does to fire"(13a17; Ackrill, trans.) -- concluding in the *Physics* context that "there are just as many species of change and alteration as of that-which-is"(201a9; Hussey, trans.).<sup>8</sup> Although consistent with Plato's claim that there is a Form of change, in combination with the commitment to the primacy of substance, and with the denial that there is anything else but the members of the categories, Aristotle's thesis amounts to a denial of the Platonic form of change.

Thus Aristotle gives the first mention of his definition of κινήσις, mentioned above, following upon the "distinction, in respect of each kind [of being], between [being] actually and [being] potentially [διηρημένου δὲ καθ' ἕκαστον γένος τοῦ μὲν ἐντελεχείᾳ τοῦ δὲ δυνάμει]"(201a9-10). This means that change is something said of other things, i.e. things which change, but it is not something in itself. Aristotle gives examples to amplify the point: short of the *qua* phrase, we note that they share a direct analogy with his definition of change, saying

the actuality of what admits of qualitative change, *qua* admitting of qualitative change, is qualitative change (ἀλλοίωσις);  
<the ἐντελέχεια> of what admits of increase and decrease, is increase and decrease (αὔξησις καὶ φθίσις);  
<the ἐντελέχεια> of what admits of coming-to-be and ceasing-to-be, is coming-to-be and ceasing-to-be (γένεσις καὶ φθορά);  
<the ἐντελέχεια> of what admits of locomotion, is locomotion (φορά).(201a11-15; Hussey, trans., my amplifications)

In each of these cases, the example is of a process, a condition which is confirmed in the explanation which follows the cases. In the explanation, Aristotle brings together the notion of *entelecheia* with the changes undergone, emphasising that the explanation he is about to offer makes it clear that change is as he has defined it. He states:

when that which is buildable is in actuality,[ἐντελεχείᾳ] in the respect in which we call it such, it is being built, and this is the process of building; [καὶ ἔστιν τοῦτο οἰκοδόμησις.] and similarly with learning and healing and rolling and jumping and maturing and growing old.(201a15, Hussey, trans.)

In this text, Aristotle seems to say that actuality is a process. Yet this is not unambiguous, because Aristotle must still be translated as saying that the *thing* which is buildable ("τὸ οἰκοδομητόν") is in "ἐντελεχείᾳ". The

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<sup>8</sup>If this translation is allowed, then Aristotle is forced into an inconsistency about being as a genus, because he elsewhere argues that it is not a genus, but *iff* species entail a genus, and "εἶδος" here means species [pl], then being is a genus. (One might render the sentence "change and alteration are forms in the same categories as the states of being".) This topic is taken up from chapter V.

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process of building is the "being built", rather than the *thing* being built or changing. Does the entelecheia mean the thing or the process?

Controversy exists about the translation and meaning of "ἐντελεχεία". For clarification of this term, we must examine a distinction Aristotle introduces in *De Anima* II.5, between types of actuality and potentiality<sup>9</sup>. In *De Anima* II.1, Aristotle distinguishes two types of *entelecheia* by using the psychological example of knowledge: the possession of knowledge by a man capable of knowledge is the actuality of that man's capacity to be a knower; contemplation by a man is the actuality of that man's capacity for knowing because he is using what he knows (412a21ff). The distinction is carefully drawn later, according to which there are two senses each of potentiality and actuality. Aristotle says:

We can speak of something as 'a knower' either (a) as when we say that man is a knower, meaning that man falls within the class of beings that know (τῶν ἐπιστημόνων) or have knowledge, or (b) as when we are speaking of a man who possesses a knowledge of grammar; each of these is so called as having in him a certain potentiality, but there is a difference between their respective potentialities [capacities/δυνατός], the one (a) being a potential knower, because his *kind or matter* is such and such, the other (b), because he can in the absence of any external counteracting cause realize his knowledge in actual knowing at will. This implies a third meaning of 'a knower' (c), one who is already realizing his knowledge—he is a knower in actuality [ἐντελεχεία] and in the most proper sense is knowing, e.g. this A. Both the former are potential knowers, who realize their respective potentialities, the one (a) by change of quality, i.e. repeated transitions from one state to its opposite under instruction, the other (b) by the transition from the inactive possession of sense or grammar to their active exercise (ἐνεργεῖν). The two kinds of transition are distinct.(417a22-417b2; my italics)

The distinctions drawn are between a potential  $\phi$ -er which is so because it can be made to  $\phi$  from its current, non- $\phi$ -ing nature, and a potential  $\phi$ -er which is so because it can be made to  $\phi$  from its current,  $\phi$ -ing nature: it is a  $\phi$ -er which isn't  $\phi$ -ing now. By *qualitatively* changing from a non  $\phi$ -er to a  $\phi$ -er the first potential  $\phi$ -er becomes an actual but non-practising  $\phi$ -er; by *exercising* the capacity to  $\phi$  which the  $\phi$ -er already possesses, the second potential  $\phi$ -er becomes an actual  $\phi$ -er.<sup>10</sup>

The account of change fits within this scheme of potentialities and actualities. If change is "the actuality of the potential *qua* such" in the sense of the potentiality of a kind (a) to actuality as possession of that capacity (b), then change is possessing the power to  $\phi$  after not being able to  $\phi$  at all. But this is qualitative change, as Aristotle said, and *prima facie*

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<sup>9</sup>Kosman argues that 'the degrees of potentiality' must be understood to appreciate Aristotle's definition of motion (1969). Cf. Kostman (1987, p.9).

<sup>10</sup>My understanding of this issue has benefitted greatly from Kosman, 1969 and Charlton 1989. The potentiality / actuality topic will reappear below.

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doesn't cover all of the cases of change: recall that he remarked in the *Physics* that change occurs to items falling under each of the categories of being. Alternatively, if we see change in terms of the second *dunamis-entelecheia* distinction, then change is the actual  $\phi$ -ing by a subject which could  $\phi$  but happened not to be  $\phi$ -ing. This account of change would seem to cover other cases of change, but appears to be *prima facie* too strong: we can say that the qualitative change from being red to being purple of Jeff Goldblum's blood in "The Fly" was a change of colour, but did not involve any "exercise" -- unless, say, reflecting rays of light in waves of various lengths is the exercise of a disposition to appear coloured. We thus find an ambiguity in the account of change, requiring some elucidation.

Recognising this problem, Aristotle continues the analysis of *dunamis* and *entelecheia* with their relation to change: he notes that things in the category of 'affection' (*paschein*) or things acted upon are said to be such things in more than one way. First, the thing acted upon can have a quality removed by its contrary: this is *phthora*, or the destruction of the first quality. For example, learning how to speak Greek is the destruction of ignorance of Greek. Second, 'to be acted upon' may mean to save or preserve what something is potentially by its actual being, when the actual being is the same in kind (*homoiou*). This is the type of affection which Aristotle would call the exercise of a potentiality, being "a transition which is either not an alteration of it at all (being in reality a development into its true self or actuality) or at least an alteration in quite a different sense"(417b6-7). The example used by Aristotle is seeing, which does not involve a change in the eye in order to occur. This is the *entelecheia* of a *hexis*, the using of a capacity which is fulfilled providing only that external conditions are right, such as opening one's eyes; the organ doesn't have to do anything in order to see, but simply "sees".<sup>11</sup> Thus, when a Greek speaker speaks Greek, this is at least an alteration in a radically different sense. Aristotle promises to clear up these distinctions (417b29), which he abides by in *De Anima* III.4 as part of his discussion of intellect. He argues that in order to think all things, because a foreign element would obstruct thought, the intellect "must have no other nature than this, that it is potential."(429a18; Hamlyn, trans.)<sup>12</sup> Yet it is

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<sup>11</sup>Cf. Hamlyn 102.

<sup>12</sup>Cf. Martin (1996, p. 111).

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potentially the objects of thought, but actually nothing before it thinks (429b29): its actuality is in thinking, and there is no change of nature in this exercise of a capacity. But how, then, can we distinguish which events require a change, from those which do not require a change?

The distinction is clarified according to the degrees of completeness of the acts. In similar uses of the potentiality-actuality distinction in other texts, Aristotle explains movement as acting on the ability to be moved. In the *De Anima*, however, Aristotle refers to this *kinêsis* as incomplete (417a14; cf. *Physics* 201b32). In the *Nicomachean Ethics*, Aristotle explains that the process (for example, of building) must be completed before it is actual (X.4, 1174a14-23): the movements are incomplete because they take time and seek an end which is separate from the movement itself.<sup>13</sup> The movement "is complete (τελεία) when it has made what it aims at. It is complete, (ἅπαντι) therefore, only in the whole time or at that final moment"(X.4, 1174a19-23).<sup>14</sup> If the act is of a type like seeing, then it is complete in any act and is the *entelecheia* of the second potentiality, the exercise of a power; if the act is not complete in any exercise, then the change is required to make the thing capable of exercising its first order ability.

The explanation of an act's completeness is to be found in the theory of parts and wholes. In the *Nicomachean Ethics* passage we are examining, Aristotle argues that:

In their parts (μέρεσι) and during the time they occupy, all movements [assumed] are incomplete (ἄτελεῖς), and are different *in kind* (τῶ εἶδει) from the whole movement and from each other. For the fitting together of the stones is different from the fluting of the column, and these are both different from the making of the temple; and the making of the temple is complete (for it lacks nothing with a view to the end proposed), but the making of the base or of the triglyph is incomplete; for each is the making of only a part. *They differ in kind, then, [τῶ εἶδει οὖν διαφέρουσι.]* and it is not possible to find at any and every time a movement complete in form,(τῶ εἶδει) but if at all, only in the whole time.(1174a21-29; italics mine)

But what is it that makes the partial movement incomplete? Not having attained the end of the action, the whole movement is incomplete<sup>15</sup>. In any part of the action or exercise, the action is not fulfilled, and so is of a different form (or minimally description) than the whole. But Aristotle

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<sup>13</sup>Cf. Hamlyn (1968), pp.100-101.

<sup>14</sup>On the unity of the process as complete or incomplete see Charlton (1983) and Kostman (1987).

<sup>15</sup>Cf. Burnet, who mentions that the majority of the manuscripts have the art of housebuilding, rather than the process, in the example which precedes the quoted text (1900, p. 449).

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seems to state that it is incomplete, rather than offer us a proof that the change is *itself* incomplete. Rather, we are given the hint that of changes, "the whence and whither give them their form"(1174b5), and told that this issue has been discussed more fully elsewhere.

The other text which Aristotle is referring to is *Physics* V.4, in which Aristotle argues that there are many senses in which motion is said to be a unity. First, motion is generically one by being of the same kind (*kata ta schêmata*)<sup>16</sup> with another motion, such as the types of locomotion which are all of the same category (227b4)<sup>17</sup>. Motion is "specifically" one (*atomoi eidei*) when it is of a type which cannot be further subdivided (227b8)<sup>18</sup>. For example all whitenings are specifically the same as other whitenings, but only generically the same as blackenings. Motion is a unity when it is numerically one and "one essentially". Aristotle explains this by giving us a distinction. All motion is spoken of in relation to a 'that which' is in motion, which is the subject or substratum of change, a 'that in which' the thing changes (as in place or in an affection) and a 'that during which', which is the time of the movement (227b24). He argues that

of these three it is the thing in which the motion takes place that makes it one generically or specifically, such as a change in color, it is the thing moved that makes the motion one in subject, such as the ripening of an apple, and it is the time that makes it consecutive, such as the ripening of an apple over a period of thirty six hours: but it is the three together that make it one without qualification (227b26-30).

Thus we have a type of unity (i.e. that unity which is without qualification) which supervenes on the other types as its necessary components: unity in kind (genus), subject and time. Such unity can be said of 'seeing', say, because any instance of seeing will be of the same kind as any other instance; it will be done by the same subject (or a subject same in kind), and it will be instantaneous.<sup>19</sup> The criterion of identity in these cases is focally the subject of change, whose privation of a particular attribute is changed into the possession of that attribute.

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<sup>16</sup>Note that this is an irregular use of the word "σχήματα" (or shape, characteristically) to distinguish kinds; as we will find in subsequent chapters, 'εἶδος' is more commonly translated as the reference of the term 'species', which is a point of controversy.

<sup>17</sup>Aristotle's examination of generic unity will be explored in chapter IX §i.

<sup>18</sup>From chapter V attention will be given to the genus-species relation, to the effect that they are not used in a classificatory manner; in this context, evidence suggesting that the classification is not rigid is the fact that in the subsequent passage, Aristotle describes the case of knowledge, which is both a genus (of the sciences) and a species (of apprehension).

<sup>19</sup>On this problem in Aristotle, see *Nicomachean Ethics* X.4 and *De Anima* 428a5.

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Aristotle is quite insistent on this notion of unqualified unity. One might well raise the question whether the act of writing this treatise, like learning to speak Greek, is a single act -- it is at least one in form, and the term over which it has been written is of regular length for a book -- and it is me, a continuing subject, which is doing the writing.

Further, a motion is also said to be one generically, specifically, or essentially when it is complete, just as in other cases completeness and wholeness are characteristics of what is one: and sometimes a motion even if incomplete is said to be one, provided only that it is continuous (228b12).

Thus the minimal criterion is the continuous time through which a motion occurs.<sup>20</sup> Aristotle is arguing that there is an ontological connection, and indeed an implication, between unity, completeness and wholeness. Yet how are these connected? An important clue can be gathered from the hint mentioned above that "the whence and whither give [changes] their form"(1174b5)<sup>21</sup>. "The whence" or *terminus a quo* of a change is the starting point, the subject which changes to the possession of a new property. "The whither" or *terminus ad quem* of a change is the ending point or goal of the change, the subject with the new property. Change is what lies between them, the process from the whence to the whither.<sup>22</sup> The two states give the change its form, as Aristotle says, by providing the initial conditions and end conditions through which the change is identified. Aristotle emphasises that there is no change apart from change in respect of an item from one of the categories of being: changing in one of these respects is the only possible change. The process between the starting and end points not only cannot be explained in itself as if it were a thing existing in the world alongside the beings given in the categories. But also, the process cannot be defined in a way which restricts it to any of the categories.

But how is it possible to prove that this was Aristotle's view? Aristotle proved this by a thought-experiment undertaken to show that

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<sup>20</sup>"Occurrence" here is suggestive of the interpretation put forward by Kostman that Aristotle is attempting to define changes as what contemporary philosophers would regard as "events" (1987, p.7).

<sup>21</sup>Heinaman argues against Kosman's view that there is no text in which the change is to "becoming" some F, by saying that (in Heinaman's translations) it is inescapable that the potentialities are for change, rather than for being in the end state (1994, p.28). However, this argument (that the unity of a change includes its end) casts doubt on Heinaman's claim.(1994, p. 27)

<sup>22</sup>Charlton argues that the *termini a quo et ad quem* are the correct factors used to explain change, and comments that this was the good point of Hume's analysis (1983).

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there is no change of change<sup>23</sup>. On the presumption that a change is explicable in itself, without recourse to the form and privation of a subject defended as Aristotle's first principles, change is found to be impossible. In *Physics* V.2,(225b33ff) Aristotle argues that a change of change or a becoming of becoming leads to an infinite regress. He argues that by hypothesis, change is not change of a subject in the sense that Aristotle uses subjecthood in his own first principles, and provisionally assumes there is an infinite series of changes, in order to reduce it to absurdity. Then take any member of the series: it has a preceding change. An instance is a becoming: it is the becoming of a becoming, but because each new becoming is the becoming of something else, the initial becoming generates new becomings with each new instantiation, *ad infinitum*. But then how do we get the series? Because each becoming is a becoming of a becoming ..., the series is never completed: he remarks that of an infinite series of changes there is no first term.(226a4) On his own principles, change requires a first stage.(226a6) Given that there is change if and only if there is a first stage, which is a *terminus a quo*,<sup>24</sup> plus something which is the result of the change, and that the thought experiment does not allow the derivation of a first stage, Aristotle concludes that in this thought experiment, there is no change. Thus Aristotle denies the assumption that there is change of change<sup>25</sup>. The conclusion to this argument, denying a change of a change, is a counter argument to the initial hypothesis, by *reductio ad absurdum* using an infinite regress, and constitutes sufficient refutation for that reason to deny the possibility of a change of change, and justify the necessity of a *terminus a quo*.

Thus, if change cannot be explained in itself, Aristotle has redeemed his argument given above that other principles are needed in order to explain it: for him, these are the subject, form and privation defended earlier<sup>26</sup>. How then is it possible to construe the definition of change given in *Physics* III.1, according to which change is "the ἐντελέχεια of that

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<sup>23</sup>The result of this argument is also a reduction to absurdity of the putatively Heraclitean view of universal flux.

<sup>24</sup>Cf. Sorabji, 1979.

<sup>25</sup>A parallel argument is given in *Metaphysics* K.12 (1068a34-b5).

<sup>26</sup>For this reason I object to Heinaman's claim that "Aristotle thinks it absurd to suppose that a change *consists of* a subject and a pair of contraries"(1994, p.31). He provides this as an objection to Mary Louise Gill's (1989, pp. 188-9) objection that Aristotle reduces change to the subject, starting-point and end-point of change. However, the use of *reduction* is misleading, because the point of these technical notions is to explain change, and the combination of the notions results in a unified account, which is more than just their sum.

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which potentially is, *qua* such"? The term is explained in the definition by means of the potentiality/actuality distinction. But is change explained by mentioning another process (or change), to which the term is reducible? Or does the definition mention something else, which is not a change, but in terms of which change is to be analysed?

First, we must note that Aristotle's definition is susceptible of an analysis as a contextual definition, as used by contemporary philosophers to explain a notion by using technical terms available within a conceptual scheme. This is marked by use of the locution using the genitive article with "ὅντος", by which Aristotle refers to "that which" potentially is. The definition is accurately paraphrased to say that "the ἐντελέχεια of *that* <kind [of being]> which potentially is, *qua* such, [i.e. as a potential being] is change <of that kind [of being]>". The <kind [of being]> phrases are carried forward from the previous lines in which Aristotle discusses the domain of change: it is change according to the possession or privation of some predicable.<sup>27</sup> But on this interpretation, a different set of questions arises. Is the potentiality the potentiality-to-change?<sup>28</sup> Or is it the potentiality of that kind of being as a subject to change? Or the potentiality of that kind of being as a predicable to be changing? Or the potentiality of that kind of being to be that kind of being into which it has changed? Or finally, is it the potential of a contrary to be its contrary? In *Physics* III.1, Aristotle says that "when being in actuality it [the thing which is potentially] is operating, .. *qua* changeable"(201a27): this suggests the interpretation that potentiality in this sense is the potentiality of that kind of being to be changing into that kind of being with a contrary. The change of a potentiality (*a quo*) is the actuality (*ad quem*) of a potentiality. In the example of seeing, this would arise at any occurrence of the eyes being open: it is actual immediately. In the case of my dog-eared book, it is changing when I start to turn the corners of the pages down, as a potential to be a dog-eared book.

As Broadie has commented, the lines which follow the definition, distinguishing actual things from things which are both potentially and actually (201a19-21), show that Aristotle intends to sharply distinguish

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<sup>27</sup>In this respect my interpretation differs from that of Owens, who argues that "the concept of actuality is functioning as the quasi-generic notion. But it is qualified in a startling way, namely in terms of its opposite, potentiality. 'As such,' or 'as potentially existing' plays the role of a differentia. The neuter gender of the Greek *toiouton* makes it refer to the subject undergoing the motion, and not to the 'perfection.'"(1978, p. 123, cf. 121).

<sup>28</sup>As Heinaman argues (1994).

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potentiality and actuality: being potentially 'F' means "suitable to be F, but not actually F"<sup>29</sup>. Aristotle makes the distinction within an argument in which he clarifies that some things are both actual and potential, and thus acting and acted upon (201a19-22).<sup>30</sup> He then argues that because that which produces change is changed when producing change in something else, it is changeable -- noting that there is one exception to this, the Prime Mover (201a27) (and from elsewhere, the intellect). Thus he reformulates the definition of change according to which change is the "actuality, then, of what is potentially -- when being in actuality it is operating, not *qua* itself but *qua* changeable", the "not *qua* itself/οὐχ ἢ αὐτὸ" phrase denoting the restriction of the notion to the fundamental change which happens in relation to something other than the thing which is the source of change -- thus allowing the definition to cover the Prime Mover and active intellect cases, too. It follows -- not only from the translation but also from the nature of the locution as provided, according to my interpretation -- that the definition imputes a process. The actualising of a potentiality is a change of a potentiality, either in the sense of making the subject a potential φ-er, whose change is incomplete until it can φ, or in the sense of making it into an exercising φ-er.

But what does the "*qua*" phrase mean? Aristotle says that "x *qua* itself" means "x without qualification and by definition itself"(201a32). He explains with the case of opposites: if "to be capable of being healthy" *qua* itself means "to be capable of being sick", they are the same thing; but they are different, so it is not the case that "to be capable of being healthy" *qua* itself means "to be capable of being sick"(201a34-b1). However, the case is different when said of the underlying subject. Aristotle asserts that "the underlying subject, that which is healthy and that which is diseased, be it moisture or blood, is one and the same"(201b2). This must appear anomalous in light of my comments in the previous chapter, where I said that the substratum of generative change does not persist: this text would suggest that either it did persist, or it was replaced by another subject which is identical to the first. And yet the following sentence provides us with another recasting of the definition of change: "Since then it is not the same thing, but as *colour* is not the same as *visible thing*, it is manifest

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<sup>29</sup>Broadie p. 115; cf. Ross, 1949, p.81.

<sup>30</sup>It is not clear whether the entailment claimed by Aristotle for this thesis is analytic -- in which case circularity would again threaten the definition of change -- or whether it would follow given other premisses already stated.

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that the actuality of the potential, *qua* potential, is change" (201b3-5; Hussey trans. and italics, my underlining)<sup>31</sup>. If the antecedent of "it" is the "underlying subject" of the previous sentence, then my previous comments must be wrong, and/or there is an inconsistency in the text. However, we need not accept either of these consequences. In the context, Aristotle is examining the meaning of "*qua*" in relation to the potentiality of the opposites, such as potential health and illness. If we are to account for the onset or healing of my back-pain, then I, the subject taken simply, must remain the same in both accounts; and also that I, the same subject, persists through either change. However, the capacity to be sick or healthy is the same (as a capacity of a living body), although each capacity *qua* what it is the capacity for, is different. If not, then medicine would be taken in vain.

The last clarification of the definition involves its place in time. Aristotle argues that "change occurs just when the actuality is this actuality, and neither before nor after" (201b5) because the subject is not incessantly acting. He gives the following example, which clarifies whether the change is defined as a process or in favour of the process. The "buildable, and the operation of the buildable, *qua* buildable, is <the process of> building"(201b7; Hussey, trans., additions marked in '<>'). This is because the operation of housebuilding (οἰκοδόμησις) is either the process, e.g. of building (ἡ ἐνέργεια [τοῦ οἰκοδομητοῦ]), or the result, e.g. the house (ἡ οἰκία); but the operation is not the house, because when the house is, "the buildable no longer is" (201b10-11). And Aristotle says that this process of "οἰκοδόμησις" is a kind of change (κίνησις τις) (201b13). Central to the problem of what Aristotle is saying in his theory of change is whether there are any texts which would seem to rule out any particular interpretation, noting that many of the texts are subject to interpretation in light of the thesis chosen. This text seems to require the process view, according to which change is the process of actualisation of a potentiality, *qua* potentiality. Thus, we find that change is defined by Aristotle as the

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<sup>31</sup>Kosman argues that this text shows the interpretation by Ross (1949) to be wrong, i.e. the definition defines a way of being rather than becoming because it does not give the actuality of the potential to be in motion: according to Kosman, the potentiality to become something is never found in the texts (Kosman, 1969, p. 44). Heinaman, on the other hand, argues that Kosman's interpretation of this is incorrect because Kosman would have to identify bronze and being a statue with each other, or at least (given Aristotle's example) colour and visible thing; yet according to Heinaman, this passage shows that the two items are not identical, and instead, the potentiality refers to the potentiality to become a statue, or be visible to a perceptive soul.

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actualisation process by which a potentiality is actualised; but this is in two ways: either because the subject of change changes to the possession of a new capacity such as "knowledgeable of Greek", or because the subject of change changes to exercise some behaviour, such as speaking Greek now.

But is this what Aristotle should want to be saying? In the course of answering the most fundamental objection to the process thesis about change, we will address this problem. That is, if change is defined as a process, then the problem arises that sceptics will say that the definition is circular, the concept of "process" presupposing that we have a concept of "change" so that our definition is not enlightening, but would rather lead us back to requiring a definition of process that would in turn require us to come up with a definition of change. (This difficulty arises too with the concept of "potentiality", but the basic sense of potentiality is that of the ability or power of some thing to become something other than what it is now.) Can Aristotle's definition be defended?

### ii. The Circularity Objections

In "Is Aristotle's Definition of Change Circular?", Dr. Heinaman argues against the "new interpretation" of Aristotle's definition of change, his name for the interpretation which holds that "the potentiality referred to in the definition should be understood as a potentiality for being, and once we do so [understand it] the circularity charge can be seen to rest on a misunderstanding"(1994, p.25). According to the new interpretation, Heinaman believes that the interpreters think that "*being* F is inconsistent with *changing* to F"(1994, p.27)<sup>32</sup>.

Before examining the case which Heinaman makes against Aristotle's definition of change as becoming in actuality, it would serve us well to review the arguments which have been changed into or sustained the "new interpretation". In *Aristotle*, W. D. Ross argued that:

Motion is 'the actualisation of that which is potentially, as such.' I.e. if there is something which is actually *x* and potentially *y*, motion is the making actual of its *y-ness*. The motion called building, for instance, is the bringing over of the bricks and mortar which are buildable-into-a-house, into the state of being a house.(1964, p. 81)

On Ross's analysis, motion is a *process* of making something out of a prior thing, a thing which could take on the results that the change will bring to it.

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<sup>32</sup>Note that Frede attempts a similar analysis of 'becoming' and 'being' in Plato (1988).

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Similarly Barnes argues that the definition defines a *process* because of the type of existence had by a changing thing. He argues that Aristotle's phrase has a problem of obscurity:

The answer [to the question what the potentiality is the potentiality for] emerges in the course of Aristotle's argument: it is the potentiality *to be changing*. .. [This analysis] seems to make the analysis platitudinous. Perhaps, however, Aristotle does not intend to give an illuminating definition of change but rather to make an interesting point about the sort of actuality involved in change. .. The point of Aristotle's definition of change is that changes are actualities of the latter [i.e. still capable of changing] sort: while it is actually changing, the object is still capable of changing; for if it ceased to be capable of changing, it would thereby cease to be actually changing.(50-51)

This is justified by the statement given by Aristotle that when the house exists, the change no longer is (201b10-11)<sup>33</sup>. The point of this interpretation is that Aristotle isn't attempting to give a definition of change, but an explication of the role of an actuality in the analysis of change. Apart from their differences, both Ross and Barnes seem to offer us a state of changing as the actualization of a potentiality.

Professor Aryeh Kosman's influential "Aristotle's Definition of Motion" is taken by Heinaman to be a central work defending the new interpretation. Ross and Barnes had argued for the process view. According to Kosman, a distinction needs to be made between the development of the subject and the development of the privation. If a privation is perfected, the change is from the "privation from which", so Kosman calls the change a "*deprivative perfection* of an imperfection"(p. 48). Alternatively, if the change is the development or perfection of the subject, then it is "the *constitutive perfection* of an imperfection"(ibid.). Although it is possible for any privation to be both of these perfections of privations, Kosman argues that the *qua* phrase of the definition shows that the definition determines the constitutive perfection of a privation (p. 50).

Motion, in other words, is not the actuality of a potentiality in the sense of the actuality which results *from* a potentiality, but rather in the sense of an actuality which *is* a potentiality in its full manifestation.(ibid.)

This is explained by the degrees of actuality which we examined above from *De anima*: there are degrees of potentiality, most fully manifest when a Greek speaker is actually speaking Greek, as we saw; to use Aristotle's own example, it is when the building has started, rather than when the house is completed, that the potentially buildable fully

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<sup>33</sup>Kostman notes that Aristotle "twice remarks that he is pursuing an answer to the question 'what is change?'" (200b14, 202b23) so presumably he was offering a definition. Aristotle later refers to the definition in this way (*Phys.* 251a12).(Kostman, p. 11)

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manifests its buildability, or to use Kosman's term, it most fully manifests its constitutive actuality. Thus change is a way of being rather than becoming, and if it is objected that the process interpretation must be circular if change is an actualization process, the definition of change as a way of being is not circular.

Against this "new" interpretation, Heinaman raises objections. I have interpreted Aristotle's theory of change in a way which is different from Kosman, or the "new" view. But Heinaman's comments might entail a problem with the process interpretation, too. Focally, Heinaman argues that "the new interpretation must claim that the potentiality to *become* F is identical with the potentiality to *be* F" because the change is the actuality of the potentiality for being (1994; p. 32). In *Metaphysics*  $\Theta$ .1, Aristotle says that the terms potentiality and actuality refer beyond the sphere of change (1046a2-3) but all senses of potency derive their meaning from this central sense of potentiality as the source of change: "*origin of change [arke metaboles] in another or [in itself] qua other.*" ( $\Theta$ .1, 1046a9-10; Furth trans. and italics), which makes it quite apparent that the definition of change is circular, because the use of the term in the definition means that the definiendum cannot be understood apart from the definiens *and vice versa*.

Kostman answers this<sup>34</sup>, arguing that the notion of a source of change "implicitly accepts a definition of 'x is potentially F' in terms of a subjunctive conditional of the form 'if such and such conditions were to obtain, x would become F.'" (Kostman, p. 13) Thus Kostman interprets the notion of a potentiality as *like* a dispositional property, not something which is solely an attribution *by us* of behaviour to a thing, but instead, (in robust Aristotelian fashion) a part of the thing's "physical constitution" (ibid.): a potentiality can be understood independently of change. Instead, it is to be seen as a sufficient condition, which is enough to give rise to a change under the correct conditions, although it will not necessarily give rise to a change, in the absence of those conditions.<sup>35</sup>

Support for this view can be found in a variety of sources: notably, recall Aristotle's claim that there is no change apart from the generation of substances and change *of* their qualifications. Thus the potentiality of a

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<sup>34</sup>Although Kostman (1987) doesn't address the objection as formulated by Heinaman (1994) since Heinaman's article is more recent.

<sup>35</sup>This qualification allows qualitative change, but can be revised as a necessary condition when members of a substantial genus are generated.

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thing lies within as a property of it, while allowing for change as the ontological source on account of which the change arises. The same point is made in a different way by Kostman, who argues that Aristotle is defining a notion which is similar to our concept of an event: "An event exists only insofar as it *occurs* (or *takes place* or *happens*); an object or a property, on the other hand, is never said to occur (in this sense of 'occur')." (ibid, p. 7) That is, an event is not a unified being as a substance is, but instead has a temporal connexion and occurs to primary beings.

Thus Kostman provides a recasting of Aristotle's definition, in a way which is intended to remove the more obscure Aristotelian technical terms. He defines change as "an entity which occurs, and occurs when and only, for some object *x* and some property *F* such that if conditions *C* were to obtain *x* would become *F*, conditions *C* obtain." (ibid, p. 14)<sup>36</sup> An example would be the actual form in the semen of the father in contact with a ripe ovum. This analysis purports to solve the circularity problem by explaining the term "potentiality" in a way which does not presuppose the notion of change or process, i.e. by explaining change as an earlier hearkening towards the notion of event, which is can be analysed as an occurrence arising from certain sufficient conditions for that occurrence; these conditions are possessed by an object due to its organic makeup. In the appropriate conditions (which are for Aristotle primarily that there are no hindrances), the object will change or act. But, Kostman notes<sup>37</sup>, someone (adopting a view like Heinaman's) might still object that the notion of "becomes" (which is used in the definition) presupposes the notion of change. To this, Kostman replies that the notion of becoming can be treated as the difference between an earlier and a later time, in the first of which a property does not hold true of an object, but at the later time, after the sufficient conditions obtain, *F* is true of the object. This is similar to the idea of a "Cambridge change", to which we will turn.

### iii. The Advantages of Aristotle's Theory

In *The Principles of Mathematics* §442, Russell defines change in terms of the difference of truth values at different times. Change is:

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<sup>36</sup>This definition is Kostman's second recasting, because he initially provides the definition for us with the Aristotelian technical terms intact (1987, p. 13), then argues that the notions of potentiality and actuality are not essential to the account.

<sup>37</sup>Kostman reviews a number of objections which one might make against his interpretation: it is analytic and too general, and that there might be uncaused events. He argues that these will not hold; or at least that these don't count as objections.

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the difference, in respect of truth and falsehood, between a proposition concerning an entity and a time T, and a proposition concerning the same entity and a time T', provided that the two propositions differ only by the fact that T occurs in one where T' occurs in the other.

An apparently eloquent theory, this allows us to differentiate change without commitment to such troublesome notions as actuality and potentiality. Thus it might seem to be a plausible grounding of the theory of change as offered by Aristotle, and defended by Kostman. It is a thesis which for Russell takes as fundamental the existence of truth-values for propositions, the logic of which can explain everything: the entities are secondary.

Some philosophers have found difficulties with Russell's endeavour. Ian Hacking describes the effort as one which allows the advocate to argue that a theory is true, without requiring commitment to the entities which the theory mentions. Russell was worried about the appeal to unobserved entities, so he

thought we should use logic to rewrite the theory so that the supposed entities turn out to be logical constructions. The term 'quark' would not denote quarks, but would be shorthand, via logic, for a complex expression which makes reference only to observed phenomena (Hacking, p.127).

But could this explain change? *Prima facie*, one advantage of Russell's theory is that it preserves the *terminus a quo* and *terminus ad quem* of the change, which Aristotle saw as necessary for the change to be a bounded phenomenon. Yet what is bounded by this? The definition makes a claim about truth values, about which the answer appears to be that the change is the boundary of the instants at which a false statement about a particular thing is assertable and at which the same statement is truthfully assertable. But this puts emphasis on the notion of an object which is the same over time, which is referred to in Aristotle's theory by the "that which" phrase (a genitive article). For Russell, the problem was the commitment to inferred entities for which we have incomplete symbols: we saw a similar motivating thesis in the philosophy of Aristotle, in the view that change does not exist *in itself*. But at least we had a commitment in Aristotle's philosophy to the primacy of substances, such as Coriscus and Bucephalus as subjects of change; i.e. Aristotle was a realist about these entities. And there are items from the other categories as respects in which the subject changes, i.e. Bucephalus being 14 hands high now, but only 12 hands high one year ago. The same commitment in the ontology grounding Russell's theory of change doesn't occur: according to Hacking,

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Russell thought that whenever possible, inferred entities should be replaced by logical constructions. That is, a statement involving an entity whose existence is merely inferred from data is to be replaced by a logically equivalent statement about the data. In general these data are closely connected with observation.(p. 48)

The interpretation of Russell's pre-war philosophy which holds that he regarded the objects of experience as inferred entities may seem to be a rather strong view; however, in *Mysticism and Logic* he argues that physical objects are constructions out of sense-data ("appearances"), which are the only justified ground upon which it is possible to build a theory of experience<sup>38</sup>. However, the reductive program which this theory introduces gives rise to a dilemma concerning the account of any particular change. Take Gollum's loss of the ring: this will be analysed as the different truth values of the statements i. "At  $t_1$ , Gollum has the ring" and ii. "At  $t_2$ , it is not the case that Gollum has the ring." Yet a) Gollum is to be reidentified at  $t_2$  as the same Gollum that we spoke of at  $t_1$ , on the basis of appearances (or possible appearances) which constitute Gollum. It is not entirely clear what this could mean, because of the many different appearances which Gollum presents: when he had the ring, he was in a cave, but when he didn't have it, at least part of the time he was in the open sunlight, so he would surely be constituted by a different set of appearances. Reenactments of his story aside, many possible scenarios can be conceived which would prevent the reidentification of Gollum as the same Gollum, even though we should want to say that it was the same Gollum who had undergone the change. Alternatively, b) how can we be assured of the same reference or even a relevantly similar reference, when the criterion of difference is truth values at a time? An object is its appearances, but we have no sure criterion according to which the appearances selected from a set are those which are the object we are seeing in change. For example, iii. "At  $t_3$ , it is not the case that (a holographic) Gollum has the ring (because the "ring" part of the holograph has been deleted). Because I have provided an explanation of the change, we know that Gollum has not changed: it putatively is not the same Gollum. But the appearances are in principle entirely the same so according to the Russellian argument, the change has occurred.<sup>39</sup>

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<sup>38</sup>I have defended this interpretation elsewhere (1991), and would refer my readers to Russell's article "On the Relation of Sense-Data to Physics" for a complete statement of his view.

<sup>39</sup>A full discussion of the dissimilarities between Cambridge and Aristotelian change is beyond the scope of this treatise; yet other points of criticism directed at the Russellian

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As examined by Williams, such a theory was not unknown to Aristotle, albeit in an ancestral form. In *Theaetetus* 155b1-2, Plato (through Socrates) mentions the thesis that "it's impossible that a thing should be, later on, what it was not before, without having come to be and coming to be", with which Theaetetus agrees. On this hypothesis, the thing has become because an assertion of its existence is later true when previously the same assertion had been false. Plato examines this issue with regard to relations, such as the fact that Socrates was taller and later shorter than Theaetetus. Aristotle addresses the issue in *Metaphysics* E.2 concerning the paradoxes which arise from this type of analysis: he argues that

Plato was in a sense not wrong in ranking sophistic as dealing with that which is not. For the arguments of the sophists deal, we may say, above all with the accidental; e.g. the question whether 'musical' and 'lettered' are different or the same, and whether 'musical Coriscus' and 'Coriscus' are the same, and whether 'everything which is, but is not eternal, has come to be', with the paradoxical conclusion that if one who was musical has come to be lettered, he must also have been lettered and have come to be musical, and all the other arguments of this sort; the accidental is obviously akin to non-being.(1026b14-21)

Following Alexander of Aphrodisias, Ross explains the first sophistic argument in the following way: if Socrates is grammatical and Socrates is musical, the musical Socrates is the same as the grammatical Socrates and the musical is the same as the grammatical; but there are cases in which the grammatical and the musical are not together, so the two cannot be the same (Ross, 1929, v.1 p. 359). Of the paradox about becoming, Ross notes that if the musical man becomes grammatical, then after the change the man is both musical and grammatical; but being grammatical, the man cannot always have been musical, because he became *what he is* when he became grammatical. Thus if the man has become grammatical and musical having not always been both, then "being grammatical he has become musical", i.e. both being grammatical and musical must precede the other, which is absurd. Aristotle's response to this is to say that there is a distinction to be made between the uses of "is" in the premisses: to say that "Coriscus is both", we must mean that he is capable of taking on the various attributes of a grammarian or learned person. *What he is* is a man, a subject which can have such accidental attributes. But in the sophistic argument, *what he is* is taken in the accidental sense as an

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view include the unclarity about what would rule out the appearances appropriate to iv. "At  $t_4$ , Bilbo has Rivendellian ale" from being a change of  $t_1$  to  $t_2$ ; and whether appeal to four dimensional objects is ontologically justified -- this point, I take it, removes the objection of "ad hominem" from my interpretation. See also Charlton, 1983.

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expression of what it means for the man to be. Thus, the accidental attributes used in the sophistic argument are treated as the subjects from which the change occurs, as the not-being out of which something comes to be. This is one of a group of cases Aristotle explains in his metaphysics, all of which are not cases of things becoming in themselves<sup>40</sup>.

The result of this examination is that *contra* Kostman, we cannot conclude that classical Cambridge change is a sufficient grounding of Aristotle's theory of change, nor is it sufficient to explain change. For the criteria of the Cambridge theory can be true of an attribute without there being a change of or to that entity. As Williams puts it, Aristotle is "sensitive to this issue in a way that 'Cambridge philosophers of the great days' were not" (1989, p. 56). Is it necessary, however, for us to provide a fundamental class into which we can fit change, i.e. a genus into which we can differentiate change as a particular form which is its nature? Recall that at *Physics* III.1 208, Aristotle said that there is no common/universal change, and that we found it possible to list various types of change, i.e. changes of quality, place, growth, decrease, etc. This suggests that it is inappropriate to seek anything more fundamental than potentiality, even as interpreted by Kostman, in order to ground the theory. We sought grounding in the appeal to Cambridge change as a justification of Aristotle's technical vocabulary against the circularity objection. But we must remain consistent with the primacy of substance if we are to provide a neo-Aristotelian response to the issue. That being the case, it follows that we must reject outright any demand that we attempt to define the potentiality of a substance to be, have, or do something other than what it is, has or is doing prior to the change: as put in Kostman's analysis, a substance will change, given the appropriate conditions, and the notion of 'becoming' which is operant here is parasitic on the potentialities of the substance.

Similar remarks hold against the Platonic theory of change, which Aristotle gives in *Metaphysics* A.9. Recall that in the *Sophist*, Plato argued that motion is one of the great classes of things. In the *Phaedo* (and elsewhere), Plato explained natural phenomena by appeal to Ideas, transcendent entities which are imitated by the natural phenomena: in

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<sup>40</sup>See Williams (1989) for an examination of the cases of things which are and are not without coming to be, i.e. points, lines, contacts, movements (we examined above), accidental things, and separated forms.



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Aristotle's words, the theory of Ideas has it that "to each thing<sup>41</sup> there answers an entity which has the same name and exists apart from the substances, and so also in the case of all other groups there is a one over many, whether the many are in this world or are eternal"(990b6-9). But what consequences for the explanation of change follow from the existence of these entities? Aristotle argues that "they cause neither movement nor any change" in natural things (991a11). The argument for this in A.9 is that the "poetic metaphor" of the participation relation used to describe how the Ideas and objects of nature interact is not explanatory: "all other things cannot come from the Forms in any of the usual senses of 'from'" (991a20). Secondly, participation is not necessary for the explanation of why things can be alike: Aristotle argues that things can be like Socrates whether or not he exists -- man being the substantial Idea supposedly used to explain the likeness (991a25). But even a natural object like a man will have several patterns (*paradeigmata*), each of which has a transcendent Form, such as "Animal", "Two-footed", and "Man"(991a29-30). Thus the problem will arise how these Forms are united in the thing which is an imitation of them.

The basic problem with the Platonic theory is the separation between the particular things to be explained, and the entities given in the explanation. If an explanation is needed for perceptible things, then according to Aristotle, on the Platonic model

we have given this up (for we say nothing of the cause from which change takes its start), but while we fancy we are stating the substance of perceptible things, we assert the existence of a second class of substances, while our account of the way in which they are the substances of perceptible things is empty talk; for 'sharing', as we said before, means nothing.(*Met.* 992a24-29)

On appeal to theoretical entities the Russellian and Platonic theories of change seem opposed, the former recharacterising them in a way which gives only the sense-data, the latter disdaining from appeal to perception because it is thought insufficient to give the explanation which will unite the sensuous manifold. But both theories are in agreement in separating the explanation from what it is used to explain, i.e. material particular objects. Although such material entities have peculiar status in both theories, ultimately the theories cannot re-establish the connection between objects and their changes, on the one hand because talk of them appeals to other entities which are outside and different from material

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<sup>41</sup>In the 1981 re-edition of Ross's translation in Barnes, "thing" is replaced by "set of substances".

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objects, on the other because talk of material objects is replaced by talk of perceptible events *at a time*. In neither case do we get the subject of change and the various things which start its motion.

Particularly important for our purposes is another problem which the advocate of the Russellian analysis cannot solve: a distinction is to be drawn between the generation of natural things, and change. The birth of a child seems to be a different sort of change than my shoulders becoming sun-burned. Yet statements encompassing these different types of opposites, with truth values at a time as the essential component, will not allow the distinction between these types of change: it seems that all changes will be generations. In the next chapter we will examine the distinction between these types of changes. For now, we must pause to notice the various respects in which the notion of genus has been used to explain change.

### iv. The Use of Genus in Change

In the preliminaries to Aristotle's definition of change, attention must be given to the denial of Plato's view that change constitutes one of the great kinds of things which are, whether abstractly or in particulars. Instead, Aristotle argues that change is something which happens to substance or the things predicated of substances: more particularly, substances are generated (but do not change in substance (*Physics* V.2 225b10)), and once generated, undergo changes in their attributes. These attributes are constituted of individuals from the other categories of things which are, the qualities, quantities, relations, et cetera. The sense of genus used of the categories of being is the sense of genus as "the subject of its differentiae" (*Metaphysics* Δ.24, 1024b3-4), as the shades of red are said of the color red. This is the sense used when we group things into kinds, which Aristotle explains by their sharing of the *hupokeimenon*. Attention has been given to *hupokeimenon* which is used to explain change of individuals from the non-substantial categories, but we have yet to fully comprehend the *hupokeimenon* involved in substantial generation. This will be examined next.

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### Chapter III Genus in the Explanation of Change: Generation, "for man begets man" (1032a24)

Having established that the explanation of change requires the student of nature to identify the subject which undergoes a change, the form which the subject comes to have or be, and the opposite form from which this change results, we can comprehend the definition of change as the actualisation of a potentiality: something potentially an F comes to be an F because it had the potentiality to become so, and is made to be so by the influence of an agent which was already an F. Incorporating the basic principles, the definition presupposes that an agent exists in full possession of the form, which acts upon the subject in order to make it come to have (or be) that form. In this chapter, I will explain Aristotle's theory of the type of change which is generation, i.e. the generation of natural substances. In this theory, we will find crucial the role of genus as the continuous coming to be of things of the same form (1024a29).

#### i. Generation

As examined in chapter I, Aristotle says that the only things which are properly said to "come to be simply" are substances (190a31). "In the case of other [τᾶλλα] things", Aristotle says, "it is plain that there must be something underlying [ὑποκεῖσθαί] which is the coming-to-be thing"(190a33-4). But generation is something said in many ways, and Aristotle provides a list of the ways that it is used. In *Generation and Corruption* I.3 Aristotle examines *unqualified generation*/γινόμενον ἀπλῶς in order to explain how it is that things come to be, and in what sense it is possible for there to be something which comes to be, "out of nothing", so to speak. This poses a problem because if there is such a type of generation, then 'not-being' must be an attribute of some things. Thus Aristotle distinguishes between different senses of "unqualified". Of particular interest is that in some cases, "unqualified" refers to the "primary predication in each Category"(317b8); for example, if there is generation from nothing, there would be the generation of a substance such as a cherry tree out of a not-substance.<sup>1</sup> However, this poses a difficulty because Aristotle is committed to the primacy of substances as

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<sup>1</sup>The 'unqualified' also means "the universal, i.e. the all-comprehensive, predication" (317b6).

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the basic constituents of the universe, so the thing which comes to be, or from which the generated thing arises, cannot have any attributes belonging to the other categories. If the non-being out of which something is generated in this thought experiment is actual unqualified non-being, then the generated thing will have been generated out of nothing.

Aristotle's solution to this problem is to appeal to the principles which we have examined earlier: he states that "In one sense things come-to-be out of that which has no 'being' without qualification: yet in another sense they come-to-be always out of what is"(317b14-6). The justification for this is had by appeal to the potentiality/actuality distinction: generation implies that there is something which potentially *is*, but which is not actually, and this something can thus be described both as being and not-being. For example, a cherry tree is generated from a cherry seed, which is not an actual cherry tree and doesn't continue as a substratum underlying the cherry tree, but it is potentially a cherry tree, which under the appropriate conditions, will become a cherry tree.

But then, Aristotle argues, what justifies us in saying that substances are generated? Rather, one could argue that it is simply qualities and quantities which are generated and destroyed and places which are moved to (317b19-22): if there is substantial generation, on this view, it occurs out of a potential substance, and decays into the same. But then, as of Aristotelian substance, one must ask how other things will be predicated of it, i.e. whether it will be red, or three stadia in length, or in the *agora*. If it does not possess any such qualifications actually, but can possess them potentially, then it is possible that such a being is capable of separate ( $\chi\omega\rho\iota\sigma\tau\acute{o}\nu$ ) existence -- an impossibility on Aristotle's view (*Metaphysics* Z.1 1028a20-30) -- and generation from no pre-existing thing is possible (317b28-31). On the other hand, if the pre-existing non-actual substance can possess attributes, then these properties will be separable ( $\chi\omega\rho\iota\sigma\tau\grave{\alpha}$ ) from substance (317b31-3).

In order to show that these views present a vicious dilemma, Aristotle introduces a further question: "what is the cause of there always being generation, both generation *simpliciter* and the partial sort of generation?"(317b33-5; Williams, trans.) Aristotle argues that it is the matter which is the explanation for the continuity of generation and destruction.<sup>2</sup> So, Aristotle pursues the first horn of the dilemma,

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<sup>2</sup>Recall that Parmenides's concern was the continuity of being (KR 34S).

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according to which there is a potential substance prior to the generated substance, which does not take predicates from the other categories of being. Maintaining the assumption that generation occurs, he asks why the finite universe did not disappear? This cannot be attributed to the infinite quantity of matter, for there is no actual infinite: things are at most potentially divisible an infinite number of times. But if this division is all there is to generation, then each generated thing would be progressively smaller than its ancestors. Concerned that our explanations should preserve as much of the empirical phenomena as possible, Aristotle rejects this conclusion because "in fact this is not what we see occurring/ $\nu\tilde{\upsilon}\nu$  δὲ τοῦτο οὐχ ὁρῶμεν"(318a23).

A more plausible solution is that generation and corruption are continuous because "the corruption of one thing is the generation of another and vice versa"(318b24-5; Williams, trans.) But if this explanation is true -- as Aristotle thinks, below -- then the problem of generation without qualification arises again, it being the case, Aristotle says, that we use both of the terms 'generation' and corruption' with *and* without qualification.<sup>3</sup> For example, a housefly is generated, or it comes to be a puddle of residues on the fly swatter. Distinguishing between how we sometimes signify "particular individuals"(τόδε τι) and sometimes not, Aristotle defends his solution. On the one hand, one must understand their difference with respect to "the things into which the changing object changes"(318b3; Williams, trans.). In such cases, by attending to the outcome B, we say that the thing A which becomes B perishes when B is generated without qualification; yet also B could be generated with the qualification "out of A" while A perishes without qualification. An example is the cherry seed giving way to a tree. These are determined accordingly as either of the termini of the generation or destruction is regarded as being or not-being: "one of the pair will be that which is, the other that which is not [τούτων ἔσται τὸ μὲν ὄν τὸ δὲ μὴ ὄν]"(318b12; Williams, trans.). In these cases, we can also distinguish the generation and corruption of items classed under mass terms which do not signify individuals: Aristotle's examples of the *termini* are fire and earth.

On the other hand, qualified and unqualified generation and corruption can be distinguished by their matter. Aristotle argues that "a

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<sup>3</sup>A controversy might arise over the translation of 318a20-b2 between Joachim and Williams, for Williams seems to have inserted an indirect object.

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material, whose constitutive differences signify more a 'this somewhat', is itself more 'substantial'(οὐσία) <or 'real'>: while a material, whose constitutive differences signify privation, is 'not real'(μὴ ὄν)"(318b14-16; '<>' added by Joachim). This is explained in terms of form and privation. Aristotle notices that his theory differs with the common opinion according to which the perceptibility of the matter determines whether something has been generated or corrupted: generation results in perceptible matter, corruption invisible. However, he notes that on this view, earth is more real than and would be generated from and destroyed into wind and air. Within his meteorological theory this hypothesis is false, because "wind and air are in truth more real -- more a 'this somewhat' or a 'form' [τόδε τι καὶ εἶδος] -- than earth"(319b31). Thus unqualified generation and destruction are most appropriately said to occur when the *termini* are more substantial, enformed *and* perceptible; this occurs while at the same time there is a qualified (correlative) destruction and generation (318b35).

Yet the question still arises why some things are generated *simply*, such as the generation of a living thing, while others come to be something, such as my book becoming dog-eared. Aristotle's answer is to re-invoke the categories:

For some things signify a this somewhat, others a such, and others a so-much. Those things, then, which do not signify substance, are not said to 'come-to-be' without qualification, but only to 'come-to-be-so-and-so'. (319a11)

This is a repetition of the priority of substance which we examined above. Another aspect of this is the priority of the form, which Aristotle uses to qualify the view expressed about the priority of substance: of changeable things in any category, the things generated are the positive forms, whereas the privations are what the positive forms are corrupted into.

Thus, Aristotle summarises the answers he has found, including that "the substratum is the material cause of the continuous occurrence of coming to-be"(319a16) for change is between contraries, and is always the generation of one thing and the passing of another. But the question arises whether the matter of the contraries is the same or different, to which Aristotle answers that the thing underlying them is "in one sense the same, but in another sense different. For that which underlies them, whatever its nature may be *qua* underlying them, is the same: but its actual being is not the same"(319b1-4).

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### ii. Change and Genus

We are at last in a position to approach more directly Aristotle's definition of genus as a term used when the coming to be of things possessing the same form is continuous (1024a29). Aristotle defines change as the actualisation of a potentiality: this is the changing of a subject's potentiality to be qualified in a certain manner, from an initial deprivation of such a qualification, to the subject's possession of the form. Yet in generation, the initial subject does not endure through the change, but is lost by the generated being's new nature taking it over. In this section, we must explore the nature of the moving entity which causes generation or change, to determine the role that the genus of that entity plays in the changes which are initiated.

Aristotle argues that the explanation of movement must refer to a source of change which is "in actuality". There are two respects in which this thesis should be understood. In *Generation and Corruption* I.3, Aristotle attributes the source and continuity of motion to the actuality which is "immovable through all time", which is the Prime Mover, a posit developed by Aristotle -- his God -- which ends the regress of teleology by being the end sought by all things. Aristotle discusses this entity later in the *Physics*, (256-258) in the *Metaphysics*, and elsewhere<sup>4</sup>: for our purposes, attributes that need to be recognised are the facts that it is "thought thinking itself" and that in thinking itself, it thinks all things (*Met.* Λ.13). The latter is significant because, apart from other things, this requires that there are actualised forms of all things whether in the terrestrial world or not. In heavenly and terrestrial changes, natural things mimic the celestial bodies which started their motion.

A similar priority of form is defended in *Metaphysics* Z.7. There Aristotle examines generation and change, to compare and contrast various modes of coming to be. He sets out the types as follows: "Things which come to be [τῶν δὲ γιγνομένων] do so either by nature or by skill or spontaneously; and they all come to be *something*, [τὶ] and come *from something*, and are brought to be *by something*." (1032a12; Bostock, trans.) He intends this to hold quite generally, occurring in any category.

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<sup>4</sup>In *Generation and Corruption* I.3, Aristotle argues that "the accurate treatment of the first of these -- of the immovable 'originative source' -- belongs to the province of the other, or 'prior', philosophy", so appeal to texts other than GC is not inappropriate.

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First he examines natural generation, which occurs according to inner principles. We are familiar with these factors from the *Physics* and elsewhere. He says of the things which come to be by nature that:

What they come *from* is what we call matter (τὸ δ' ἐξ οὗ γίγνεται, ἣν λέγομεν ὕλην); what they are brought into being *by* is something which exists naturally; and what they come to *be* is a man or a plant or something else of this sort, which we most strongly affirm to be substances.(1032a16-20; Bostock, trans. and italics)

He emphasises again that "all things which come to be by nature have matter", which gives them the potentiality for being or not-being, by generation or corruption. But Aristotle also regards the matter as being a nature (1032a21-2)<sup>5</sup>, as is the source of their coming to be. This partially explains the respect which Aristotle mentions in the definition of genus when he says that "people are called by genus from the female too"(1024b1; Kirwan, trans.), for as we shall see in the examination of the biological texts, the female is associated with the material source of organic generation, and that matter is a nature.

The source of change is more fundamental in the explanation of the generation of something, because it gives identity to the thing which comes to be. "For this is the nature that is spoken of in accordance with form, the nature of the same form, but in another; for man begets man"<sup>6</sup>.(1032a24-5; Bostock, trans.) The agent of the generative change is the actual possessor of the form, which it transmits to the thing which comes to be by causing it to instantiate the form which before the generation, it had only in potentiality. For example, from the cherry seed we could generate a tree, because it contains in potentiality the form of the mature tree, but the seed has to be in a position which would allow it to grow into a tree: in nature, the source of this change is usually the mature tree bearing fruit; in the orchard, the farmer sees to it that the seed gets what it needs to transform into a tree.

However, this examination of Z.7 can guide our understanding of another passage elsewhere in the corpus. In *On Generation and Corruption* I.7, Aristotle says that:

But, since action and passion belong naturally, not to any old thing, but only to things which have contrariety or are contraries, agent and patient are necessarily alike and the same in genus but unlike and contrary in species.(323b30-3; Williams, trans.)

οὐ τὸ τυχὸν πέφυκε πάσχειν καὶ ποιεῖν, ἀλλ' ὅσα ἢ ἐναντία

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<sup>5</sup>In *Metaphysics* Z, Aristotle pursues the nature of the substratum at 1028b35. On matter as a nature, see chapter VIII.

<sup>6</sup>This is a recurrent example in the works of Aristotle: see also *Physics* 194b13 and 198a27, and *Metaphysics* 1032a25, 1033b32, 1070a8, 1070a28, 1070b34, 1092a16.

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ἐστὶν ἢ ἐναντίωσιν ἔχει. ἀνάγκη καὶ τὸ ποιοῦν καὶ τὸ  
πάσχον τῷ γένει μὲν ὁμοίον εἶναι καὶ ταυτό, τῷ δ' εἶδει  
ἀνόμοιον καὶ ἐναντίον.

The agent spoken of here is the agent of a change, who also plays a role in generation, which we noted from Z.7, above, and who acts upon the patient: this is our form-providing sperm, and the material *katamenia*, to provide the tacit details of Aristotle's example in Z.7 (see *De Generatione Animalium* I.2 716a5-18 and below). The agent and patient both have contraries, but are identical in kind and different -- nay contrary -- in *eidōs*. This statement may appear extraordinary<sup>7</sup> for at least two reasons: if we instantiate the statement with an example, the human seed and *katamenia*, then Aristotle is saying that they are the *same in kind* but at the same time *different in species*. Aristotle would first disallow that seed and *katamenia* are natural kinds, so these must be replaced by references to the father and mother as agent and patient, even though the seed and *katamenia* are of the same kind "reproductive residues". However, how do they differ in species? Aristotle doesn't allow male/female to be criteria distinguishing types of creatures (*Metaphysics* I.9), and although there could be sciences of spermatology and gynaecology, the criteria don't work to differentiate, because there are hermaphrodites and (Aristotle believed) spontaneously generated creatures<sup>8</sup>. One difficulty one faces in attempting an interpretation of this passage is the translation of "εἶδος", which according to Williams is the "species" in which the agent and patient differ. The primary sense of "species" as used by us is the notion of a biological kind, i.e. as we discriminate between the species of reptiles. But the more appropriate translation here, is "form", because Aristotle wouldn't want to rule out the similarity in kind of the agent and patient of a change. For the fundamental respect in which the agent and patient differ is in form, a structural quality which the agent possesses, and transfers to the patient: this is the basis upon which the roles in a situation of change are identified. They might differ in genus, depending on the

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<sup>7</sup>Note that a possible reading of this statement brings Aristotle's thesis much closer to evolutionary theory than is sometimes admitted, if it is taken that new animal types arise from progenitors of a different DNA structure than their offspring. This would require us to read Aristotle as saying that animals of different species -- or allowably "forms" -- could mate, as long as they are within the same genus. Such would be allowable in current genetics.

<sup>8</sup>See *De Generatione Animalium* I.1-2 for the varieties of generation; also Theophrastus *De Causis Plantarum* I.1.1-I.6.10 on trees generated from cuttings or grafting: in I.1.3, he argues that such plants require vital heat (*thermon*) in order to survive, in an analogous fashion to the heat of the sperm.

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nature of the *change* to be explained, such as the carpenter making a table, but they could also be of the same genus. What makes agent and patient differ in form is the possession by the agent of the form, and the lack of that form in the patient, which will be replaced by the generation in it of the agent's form.

That form is the crucial factor, which must exist in actuality, is confirmed by the contrast case which Aristotle pursues next in Z.7. This is the case of the human production of artefacts, which are produced "either by skill or by some capacity or by thought"(1032a26) and sometimes even spontaneously or by chance. In the case of things produced by skill, the form exists in actuality prior to the production because the form of the thing which is produced is in the soul of the craftsman. For example, for a house to be built in the primary sense, the form of a villa must exist in the mind of the carpenter or mason, so that it can be built to be something that has the form.

Aristotle explains what he means by the form (*eidos*): he says that "by the form I mean what being is for each thing and its primary substance [εἶδος δὲ λέγω τὸ τί ἦν εἶναι ἐκάστου καὶ τὴν πρώτην οὐσίαν]" (1032b1; Bostock, trans.). Bostock's rendering of "τὸ τί ἦν εἶναι" as "what being is" can also be rendered "essence", so that Aristotle is here saying that the form is the essence of something, its substance. Yet the description of the form as in the soul of the producer is perplexing because the "form of housebuilding" doesn't seem to be the substance of the man who is the house builder. But Aristotle notes that his statement has to be taken in an elliptical manner:

For in fact opposites have in a way the same form, since the substance of a privation is the opposite substance. Thus health <is the substance> of disease, since disease is the absence of health, and health is the formula in the soul (1032b2-6; Bostock, trans.; angle bracketed texts are inserted by the translator)

From the example, we gather that the form of health is plausibly a body in such and such a state, and the form of disease is the negation of that bodily state. However, this distinction is itself problematic. In his *Metaphysics*, Theophrastus points out that:

are we .. to say .. that where there is generation, the *essence* of the things generated depends on their being shaped in accordance with their definitions? But on *this* showing, while the change would perhaps be a change for the better, yet, none the less, being would be truly predicable of things in virtue of their matter (for the things would not even come into being if it did not pre-exist), but there would be only that which is neither a particular thing nor of a particular quality or

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quantity, as being indeterminate in its specific characteristics, but having a certain potentiality (δύναμιν) (8a8-19; Ross and Fobes, trans.).<sup>9</sup>

We will disregard the possibility of a "total" indeterminateness of the matter until chapter VIII<sup>10</sup>, yet reconstruct this argument as the problem that if the form is the substance of both the subject and the privation, the subject must be construed as a possessor of the form, but a possessor "in potentiality", being at least relatively indeterminate with respect to its substance until the change has taken place. This would be true if the substance of the opposites is the same, even though the form is not possessed by the recipient of the change, in actuality. A problem is posed by these statements because the notion of a privation suggests the absence of a form in the subject of change/*terminus a quo*, but the potential possession of the form suggests that the form can be said of the matter. How could this be the case?

Theophrastus continues that "in general we must understand matter by virtue of an analogy with the arts, or any other similarity that may exist" (8a19-20)<sup>11</sup>. Aristotle pursues the cases of generation on the analogy with the arts: the knowledge of health is produced when one thinks "since health is of such a kind, [ἐπειδὴ τοδὶ ὑγίεια] if the subject is to be healthy he must have so-and-so (e.g. an equable state of body), and if he is to have that he must have warmth, and so on"(1032b6-8; Bostock, trans.). Ultimately this thought process will result in something which one can make, and in making it, there is production.

The production of artefacts and the production of changes in natural bodies is the same in at least one respect, for Aristotle remarks that whether one is producing a house, or a healthy body, the form of a house and the form of health pre-exist the things which come to have them: production occurs when "the one [form] that has matter [is produced] from the one that does not"(1032b12; Bostock, trans.) The forms pre-exist the things which come to have them, as we have seen, because the agent of the change must have the form at least in mind, if not in body. What is it that is the form without the matter? Aristotle defines "essence" in exactly this way: "by the substance without matter I mean the what-being-is [λέγω δὲ οὐσίαν ἄνευ ὕλης τὸ τί ἦν εἶναι.]"(1032b14; Bostock, trans.). For the case of productions, the form of either health or a house is the skill of

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<sup>9</sup>I believe that this problem is presented as a problem, rather than an objection which Theophrastus would make on behalf of his own theory.

<sup>10</sup>Recall the Platonic receptacle .

<sup>11</sup>This parallels *Physics* I.7, 191a7-12.

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producing it, which Aristotle says is the thinking which proceeds from the original form, production of that form following upon the thinking.

However, a contrast is also to be made between types of production, because "the form in the soul" of the skilled producer, which *is what produces* health,(1032b21; Bostock, trans.) isn't necessarily the cause of health. Instead, the change can be spontaneous (*tautomatou*): in this case, the production "begins from what would on other occasions be the beginning of production for one who produces by skill, e.g. in the case of health it might begin from the warming (which he would practice by rubbing)" (1032b22; Bostock, trans.).

Aristotle thus addresses the role of the recipient of the change. He argues that "a thing could not come into being if nothing were present beforehand."(1033b21; Bostock, trans.)<sup>12</sup>. This is because both the warmth in the body, to continue the previous example, and the rubbing by the doctor, are components of health: the body of Amyntas and the skill of Nicomachus are both required in order for there to be a healing of a subject, as the body's form (illness due to cold) is replaced by health (by warmth through the doctor's rubbing). That Aristotle intends to include the matter as substratum in this argument is clear from his other example: he says the stones are a part of the house<sup>13</sup>, being the proximate stuff of which the house is built. And Aristotle argues secondly that whether the warmth in the body is a part of or "followed by" the form, some part of the generated thing "must necessarily be present, since the matter of a thing is a part of it (as it is present in it), and it is this which comes to be the thing"(1033b30; Bostock, trans.) in the generation of substance. Thus the matter of a generation is part of the thing independently of the form.

But what, then, can be said of matter in the account of what a thing

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<sup>12</sup>Anticipating a topic to be more fully discussed later, but mentioned, above, I suggest that this premiss is inconsistent with the bare substratum interpretation of matter.

<sup>13</sup>Aristotle comments in the defence of his conclusion that "the warmth in the body either is a part of health or is followed, more or less directly, by something which is a part of health". This distinction depends on whether the topic under consideration is the alteration or generation of a substance. As I have argued elsewhere, the matter and form of a substance are co-occurrent in it, being a unity; such locutions as "the form unifies the matter" are inappropriate in this respect, but are attributed to Aristotle because of problems associated with his example of the production of artifacts. In the case of the generation, the warmth in the body example would have to be a part of health, being the matter which is a unity with the form, making the thing "healthy". The point is made more directly in *Metaphysics* Z.8, where Aristotle argues that the matter and the form of a substance are not generated, lest the generation lead to a vicious regress. See Carr 1995.

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is? It is part of the thing, but must it occur as a part of the definition of the thing? Aristotle addresses this issue with the question:

must there also be present a part that occurs in the formula? Well, in fact we speak in both ways when we say what a bronzen circle is, saying that the matter is bronze and the form is such-and-such a shape (that being the genus under which it first falls). So the bronzen circle has its matter in its formula.(1033a1-5; Bostock, trans.)

In the argument we have just read, Aristotle says that the formula of a bronze circle contains both the matter and the form. But which of these is the genus? Of a bronze circle, shape seems to be the genus, being the kind into which bronze circles would be classified. But then how does this prove that the matter occurs in the definition? Both the matter may exist beforehand -- under the guise of the "privation from which" the change occurs -- and the form must pre-exist, as the new characteristic or structure which the agent of change passes on to the subject of change. Given that the form is essential to the occurrence of change, in Aristotle's view, then we have at least a *de dicto* "must" for the form being present in the formula or *logos* of the thing. But how is it possible to get the matter as a necessary part of the formula? Put simply, the answer is by parity of reasoning. Just as the form is essential to a change and is thus important enough to occur in the formula of what something is, the same is true of the matter. That is, the matter is the subject which is a unity with the form, when its privation has been replaced by the new qualification in non-substantial change; and the matter partially forms the basis upon which we can explain the essence of substances when it is itself replaced upon generation of a substance. It is replaced because in an organic body, its nature changes.<sup>14</sup> Aristotle follows the passage we have just examined with an explanation of the Greek linguistic practice of speaking of the thing as "of such and such a matter" rather than referring to it directly by the name of the material from which it is made. Aristotle argues that:

Some things, when they have come into being from a certain matter, are said to be, not *that* from which they came, but rather *of that*, or *that-en*; for instance, a statue is not said to be [some] stone, but rather *of* stone. By contrast, a healthy man is not said to be that from which he came to be health (1033a5; Bostock, trans.).

Aristotle offers a number of arguments for this conclusion. First, it is the case that the result of the change is most often said to come from the privation, rather than the subject or matter. He points out that the

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<sup>14</sup>Scaltsas (1994a) uses the effective expression "identity dependence" for the relation between matter and the substance it constitutes. This shall be examined further, below, as will the apparently un-Aristotelian claim that the matter is needed to explain the essence: this is because the genus is implied by the differentia in the same way as the origin of the substance -- the seed or menses of humans -- is implied by the human they generate.

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outcome arises from the subject "no less than" the matter, but that this is because both the form and the privation are potentialities of the subject, which would not be distinguished if the thing was said to be the subject, rather than *of* the subject with a privation. The example is the healthy man, who is "most often" said to come from the sick man, rather than from the man, since the man can be healthy but can also be ill (1032b4). Thus we find confirmation of the dual nature of the *hupokeimena* of natural change, with emphasis here on the material substratum which gives rise to the generated thing, rather than the alteration of a persisting substantial subject.

Second, the privation may be "nameless and obscure [ $\acute{\alpha}\nu\omega\nu\upsilon\mu\alpha$ ]", such as the lack of shape in bronze, or the indeterminateness of bricks and timber before they are built into a house(1033a14; Bostock, trans.). In these cases, "the thing appears to come *from* these materials" but isn't to be identified with those materials. So rather than calling the statue "wood", it is said to be "wooden", to mark off the difference. Finally, Aristotle remarks that even this locution is liable to mislead because "if we considered the question closely, we would not say without qualification that a statue comes into being *from* wood, or a house *from* bricks, since what a thing comes into being from should change, and not remain"(1033a19). Earlier in this chapter, we saw how some (non-substantial) changes involve a persisting subject. However, others do not involve a persisting subject: the generation of living creatures.

We thus return to the beginning of the problem of change, from seeking an account of change, to finding out that in substantial generation, the components of which the substance is a unity undergo a change. We need to explore how and why the components change: what is it about a substance that encompasses the nature of its components in such a way that their natures change? Part of the answer is had by understanding the role of the genus in a definition. We turn to this in the next chapters. The next section will be an exploration of the the type of change which is the generation of living things and how the genus of the agent shapes the patient of generation.

#### iii. The Generation of Animals as Organic Substances

In the biological works, we find brought to the forefront the definition of genus in  $\Delta.28$ , which emphasises the generation of natural kinds: in such contexts, genus is used "if generation of things which have

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the same form is continuous, e.g. 'while the race [γένος] of men lasts' means 'while the generation [γένεσις] of them goes on continuously'" (1024a30). In *GA I*, Aristotle provides an introduction to this theory of genus:

Now some animals come into being from the union of male and female, i.e. all those kinds [γένεσι] of animal which possess the two sexes. This is not the case with all of them; though in the sanguinea with few exceptions the creature, when its growth is complete, is either male or female, and though some bloodless animals have sexes so that they generate offspring of the same kind, yet other bloodless animals generate indeed, but not offspring of the same kind; such are all that come into being not from a union of the sexes, but from decaying earth and excrements (715a19).

In this section, I will examine the manner in which the genus is reproduced in the offspring, and the apparent counterexample of the generation of grubs from rotting earth -- which is not the replication of the genus of its parents -- and in the final section the generation of the mule.

Aristotle specifies the reason for his interest in the generation of animals, which is to find the characteristics of the creatures he is examining, i.e. to find their essence. In the introductory chapter of the *Parts of Animals*, he asks "whether the proper subject of our exposition is that with which the ancient writers concerned themselves, namely, what is the process of formation (γίγνεσθαι) of each animal; or whether it is not rather, what are the characters of a given creature when formed." (640a10-13). Admitting the plausibility of the first view, he rejects it because his predecessors had reversed cause and effect: "the process of evolution (genesis) is for the sake of the thing evolved, and not this for the sake of the process"(640a18-19). What Empedocles (the philosopher being criticised) had missed was two things: that there is some seed for generation which has particular properties, and that there are parents. Empedocles had treated only of the accidental processes occurring to the matter. Yet as in the *Metaphysics* (1032a24), Aristotle claims that "man is generated from man"(640a25-6).

*Contra* Empedocles, Aristotle argues in particular that the semen plays a crucial formative role in the generation of offspring, and that the generated animal arises because the semen comes from a pre-existing creature with a *nature*.<sup>15</sup> In an argument against chance or spontaneous generation, Aristotle supports his argument for natural teleology in

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<sup>15</sup>James Longrigg draws attention to the interest of philosophers *qua* physiologists of the fifth and fourth centuries in the nature of animal generation and particularly the role of the semen (1985).

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animal generation with an argument appealing to the necessity of a nature contained within the reproductive residues of animals with sexes: this argument can be used to justify reproduction generally by members of kinds of members belonging to the same kinds. He argues that "there must be a something or other really existing, corresponding to what we call by the name of Nature [ὥστε εἶναι φανερόν ὅτι ἔστι τι τοιοῦτον, ὃ δὴ καὶ καλοῦμεν φύσιν]." (PA I.1 641b26) and this is the seed (*spermatos*). This is shown by the facts that the seed creates particular types of creatures, and comes from particular types of creatures<sup>16</sup>. In the absence of intervening variables, the natural course will be the production of the same kind: "For every germ implies two organisms, the parent and the progeny." (641b33) The progeny are the result of the process, yet prior to both the seed and the progeny is the parent, whose seed it is. In the counterfactual circumstance of the combining of kinds, the seed has thus a dual nature: using the example of the mule, Aristotle explains that the seed of the horse is the source of its development, yet it is also the seed of the mule, as the result which comes from the impregnation of the she-ass. Thus there is the minimal implication of a parent with a nature, and the necessary consequence, in absence of preventative conditions, that the progeny will share the nature of the parents.

Yet specifying the reproductive residues tells us the mechanism of generation by kinds, but not the reason. What kind of necessity is being appealed to in the context of animal generation? The nature of the case is strongly suggestive of Saul Kripke's necessity of *origin*. According to Kripke, if Queen Elizabeth's (or Elizabeth Windsor's)<sup>17</sup> birth was to a different set of parents, (particularly of different sperm and ova) then she would not be the same person; similarly, a table which is visually identical with the table I work at although made of ice would not be the same table (1980, p.110-15). Kripke's defence of this seems to be a reliance on our 'modal intuitions', which I don't consider to be helpful<sup>18</sup>. Yet McGinn

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<sup>16</sup>Cf. Lennox 1985, p.75.

<sup>17</sup>Some difficulty exists with the example, because the Queen's position, like the Pope's, entails that there could only be one occupant. Yet his argument is about the necessity of origin for individuals.

<sup>18</sup>David Lewis denies Kripke's intuition outright, claiming that "if I ask how things would be if Saul Kripke had come from no sperm and egg but had been brought by a stork, that makes equally good sense. I create a context that makes my question make sense, and to do so it has to be a context that makes origins not be essential" (1986, p. 252). I will not address the debate between his and Kripke's use of either possible-world semantics or theories of

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uses principles established by Dummett and Prior to ground the *de re* necessity of origin: to quote Dummett,

we cannot push back the moment in respect of which a property is to be characterized as presently accidental behind the point at which the object came into existence: that is why, in the case of a human being, his parentage and even the moment of his conception seem absolutely necessary to his identity (1973 p. 131; quoted in McGinn, p. 132)

McGinn grounds this on his relation of 'd-continuity', the thesis that origin is essential because (spatio-temporal) continuity is (p. 133)<sup>19</sup>. Yet it seems that this must be construed in a particular way if it is to be used to ground Aristotle's necessity. He does not accept that the positions in space or in time of an object are criteria of individuation (*Physics* IV.1 208a27-209b5 and *Metaphysics* Z.3; *Physics* IV.11 217b29-20a3), so we must see other reasons why the criterion of origin might be acceptable to an Aristotelian.

However, a certain caveat is in order. The problem which Kripke is addressing is the problem of how one establishes the identity of individuals, to which part of the answer is that they have an origin which they necessarily derive from as part of their (logical) identity. The problem which we are trying to answer is how does Aristotle justify the claim that there must be something which precedes the generation if it is according to kinds? This is a different question because it makes a claim not about what is entailed as the causal source from which something comes, but about the causal result given that there is such a source. Whether in the *Metaphysics* or in the biological texts, the emphasis is placed by Aristotle on the parental form, which gives rise to the generation of individuals of the same kind (always or for the most part, as we will qualify it when we acknowledge the possibility of mules).

What then justifies the "must" which Aristotle (or at least the translator) is presupposing? Clearly some kind of *de re* necessity is in use here because transplantation of organs requires that there be some feature of the pre-natal foetus or post-natal person which facilitates the transplantation of certain organs, which can't (at least technically) be provided from any other source<sup>20</sup>. The source seems to be related to the

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causation, in this context. Cf. Wiggins also disagrees: we must not "grant the conclusion that what a thing springs from it necessarily springs from" (1980, 116n22).

<sup>19</sup>McGinn notes, however, that this relation will work for that between the zygote, gametes and person, but not for the wood of the table, nor artefacts generally (p. 133).

<sup>20</sup>See Munzer (1993) for a defense of Aristotle's work as it relates to this contemporary problem; and Theophrastus's *De Causis Plantarum* for ancient antecedents.

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history of the organic thing, however, in the criterion of the substantial form.

The explanation of this is to be found in the theory of hypothetical necessity, that type of necessity which Aristotle says occurs in the phenomena studied by natural (as opposed to theoretical) science (*PA* I.1 642a5). The use of hypothetical necessity is inextricably bound up with Aristotle's teleological or goal-directed view of nature: it is invoked when the fulfilment or achievement of a substance's purpose (i.e. form) or best would be impossible without the material which is hypothetically necessary (640a33-5). This type of necessity is invoked for various purposes: Aristotle's examples are the necessity of food for living things to stay living, the necessity of iron or something hard to make an axe if it is to split wood, and the animal body of such and such materials if it is to fulfil its function (642a7-13). These are cases of things which are necessary for continuance as an entity of a certain kind, and things needed in the creation of an artefact, and of the material conditions of the achievement of an animal's essence. Can it be applied (in a sense) backward in time to show that necessarily some Nature must exist in order for generation according to kinds to occur, and do so in a *non-trivial* way? This qualification is necessary because to say that generation according to kinds occurs *necessarily* according to kinds will be trivial if there is nothing to justify that such does occur.

Using Aristotle's own focal sense of necessity, according to which "when it is not possible for a thing to be otherwise, we assert that it is necessary for it to be so" (1015a33; Kirwan, trans.), we can explain his claim. (This is the focal (1015a35-6) sense of 'necessary', although "*πρὸς ἓν*" isn't used). Aristotle defends the necessity in this circumstance using an infinite regress to establish the impossibility of the opposite view, i.e. that something could reproduce although was itself generated in a way different than the way it reproduces. The contrast case is the inability of spontaneously generated grubs arising from rotting earth to reproduce according to kind. The argument is as follows:

Some parents are generated by rotting matter.(715b5)

If these parents produced (by coupling) offspring of the same kind, then the parents should have been produced by coupling.(715b9)

If these parents produced (by coupling) offspring of a different kind, which could couple, then infinite types of animal would result.(715b14)

Yet "Nature flees from the unlimited", but rather always seeks an end.(715b14)

The conclusion of this is that parents spontaneously generated from rotting matter do not produce fertile offspring, because the progeny are not generated as were the parents. Balme comments that the argument does

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not rely directly on the infinite regress -- *contra* Michael of Ephesus, 4.19 -- because the infinity of species is not absurd (Balme, p.129): crucial is that of an infinite series, there can be no final cause (p.129). However, we must regard the regress as benign, because the proliferation of species is logically -- and factually -- possible. Of course, Aristotle was wrong about the parents' generation from rotting matter, and the other premises are problematic: we cannot found the necessity on the counterfactual argument appealing to an infinite regress. Yet even given the limitations of the argument, the point that there is some pre-existing Nature is shown by the counterfactual. That is, when we are examining cases of animal reproduction by coupling, reproduction by members of a kind (having a certain nature) of members of the same kind is the norm; but of animals not reproducing by reproduction of their own origins, the lack of a teleological process prevents the generated creatures from thriving. There is a nature preceding their generation in time (i.e. the sunlight acting on the compost) but it does not have the same generative capacity as the generation of like by like.

A similar point comes through in Aristotle's account of why man begets man: he follows up this claim by addressing the objection based on spontaneous generation and artificial production. One could raise the objection to his theory that things are produced spontaneously which are thought to require creation by natural reproduction. Yet Aristotle meets this objection by reconceptualizing the phenomena in a way which is consistent with his own theory. That is, even with spontaneous or artificial production, a "Nature" exists prior to the change which allows for the change to occur. The argument appeals to the analogy between organic change and the production of artefacts, similar to the argument we examined in chapter I about the subject/substratum of change (ch. I §2, above, concerning *Physics* 191a8-12).

The same statement holds good also for the operations of art, and even for those which are apparently spontaneous. For the same result as is produced by art may occur spontaneously. Spontaneity, for instance, may bring about the restoration of health. The products of art, however, require the pre-existence of an efficient cause homogeneous with themselves, such as the statuary's art, which must necessarily precede the statue; for this cannot possibly be produced spontaneously. Art indeed consists in the conception of the result to be produced before its realization in the material. As with spontaneity, so with chance; for this also produces the same result as art, and by the same process.(640a27-34)<sup>21</sup>

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<sup>21</sup>In the Barnes (1984) translation by Ogle, the editor notes that this entire paragraph was excised by Peck; the statement that the cause 'must necessarily precede' the statue is entirely removed from the 1984 edition. This is also removed by Balme.

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In the examples given, health and the statue, we don't have the same types of change as we have with generation. However, the parallel is unproblematic: there is a regular sequence of generation because as with spontaneous creations or the production of artefacts, something must exist to be what is generated into the new thing, and this is necessary, by hypothesis, for such a generation to come about.<sup>22</sup> Not only refuting the possibility of absolute generation *ex nihilo*, because something must be present, Aristotle's argument establishes that the determinate character of the pre-existing nature limits what can be generated from it<sup>23</sup>. Thus Aristotle also defends what we can see as a variation of the *necessity of origin*. He argues that

we should say, because man is an animal with such and such characters, therefore is the process of his development necessarily such as it is; and therefore is it accomplished in such and such an order, this part being formed first, that next, and so on in succession; and after a like fashion should we explain the evolution of all other works of nature.(640b1-4)

Although not mentioned in this quotation, we have seen reason to believe that the necessity of origin thesis as it occurs to Aristotle includes not only the necessity of the process of generation, but also the necessity of the materials of generation.

In the case of animal generation by coupling, then, the mechanism of reproduction is as follows: when it comes into contact with the female seed in the uterus, the male seed sets in motion the female seed, transferring to it the same motion by which it is moving. This is the motion that has the soul of the parent and the progeny in potentiality, and constitutes a ground for the generation of new members of the parent's kind (GA II.3 737a18). Aristotle's complete account of this is contained within GA II, from the development of the heart out of the earliest integration of the semen and menses (II.4), through the development of the uniform and non-uniform parts to the development of the foetus actually resembling a member of the human kind<sup>24</sup>.

But how do the male and female contributions determine the character of the resulting being? To explain this we must examine Aristotle's theory of the seed. In *De Generatione Animalium* I.18, he gives particular attention to this, concluding that seed is "a residue of useful

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<sup>22</sup>Balme refers us to the parallel arguments given in *Metaphysics* Z.7 1032b23 and Z.9 1034a9 (1992, p. 86), in which the generation of organic beings is used as an instance of the theory, and GA III, where spontaneous generation is explained.

<sup>23</sup>Cf. Martin (1996, p. 111).

<sup>24</sup>The development is nicely summarized by Furth (1988, p. 115-17).

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nutriment in its last stage."(726a26, Balme, trans.) In summary, it is the stuff out of which organic things come to be (724a17). The organic substance comes out of it either as out of matter, or as out of the proximate mover (724a35). Because it is not a "colliquation" (or excrement of decomposition (as is perspiration)), it must be a residue. But it is not a useless residue (because this would be harmful, but the sick or elderly are in a weakened position, and this is shown by the deficiency of semen), so it must be useful (725a3). Yet the most useful residue is the last, "that out of which each part is immediately produced"(725a13; Balme, trans.). This is the nutriment which becomes the tissues of the body, particularly in the respects in which it grows. But the sources of this differ whether they are from the female or the male. In Chapter 19, Aristotle distinguishes the seed from the menses. He has argued that in the blooded animals, the blood is the last stage of nutriment (726b2, referring to *PA* 650a34, 651a15, 678a8-10), so the seed is the nutriment which becomes residue having not been made into blood (726b10) but is instead distributed to the bodily parts. Thus he claims that

because of this its capability is great (for the withdrawal of the healthful blood is also weakening) and the resemblance of offspring to parents is reasonable; for what has gone to the parts resembles what is left over.(726b12-15; Balme, trans.)

The seed plays a formative role in the generation of offspring because being a residue of blood, it contains within it all of the motions which the blood would have, except that it contains them in potentiality (726b17; *GA* II.1 734b33). To explain this it is necessary to distinguish the sexes, those which generate into another (i.e. males) and those which generate within themselves (i.e. females), even if the seed of some things such as plants contains within it both the moving paternal principle and the material maternal principle. The residue of the female, because containing blood-like fluid, is also a residue; both male and female residues are concocted in the heart as the source of productive residues; as Cooper notes, the containing of movements by the female blood is as true of it as it is of the male (1988, p.16). Yet Aristotle gives reason to ward off the identification of the menses with seed, saying that "two spermatic secretions cannot be produced at once" (727a27; Balme, trans.), presumably because the different functions of each would conflict<sup>25</sup>. Yet that the seed is *in* the menses as shown by the parallel maturation in the genitalia of males and females

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<sup>25</sup>We will explore the problem of a substance having two highest functions in ch. VII §1, concerning *De Caelo* 292b10ff.

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(GA I.20 728a23-33). The seed of both is produced by the heart out of the body's nutritive blood (*threptikon*), the female's into the *katamenia*, which is more concocted, the male's into the sperm or "γονή", which is most (i.e. fully) concocted. But because they originate in the nutritive blood of the kind of creatures whose blood they are, the sperm and menses are capable, between them, of generating a new member of that kind (738a37-b4, that the female's seed was potentially material for her body, so possesses the potentiality to be the body of the progeny<sup>26</sup>).

The seed of both parents is necessary, Aristotle summarising in GA I.20 that

the male provides both the form and the source of movement while the female provides the body, i.e. the matter. Just as in the setting of milk, while the body is the milk, the curdling-juice or rennet is the container of the source that constitutes it, so is that which comes from the male when it is partitioned in the female (729a10-14; Balme, trans.; see also 728a26-30).

By constituting the matter of the female, the sperm gives it form. In the description which Aristotle provides of the generative components, we find that he uses and sees great explanatory value in portraying the male/female contributions in terms of the form/matter relation. The masculine contribution is the semen, which carries the structural encoding to set the material contribution without providing anything material itself (724b30-1; and as a question 729b4-9). This claim instantiates the view from *Metaphysics* Z.7 1032b12 that generation comes from the form which has no matter. He argues for this conclusion in GA II.1 that no parts of the progeny exist in the semen or seed, or else these would be made by the producer of the semen, and the semen would be irrelevant (734a34). Nor does the semen possess soul, in actuality, but it does have soul potentially (737a19); the semen is "a compound of *pneuma* and water, (*pneuma* being hot air [or vital heat])" (736a1-2; Peck, trans.). Yet the male can concoct, give shape to, and discharge semen, having the formal principle (IV.1 765b11) which is given to the residual seed.

The female contribution, on the other hand, provides only the matter (766b12-4). It does not contain within itself a principle of movement sufficient for the generation of offspring (765b15) but is instead capable of receiving the vital heat of the spermatic motions. It does not have the power to make something living (728a18, 26-30), but is in need of an external principle to set its own motions. Furth emphasises that the

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<sup>26</sup>This argument may appear to be *post hoc ergo propter hoc*, although it is actually *a fortiori*, because the semen is a refinement of the blood (actualized).

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female motions are minimally *auxetic*, i.e. those concerned with the growth of the progeny (p. 136; see *GA* II.6 744b32-8). In *GA* I.22 Aristotle describes the contribution of the sperm in relation to the menses for generation as like that of the carpenter. As the carpenter gives shape to the wood, without leaving any of his own physical parts, so the semen gives shape to the *katamenia*, without contributing any material part (730b10-14). Yet nature functions similarly to art, and as the form in the mind of the carpenter is transmitted to the wood by his swing of the hammer, for example, so the actual motions of the semen are used as a tool for the shaping of the embryo, the mother contributing the stuff used in the growth of the developing offspring.

However, there is another feature of Aristotle's theory of the generation of organic substances from coupling parents which does relate to the necessity of origin. Generation is according to kinds -- which is what Aristotle starts the *Generation of Animals* by explaining in the first book, at least. However, a qualification needs to be made to this because of his remarks later in *GA* IV, that in passing his form, the male is first generating his own form, then the form of male, then the form of man<sup>27</sup>. On the principle that "the peculiar and individual has always more force in generation than the more general and wider characteristics"(767b29-31), if the man's semen is healthy and nothing prevents it, it will move the *katamenia* to reproduce the father.

Thus if this movement prevail, it will make the embryo male and not female, like the father and not like the mother; if it prevail not, the embryo is deficient in that faculty in which it has not prevailed. .. In generation both the individual and the class [τὸ γένος] are operative, but the individual is the more so of the two, for this is the only true existence. And the offspring is produced indeed of a certain quality, but also as an individual, and this latter is the true existence. Therefore it is from the forces of all such existences that the efficient movements come which exist in the semen; potentially from remoter ancestors but in a higher degree and more nearly from the individual (and by the individual I mean e.g. Coriscus or Socrates).(767b23-X)

Furth calls this a 'rout' or 'retreat'(1988, p.132) from the view of the earlier *GA.*, presumably in part because Aristotle is no longer defending the thesis that the male is the sole formal influence (Cf. Sharples (1985), p.120). However, Balme argues that this is not proved, according to cases: he

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<sup>27</sup>Cf. *Met.* 1034b1. I set aside issues relating to universal versus individual substantial forms, in this context, because they are beyond the scope of this dissertation. Yet caveats about the use of this text are in order, because the reproduction by Socrates of his form does not entail that it is individual, even given the contrast of the 'male' form and 'human' form: they could all amount to an identical thing, yet allow for the generation in the progeny of accidental characteristics.

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argues that none can be found in which it is said that the semen generates only the father's and the *katamenia* only the mother's formal traits (1987, p. 293; he lists various sources which the sceptic would be obliged to reinterpret). Pellegrin argues in particular that the reason why Aristotle is not forced to retreat<sup>28</sup> is that his explanation of the manner in which the mother's traits are passed is by the transforming of "itself into its contrary" of the sperm (1985, p. 110-111; see 768a11-14)<sup>29</sup>. Whether by passing on traits which are had by the mother because they are traits of all such creatures, or because the movements of the semen and *katamenia* become synchronised in the way that the dancer who leads determines the steps of the partner, the formal emphasis is maintained. Thus it is possible to allow that there is a "secondary formal influence"<sup>30</sup>, to quote Balme, of the maternal contribution, which is active when the father's motions are insufficiently strong to dominate the matter. Similarly the qualities of remote ancestors have a role, Aristotle allowing for the inheritance of their traits when the traits of Coriscus, *qua* father, cannot prevail upon the *katamenia*, even to the possibility of the provision of human traits, providing a resemblance to no particular family member: Aristotle says that the resemblance to members of the genus at large are "consequential" (767b32). Thus Balme comments that Aristotle "makes room for a real contribution by the universal"(1987, p. 312). What then does this tell us about the necessity of origin? It is at least logically possible, on this hypothesis, that the personal traits of the offspring do not qualitatively depend on the parents. They depend for their *existence* on the mating of the parents. Yet the offspring can be the bearers of traits which are universal, in the sense that they resemble the traits had by anyone of their kind, yet of no one, especially of no blood relatives, in particular. The necessity of origin would appear to be particularly the necessity of being born to parents of a kind, the necessity of the kind being all that follows from the essence of the individual. The individual Socrates will in ideal conditions reproduce his form in Lamprocles, Sophroniscus and Menexenus, but it won't necessarily be the case that from the appearance of these men, we will find evidence that Socrates and Xanthippe were

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<sup>28</sup>Cf. Sharples, who argues that in "GA V.1 he attributes accidental features to the matter *and* to the source of the movement, contrasting this with the *logos* of the creature's being (778a35:121 cf. Michael *ad loc.*)"(1985, p. 120-1)

<sup>29</sup>Cf. Cooper p. 20ff.

<sup>30</sup>Cf. Balme 1987 p.18.

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their parents. As Pellegrin argues, there is an inherent tendency to reproduce likenesses of the parents; yet (referring to *GA* IV.3 767b5) any deviation from the form of the parents, particularly from the father, is a kind of monstrosity (1985, p. 111).

Thus, like Pellegrin, we find the explanation of the use of genus meaning "continuous generation of things of the same form" (1024a29-30) has this broad meaning: not only do the children of Socrates belong to his genus by sharing in his form, they could also do so at a more abstract level, being progeny similar to him in being human or animal. As Pellegrin puts it,

the correct interpretation of the *Metaphysics* passage (1024a29-30) is between two extremes. γένεσις συνεχῆς τῶν τὸ εἶδος ἔχόντων τὸ αὐτό should at least mean that within a single γένος the individuals have the same general look. But this expression can also have a *maximal* meaning, designating that which the γένος *ought to be*: the conservation from one generation to the next of the εἶδος contained in the sperm of its male founder (1985, p. 111-12).

This analysis fits focally with the generation of organic substances, but as we have seen, the rudiments of this are contained in Aristotle's principles of natural philosophy generally, i.e. in the principles of change and from the nature of change itself: there must be an originator of the movement to produce something.

To explain the ramifications of this, examination of the problem of cross-breeding will show how fundamental the transmission of form is to generation. The problem of cross-breeding is how do the parents from two kinds of creatures procreate: whose kind does the progeny emulate?

#### iv. Animal Generation and the Mule

Aristotle gives considerable attention to the problem of cross breeding, such as that of the mule, because this poses a counter-objection to his thesis that generation is of progeny resembling the father in form and kind. The use of this example had a precedent, particularly in Socrates' defence against charges of impiety in Plato's *Apology*. Socrates (possibly being ironic) argues that given that he believes in spirits, it is absurd to suppose that he does not believe in the gods: "It would be just as absurd as if one were to believe that there are children of horses and asses, namely mules, but no horses and asses" (27d10-e3; Fowler, trans.). The mule is one of Aristotle's favourite examples, being the result of cross breeding a male donkey and a female horse. The most important question (for our purposes) which he sets out to answer is why they are infertile, this fact being a commonplace.

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Arguing against the appeal to abstract principles which do not explain the features of the subjects under scrutiny, Aristotle argues that "two animals which differ in species (τῶ εἶδει) produce offspring which differs in species"(GA II.8, 747b34). Take the case of mules, male and female of which do not differ in form. Nothing can be produced from them, because if two mules were to mate, the offspring would be of the same species, but the mechanism of reproduction would differ<sup>31</sup>; if a mule were to mate with a horse or ass, another mule would not be produced because mules are the progeny of horse and ass. Aristotle objects first that "this theory is too general and empty. For all theories not based on the special principles involved are empty; they only appear to be connected with the facts without being so really"(748a7-9; cf. 765b4-6): rather, one must look at the nature of the horse, ass and mule to see why generation would be a problem. The second problem is that the theory is false: (748a12-13) the thesis that things only produce of the same kind has counterexamples as Aristotle and breeders realise. We are aware of this from evolutionary theory. But looking at the particular kinds of animal, Aristotle points out two factors which hinder the possibility of reproduction: both horses and asses tend to produce only one offspring with each pregnancy, arising from sparse menstrual cycles; but the female horse produces little *katamenia*<sup>32</sup>, the female donkey tends to purge the semen (also the she-mule HA VI.24 578a2), and both animals are cold, inclining to infertility (738b11-13). Thus the likelihood of the mating of their offspring is less than the unlikely mating of either horse or ass individually (HA VI.23 577b6).

His replies are based on empirical knowledge about the nature of the creatures, and the facts are given to support the infertility of the mule<sup>33</sup>. As explained in the previous section, the semen must give form to the maternal contribution, being a source of movement. But the particular mechanics of the movement of the contribution by both parents in the case of horses and asses, and derivatively mules, show the problems for reproduction. Generation requires the mastery of the *katamenia* by the semen, and Aristotle explains that the hot residues of the horse and the

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<sup>31</sup>Recall the situation of spontaneously generated insects, above.

<sup>32</sup>In *On Length and Shortness of Life* 5, Aristotle argues that mules live longer than the horse and ass it had as parents because less of its growth is in the production of residues; and all of these types of animal live longer because they do not lose so much as residue (466b8-10).

<sup>33</sup>Cf. Pellegrin (1985, p. 109).

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colder residues of the ass are compatible in fertility. But they are not compatible serially: just as a smaller fire will extinguish a larger one<sup>34</sup>, so the intercourse of an ass with a mare will render impotent the previous intercourse of the stud. Yet the female mule, being colder than the male, was known by Aristotle only to have been impregnated, not carrying the pregnancy to fruition -- except in Syrophenicia, where females bear a different kind than mules (*HA* VI.24 578a22ff<sup>35</sup>). The mule itself was known to produce "hinnies" by mares, by impregnating them without the heat of the semen being extinguished(577b20-3). This case is particularly interesting, because it conforms to the argument examined earlier about how the offspring of parents of the same kind can be more or less resembling of their parents, until they are said only to be of the kind, but otherwise deformed (possessing disproportionately sized genitalia (*HA* VI.24 577b28-9)): the hinny combines formal attributes of horse and ass, possessing traits appropriate to a higher generic level (*GA* II.8 748b33)<sup>36</sup>.

What then does the mule case lead the philosopher to conclude about the reproduction by members of a kind of members of the same kind? Unlike the production of animals out of rotting matter, the method of creation can be re-enacted by the generated thing, despite the unlikelihood of a resulting pregnancy. So despite the principle that creatures of the same kind generate the same kind, counterexamples can be found. However, by the third generation the risk of infertility is proportionally increased, and depends heavily on cases. Notably, the offspring still resemble the progenitors, particularly because the successful cases tend to be those of a mule (rather than a she-mule) impregnating a horse -- and the foal resembles the mare (577b10) whose own birth was the result of procreation within the genus. Throughout the account of animal generation in the normal cases in which "the offspring which a male and female of the same species<sup>37</sup> produce is a male or female of that same

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<sup>34</sup>Contra Theophrastus "On Fainting" FHSG 345, in which a greater fire extinguishes a smaller fire. Sharples refers us to Theophrastus *On Fire* I, 10 and Aristotle *GC* I.7 323b8, *On Youth and Old Age* 5 469b32, and various references in the *Problems* where the opposite view to the one presented here is affirmed, and directs us to Flashar (1962) for further references (Sharples 1994).

<sup>35</sup>In *HA* VI.38, Aristotle calls these a separate genus and says that they can mate with their own kind (580b5-6).

<sup>36</sup>Cf. the *HA* VI.24 data, in which the hinny is said to be the result of illness during gestation. Peck (1965, p. 237) affirms that the hinny was probably a small ass or horse rather than a mule.

<sup>37</sup>In *HA* I.6, Aristotle does refer to the mule as both an *eidos* (491a4) and hints at their being a genus, (490b32) and of a genus(490b35) but these are better taken as type or form, in

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species" (GA II.8 747b31-2; Peck, trans.), we find the use of genus which means "the continuous generation of things of the same form" (Met. Δ.28 1024a29-30). The crucial role of the motions within the paternal semen assures this, by setting in motion the *katamenia*, indeed allowing it to generate at all.<sup>38</sup> The membership of a natural kind is referred to as of a genus because the origins of its members lies in things of the same form, and hence kind.

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the first context, and kind in the second. This seems to be most consistent with the second sense of genus, those stemming from an originator like Ion (1024a31-5).

<sup>38</sup>Other counter-examples would be the generation of monsters (i.e. deformed versions of the parents) and creatures procreated by asexual progenitors. However, both still require some form being transmitted to a patient of change, whose nature is determined by that form.

## Chapter IV

## Genus in Definitions: the Aristotelian and Platonic Division of a Genus

In the previous chapter, the reproduction of new members of the same kind was examined, with the conclusion that the continuous generation of things of the same kind resulted from the transmission of the form of the father to his offspring. This form contains within it various properties: fundamentally those of the individual father, e.g. Socrates, but also those of his kind (human) and genus (animal). But the notion of form is still incompletely defined, because the exact respects in which Socrates' form differs from those aspects of it which make the offspring human and animal have to be given content. The form of an organic substance is associated by Aristotle with the essence of the substance, which is expressed in its definition. An exploration of these notions, particularly in relation to genus, will be the topic of the next chapters.

The paradigm case of Aristotelian definition is that of defining an *eidos* as that part of the genus possessing a certain difference, which distinguishes that *eidos* from the other *eidê* of the same genus (103b16; 139a28; 143b8; 153b14). Aristotle tells us both that he defines things, and words, causing us to ask many questions about the relation between the things and the words. However, it seems that Aristotle can connect them by his notion of essence, the content of the definition -- 'the what it is to be' of a substance, to Aristotle -- which is signified by a word. Yet this is not Aristotle's only kind of definition: his other main type of definitions are statements of the nature of something, distinguished by their manner of demonstrating its occurrence. Aristotle places great emphasis on the logic of definitions. This logic contains rules for explanation, restrictions for definition and formulae for the derivation of valid definitions. But it also acknowledges accidents, exceptions and objections to the standards it upholds. Of course, Aristotle does not grant that these deviations are of equal status to the metaphysical project. He thinks that essences have priority in explanation and in ontology.

Now the fourth sense of "genus" which Aristotle provides in *Met.* Δ.28 is "in definitions the first constituent element, which is included in the 'what', ... whose differentiae the qualities are said to be/έν τοῖς λόγοις τὸ πρῶτον ἐνυπάρχον, ὃ λέγεται ἐν τῷ τί ἐστι, ... οὐ διαφοραὶ λέγονται αἱ ποιότητες"(1024b4-7; Greek is Loeb). "The 'what'" is a translation of "τί

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ἔστι", a phrase which Aristotle often uses, like "τὸ τί ἦν εἶναι", "the what it is to be a substance", for the substantial essence of a thing -- these notions will be disambiguated, below. One should ask what difference it makes whether or not essences are features of the world. The Aristotelian answer, which I shall explain in the following chapters, is that through definitions as (according to my interpretation) Aristotle defended them, sufficient criteria of meaning are given, by the necessary attachment of essences to the things whose essence they are. In this chapter, the role of definition in scientific demonstration<sup>1</sup> will be introduced, followed by an examination of the theory of division, so crucial to Aristotelian definition, but as it was defended by Plato.

### i. Preliminary Remarks on Proofs

In the methodological principles for our pursuit of knowledge, definition plays a central role, because it is a statement of what a thing is.

Aristotle argues that

a definition is rendered in order to come to know the term stated, and we come to know things by taking not any random terms, but such as are prior and more familiar, as is done in demonstrations (*Topics* VI.4 141a26)

The notions of the "prior" (*proterôn*) and "better known" (*gnôrimôterôn*) are commonly found in Aristotle's investigations because of the need for explanations to be truly explanatory: rather than confirming the prejudices of a scientist, the results of the scientific procedure must explain something which is not apparent to sense. In a related passage in the *Posterior Analytics*, Aristotle argues that we must distinguish between what is prior and better known for human awareness (*pros hêmas*), and what is prior and better known according to nature (*tê phusei*)<sup>2</sup>. Aristotle argues:

I mean that objects nearer to sense are prior and better known to man; objects without qualification prior and better known are those further from sense. Now the most universal causes are furthest from sense and particular causes are nearest to sense, and they are thus exactly opposed to one another. .. the premisses of demonstrated knowledge must be primary (πρώτων), [i.e.] they must be the 'appropriate' basic truths, for I identify primary premiss and basic truth. A 'basic truth' in a demonstration is an immediate proposition. An immediate proposition is one which has no other proposition prior to it. (*A.Po.* I.2 72a1-8)

(Much more will be said about "immediate propositions" in what follows, for these are one type of definition given in the *Posterior Analytics*.) Thus what is prior for human awareness is the particular, but as we shall see, no

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<sup>1</sup>According to Aristotle, "demonstration" is "scientific deduction" (*APo.* I.2 71b17).

<sup>2</sup>See Cleary, p. 9-10.

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scientific theory can make deductions from particulars: the doctor does not practise curing my cold, but the doctor does practise curing colds. Instead, the scientist must seek knowledge beyond particulars present to the senses, starting from basic universal propositions.

However, 'priority' is another ambiguous notion<sup>3</sup>. In the *Categories* 12, Aristotle offers the explanation that there is priority in respect of time, and three other senses of priority:

Secondly, what [is called prior] does not reciprocate as to implication of existence. For example, one is prior to two because if there are two it follows at once that there is one whereas if there is one there are not necessarily two, so that the implication of the other's existence does not hold reciprocally from one; and that from which the implication of existence does not hold reciprocally is thought to be prior. Thirdly, a thing is called prior in respect of some order, as with sciences and speeches. For in the demonstrative sciences there is a prior and posterior in order, for the elements are prior in order to the constructions (and in grammar the elements are prior to the syllables); likewise with speeches, for the introduction is prior in order to the exposition.(14a26ff; Ackrill, trans.)

The fourth sense is priority in the sense of the better. A difficulty arises because the 'third' sense, in which priority is established by some order, would seem to be consistent with but not explanatory of the need for "immediate propositions". That is, any proposition could be prior if it is taken first in the derivation. Although this relativity of priority thesis is not without adherents, if not justification -- it is, in a sense, the minimalist thesis -- the sense of priority intended by Aristotle in the *Topics* passage is the 'second' one: this is the transitive relation holding between something *A* whose existence is implied by a second thing *B*, (so  $B \rightarrow A$ ) but itself does not imply that second thing:  $\neg(A \rightarrow B)$ . In a related context, Moravcsik sets the logical hierarchy as follows:

predicate *p'* is higher than predicate *p''* if and only if all members of the class which makes up the range of application of *p''* are also members of the class which makes up the range of application of *p'*, but not the other way around.(Moravcsik, 1967a, p.137)

The cataloguing of highest genera stops, Moravcsik argues, because anything higher would lack ontological status (ibid.).<sup>4</sup> For example, science would be easy if it was possible to generate all knowledge from a few basic axioms, in a deductive fashion. However, Aristotle did not conceive of science in this way. Although some propositions certainly do have consequences which are entailed by the propositions themselves, Aristotle argues that demonstration is also for what is empirical and

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<sup>3</sup>See also *APo.* I.2 71b33, *Phys.* VIII.7 260b15, *Top.* VI 4 141b6.

<sup>4</sup>Moravcsik argues that this asymmetrical priority is essential if the notions of inherence and predication are to remain meaningful.(Moravcsik, 1967, p.93)

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'could be otherwise'; because of this fact, rules for the proper demonstration of the unknown are mandatory. These start with basic propositions which are prior in the sense that the information they contain is basic, not derived from anything else, but in combination with other premisses, they can be used to derive other truths.<sup>5</sup> In Barnes's explanation, "a demonstrative science is an axiomatized system comprising a finite set of connected *apodeixeis* or demonstrations" (1975b p. 65). It starts with the immediate propositions, and by a rigorous method, allows the derivation of other propositions.

But what form, then, can the basic propositions take? In *Posterior Analytics* I.2, Aristotle distinguishes two types of starting principles in science: axioms are either suppositions, distinguished by whether they assert or deny something of a subject term, and definitions, which make no such claim about the subject, but instead tell us what the subject is. The example given is the mathematician's definition of a unit as "what is quantitatively indivisible"(72a23, Barnes, 1993, trans.). By this definition of a unit, Aristotle takes it that the existence of units is not assumed, but rather, they are posited as the starting points from which the existence of other things can be proved<sup>6</sup>. The definition of 'unit' which is given, however, points to the ambiguity of the notion of definition, because a definition of the form "what is ..." is typical of the modern procedure of contextual definition, according to which a term is defined according to the place it holds within an explanatory scheme -- Quine is one of the primary advocates of this theory. One issue about the use of this type of definition is that of scope: is contextual definition the most one can hope for in explaining the nature of something, i.e. from an internalist frame of reference in which a definition is rendered only as an entailment from or supposition to other propositions within a theory? Or is it possible to state the nature of some things, if not all things, from a theory-neutral frame of reference? Part of the problem in the present context is implicit in the example: "unity" is something said about everything in the universe, so there is nothing in the scope of which (as a genus) it can be contrasted: greater numbers are sums or multiples of units. (In *Metaphysics* B.3, Aristotle argues that neither unity nor being can be the highest genus

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<sup>5</sup>See Cleary p. 5,7.

<sup>6</sup>This poses interesting problems for a theory of signification. See Charles 1994. One of the problem results from the fact that "unity" is a property which applies to individuals from all of the categories, so the paradigmatic rules might not apply.

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because they would have to be predicated of their *eide*, independently; or it would be possible to predicate something about the genus without the differences; both are impossible (998b20ff.)<sup>7</sup>) Yet this might require the investigation by distinct sciences, lest premisses from one area of inquiry be introduced into a domain in which they have no place.

One must define by saying "x is what is y" because according to Aristotle, there are things which the pedagogue cannot prove to the students, but which they will understand when they have built up the requisite experience. The *Posterior Analytics* starts with the claim that "All teaching and all intellectual learning come about from already existing knowledge", which Aristotle justifies by appeal to the mathematical sciences, and by an explanation of teaching's appeal to things which we already know. He makes similar points in his ethical writings, arguing in the *Nicomachean Ethics* that:

every science is thought to be capable of being taught, and its object of being learned. And all teaching starts from what is already known, as we maintain in the *Analytics* also; for it proceeds sometimes through induction and sometimes by syllogism. Now induction is the starting-point which knowledge even of the universal presupposes, while syllogism proceeds from universals. There are therefore starting-points from which syllogism proceeds, which are not reached by syllogism; it is therefore by induction that they are acquired. Scientific knowledge is, then, a state of capacity to demonstrate (1139b25-32).

It is by induction, Aristotle suggests, that the knowledge of first principles arises. The passage from experience to scientific knowledge suggested in the passage just quoted is as follows: based on our experience of particulars, induction gives us the nature of the entities basic to enquiry, as universals; from these starting points, syllogistic arguments can be produced to explain other phenomena. The teacher educates students in scientific knowledge through demonstration by syllogism. In the *Eudemian Ethics*, Aristotle makes a similar claim (while introducing the attempt to define happiness); he says that

It would be best that all men should clearly concur with what we are going to say, but if that is unattainable, then that all should in some way at least concur. And this if converted they will do, for every man has some contribution to make to the truth, and with this as a starting-point we must give some sort of proof about these matters. For by advancing from true but obscure judgements he will arrive at clear ones, always exchanging the usual confused statement for more real knowledge.(1216b26-34)?

Aristotle's common method of inquiry is to explore the beliefs (*endoxa*) of his predecessors and contemporaries, for the truths which they might have endorsed. The knowledge to which Aristotle is appealing is to be

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<sup>7</sup>See also *APo.* II.13 96a29.

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included in the category of things which are prior to us and more familiar, from which the scientist must start. Of course, the "scientist" mentioned here is the practical scientist, who will differ from the natural scientist because the natural scientist deals with necessities, in contrast to the domain of things which might be the case, as studied by the ethicist or politician. Nevertheless, the procedure will be similar: the enquirer will proceed from the particulars apparent to observation, which are prior to us, and develop a generalised account of what is clear in itself.<sup>8</sup>

Another reason why not everything can be taught is the fact that according to Aristotle, all practical and theoretical processes of thinking must come to an end: they cannot be continued indefinitely. In answer to those who argue that there can be an infinite regress of justification<sup>9</sup>, Aristotle argues that:

For all practical processes of thinking have limits -- they all go on for the sake of something outside the process, and all theoretical processes come to a close in the same way as the phrases in speech which express processes and results of thinking (*De Anima* I.3 407a23-26).

The argument drawing the regress to a close seems to be that there is an analogous criterion of measurement between practical and theoretical processes of thinking: they are for the sake of some conclusion or action outside the process (Cf. Hicks p.259, and my chapter I.i). Aristotle continues that

Every such linguistic phrase is either definitory or demonstrative. Demonstration has both a starting-point and may be said to end in a conclusion or inferred result; even if the process never reaches final completion, at any rate it never returns upon itself again to its starting-point, it goes on assuming a fresh middle term or a fresh extreme, and moves straight forward, but circular movement returns to its starting-point. Definitions, too, are *closed groups of terms*. (407a23)<sup>10</sup>

Thus, the limiting role in the domain of logic by definitions is apparent.

Similarly in his *Metaphysics*, Theophrastus argues that an inappropriate infinite regress arises from the effort to find the causes of sensible and intelligible objects, because thought must reach a limit: the objects themselves are the principles (i.e. the sensible objects are principles for us and the intelligible objects are absolute principles of explanation) (VIII 9b4-8, Ross and Fobes, trans.). Later he argues that "οἱ γὰρ ἀπάντων ζητοῦντες λόγον ἀναιροῦσιν λόγον. ἅμα δὲ καὶ τὸ εἶδέναι μᾶλλον δ' ἀληθέστερον εἰπεῖν ὅτι ζητοῦσιν ὧν οὐκ ἔστιν οὐδὲ πέφυκεν"; "those who demand proof of everything destroy proof, and at the same time

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<sup>8</sup>Compare 1095b2-13 and 1095a14-b1; on these, see Burnyeat p.71.

<sup>9</sup>Such as Bradley, Armstrong and Sextus.

<sup>10</sup>Hicks translates the italicised text as "are all limited".

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knowledge; or rather it is truer to say that they seek proof of things of which there is not and from the nature of the case cannot be proof" (9b21-24; Ross and Fobes, trans.).<sup>11</sup>

In the *Posterior Analytics*, Aristotle appeals to a vicious regress of justification in what he calls his "analytical proof" that an infinite regress is impossible. In I.22, he provides a theory of demonstration, explaining the manner in which a proper science is presented. Within the theory he says that:

P.1 If there are principles of demonstration, neither is everything demonstrable nor is there an infinite regress.(84a32)

P.2 Demonstration (of a proposition) occurs by the interpolating of a middle term.(84a36)

P.3 If middle terms are interpolated to infinity, there would be infinitely many middle terms.(84a37)

P.4 But only if the predications come to a stop upwards and downwards, there are not an infinite number of middle terms.(84a39)

A.P.5 The predications come to a stop upwards and downwards.(see *An.Post.* I.19)

C.1 The infinite interpolation of middle terms is impossible.(84b1)[MP, P.4, AP.5]

First, recall that Aristotle's ideal of scientific explanation is explanation by syllogism: from sound premisses with a shared middle term, a scientific conclusion can be derived. Aristotle's argument for the finitude of middle terms is a reaffirmation of the role of middle terms in his logical theory: if there are no limits to the derivation, there is no middle; this is an "analytic" truth. In the *Prior Analytics*, Aristotle says "I call that term middle which both is itself in another and that in which another is contained"(25b35)<sup>12</sup>. By being intermediates, the middle term relates the extremes of the syllogism, the major and minor premisses. The problem of infinite interpolation is vicious, because each new term introduced into the set of premises would prevent the demonstration; at any step in the demonstration, it is incomplete. Therefore, Aristotle's proof requires that the antecedent of P.3 is rejected, because the successive interpolation of middle terms is inconsistent with the limits to demonstration. Again, my interpretation is controversial: Barnes suggests that the argument is circular if Aristotle is taken to be saying that the existence of a finite number of terms proves and is proved by the existence of principles (Barnes, 1975, p.173)<sup>13</sup>. Elsewhere, however, Aristotle argues that the terms come to a stop: e.g. the PNC is the basic axiom of explanation<sup>14</sup> and

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<sup>11</sup>See also *APo.* I.3 72b5 for the regress of knowledge; and *Met* a.2.

<sup>12</sup>These pertain to the terms in the first figure of the syllogism.

<sup>13</sup>These are from his comments about the extant Greek text.

<sup>14</sup>See Bolton, (forthcoming).

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the final cause -- that for the sake of which -- of each organic thing is the upper limit of its explanation. Also, in *Posterior Analytics* I.22 Aristotle explains that the upward and downward *termini* of predications are the universal and the particular, respectively (83b1ff). For this reason, I have added the assumed premiss that there are limits to explanation, based on the *De Anima* I.3 passage examined above. If there were no limits, Aristotle would be vulnerable to the sceptical challenges about proof: recall that a powerful tool of both ancient and modern skeptics is to ask for proof of each of a Dogmatist's premises, *ad infinitum*.<sup>15</sup> Aristotle's statements about proof suggest that those challenges are illegitimate.

### ii. "What is definition?"

One difficulty in interpreting Aristotle's theory of genus is that as far as it is used in definitions, it apparently can be used in only one of the ways in which definitions occur, within the Aristotelian framework, i.e. definition by genus and difference. In the *Corpus Aristotelicum*, there are accounts of definition which seem distinct, and irreconcilable. In the *Topics*, the concern is with essential definitions by genus and *diaphora*; in the *Posterior Analytics*, the concern seems to be with causal definitions and essential classifications; in the *De Anima*, attention is given to definitions by matter and form and by final cause; in the *Metaphysics*, Aristotle examines essentialist definitions, the definitions of properties and accidents, and definition by matter and form. According to LeBlond, definition by matter and form is the "ideal definition"(p.70). More will be said about this in chapters VII-IX. The *genê* of definitions are clearest in the definition of substantial essences, because we know of the thing defined "what it is".

Care must be taken in pursuit of the notion of definition in Aristotle's works because of the profound role it plays, for him as it does for us. "Definition" is an ambiguous term, as we shall see in the examination of *Posterior Analytics* II.10 (in chapter VI) and other works. But Aristotle uses definition as a methodological tool throughout the texts. Thus some preparatory remarks are in order about the domains over which Aristotle sees definition appropriate, or indeed necessary. In *De Anima* I.1, Aristotle sets out to explain the *psuchê* (soul or animating principle) and in doing so, he explains some of his methodological

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<sup>15</sup>See Barnes, 1990, pp.39ff.

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principles. First, definitions should be provided for movements, parts or faculties of bodies "by this or that cause and for this or that end"(403a26-27). This places the study of the soul in the science of nature, but distinctions are to be drawn between the definitions appropriate for various scientists. For example, the physicist would define anger (*thumos*) in terms of the boiling of blood -- a material definition; whereas the dialectician would define anger as the desire for revenge -- a definition by form or essence;<sup>16</sup> yet again the specialist in the psychology of anger -- see Theophrastus's *Characters* <sup>17</sup>, from which I have combined grief and hostility -- might define it as an "aggressive reaction to the outcomes in one's life", a definition by outcome; the mathematician might define anger in terms of ratios, or what might today be statistics; and the First Philosopher might define it in terms of enmattered form which exists for an end<sup>18</sup>. Thus we note that a number of scientific pursuits share the same principles, pursuing them in their own or possibly in the same way, applying the principle in the manner best suited to their domain.

Aristotle is willing to allow various styles of definition because the sciences occupy different domains. Each domain has principles appropriate to it. In *APo* I.7, Aristotle argues that "One cannot, therefore, prove anything by crossing from another genus--e.g. something geometrical by arithmetic."(75a38-9; Barnes, trans.) The example provided is a crossing over because contrary to fact, in most geometrical questions one could only arrive at conclusions if numbers are (spatial) magnitudes. The reason for the exclusivity of such principles is that "it is necessary for the extreme and the middle terms to come from the same genus. For if they do not belong in themselves, they will be accidentals."(75b10-12) This is what Aristotle calls the proper principles of a field of scientific endeavour.<sup>19</sup>

However, Aristotle does acknowledge that some principles do have application in different domains, i.e. supervenient or prior principles. But even then, a limitation is necessary: they are generally *pros hen* equivocals.<sup>20</sup> Aristotle was well aware of the problem arising from the

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<sup>16</sup>Aristotle compares this with the case of a house, so famous from the appeal made to it in the *Physics*.

<sup>17</sup>References to 'θυμός' and derivative phrases are given at *Characters* 2§2 l.1; 4§3 l.1; 8§8 l.2; 12§10 l.1; 29§1 l.1; 30§1 l.1. One could also explore *De Motu Animalium*.

<sup>18</sup>Cf. the definition of 'megalopsuchia' in *APo* II.13 97b16-25.

<sup>19</sup>Aristotle continues this chapter with a discussion about reductionism and emergence.

<sup>20</sup>See the Introduction.

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use of ambiguous terms in science<sup>21</sup>, saying in the *Magna Moralia* (possibly not written by him) that:

And generally one can see that it is not the part of any one science or capacity to consider the question of good in general. Why so? Because good occurs in all the categories--in that of substance, quality, quantity, time, relation, and generally in all (1183a8-12; cf. *NE* I.6).

The examples are the doctor's expertise in medicine and the pilot's expertise in navigating. The doctor knows when to amputate, and the pilot when to sail. But that the expert knows the good in his art doesn't entail expertise in the other arts. Aristotle says "For neither will the doctor know the time of the good in navigation nor the pilot that in medicine"(1183a17-18). Appeal to the common good is of no use, nor is appeal to time: these both cut across the scientific categories.

The same restrictions apply in other sciences, but the scope of philosophy, the study of being *qua* being, is wider. In *Metaphysics* Γ.2, Aristotle argues that

for each one class [γένους] of things, as there is one perception, so there is one science, as for instance grammar, being one science, investigates all articulate sounds. Hence to investigate all the species of being *qua* being is the work of a science which is generically one, and to investigate the several species [τῶν εἰδῶν<sup>22</sup>] is the work of the specific parts of the science.(1003b19-22)

Aristotle's reasoning here is by analogy: as there is one perception of each class of things, so there is one science of each class of things. Thus, one science studies being *qua* being. The several species of ontology have sciences of their own, such as biology as the science of being *qua* living things.<sup>23</sup>

In *Topics* I.4, Aristotle distinguishes the abstract parts of an argument, "the subjects on which deductions take place". He provides what is for us a lexicon of the foundations of his theory of scientific enquiry, with the appropriate distinctions drawn as follows:

Now every proposition and every problem indicates either a genus or a peculiarity or an accident--for the differentia too, applying as it does to a class (or genus), should be *ranked* [τακτέον<sup>24</sup>] together with the genus. Since, however, of what is peculiar to anything part signifies its essence, while part does not, let us divide the 'peculiar' into both the aforesaid parts, and call that part which indicates the essence [τὸ τί ἦν εἶναι] a 'definition' [ὅρος], while of the remainder let us adopt the terminology which is generally current about these things, and speak of it as a 'property' [ἴδιον]. What we have said, then, makes it clear that according to our present division, the elements turn out to be four, all told, namely either property or definition or genus or accident.(101b17)

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<sup>21</sup>Of course, Aristotle opens the *Categories* with a definition of equivocity.(1a1)

<sup>22</sup>Kirwan translates all uses of "εἶδος" and its derivatives as 'form' (1971).

<sup>23</sup>Cf. Ross and Kirwan, *ad loc.*

<sup>24</sup>Liddell and Scott translate this as "arranged" or "stated".

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Thus, given any assertoric or interrogative sentence, the predicate will either contain a genus, definition, property<sup>25</sup> or accident of the subject. For example, in the assertion "cat is the quadruped with retractable claws", "quadruped with retractable claws" is the definition of the subject term; whereas in the problem "do cats chase yarn?", the predicate "chase yarn" is conjectured to hold as an accident of the subject. In the quoted passage, a threefold distinction is drawn between genus, peculiarity and accident. With the genus is classified the difference. They are grouped together because they both indicate the *ti ên einai* or essence.<sup>26</sup> In problems about the peculiar characters, those parts of the peculiar which signify the essence are the definition; those which do not are the property.

Aristotle's two clearest definitions of 'definition' in the logical works occur in *Posterior Analytics* and the *Topics*. In *Posterior Analytics* II.2, Aristotle says that definition "is said to be the statement of a thing's nature [Ὅρισμός δ' ἐπειδὴ λέγεται εἶναι λόγος τοῦ τί ἐστὶ]"(93b29-30). In *Topics* I.5, he says "A 'definition' is a phrase signifying a thing's essence [ἔστι δ' ὄρος μὲν λόγος ὁ τὸ τί ἦν εἶναι σημαίνων]." (101b39). In *Topics* I.8, the constituents of a definition are delineated as follows: "the definition consists of genus and differentiae [ὁ ὀρισμὸς ἐκ γένους καὶ διαφορῶν ἐστίν]"(103b15).<sup>27</sup> This is not a definition of definition (except in the material sense), but a statement of the constituents of a definition. In *Topics* VI, Aristotle argues against the theory that a statement of what something is can be expressed by listing its constituents (cf. *Met.* H.6 1045a14). Yet two different terms have been translated "definition": 'ὀρισμὸς' and 'ὄρος'; and two different terms are given for the subject of definition, the 'τί ἐστὶ' and 'τὸ τί ἦν εἶναι'. Aristotle apparently uses the first pair of terms indistinguishably in the *Topics*, (101b36-102a4) and in the *Posterior Analytics* (e.g. 94a7).<sup>28</sup>

Some assistance for sorting out the distinction, or at least the distinct uses, can be gleaned from Theophrastus, who uses the term 'ὄρος' in his *Metaphysics*:

Understanding and conviction are difficult at this very point, since apart from its value in other respects it is necessary with a view to particular inquiries, and above

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<sup>25</sup>This is called a 'καθ' αὐτὸ ἴδιον' at 110b21; cf. *Topics* V.1 128b14f, 34f.

<sup>26</sup>See Granger (1984).

<sup>27</sup>Cf. A definition is "an account of what the name, or a different name-like account, signifies" (*Post.An.* 93b30-31)

<sup>28</sup>A statistical study of the classes of objects used for each term, and whether they are examples or the objects of verbs was not be undertaken.

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all to the most important, to know at what point one should set one's limit [ὅρον] (9b16-20; Ross and Fobes, trans.).

The translation of 'ὅρος' as 'limit' is confirmed by Liddell and Scott, who treat 'limit' as the more basic use of the term, 'definition' running a close third -- my mention of this is not to suggest that it is less significant in its philosophical use, nor endorse the criteria by which Liddell and Scott arrange the priorities.

The other distinction is between the 'τί ἐστί' and 'τὸ τί ἦν εἶναι'. Pointing to the fact that they are often taken to be equivalent in meaning, Evans points out that Aristotle used the latter term more so as his own theories developed, because the former term was used by earlier thinkers (e.g. Plato, *Rep.* 524c11, *Theaet.* 146c4)<sup>29</sup>, but, Evans conjectures, 'τὸ τί ἦν εἶναι' is used "to avoid paradoxes of the third-man type which arise when universals are hypostasised". Wieland quotes a theory put forward by Arpe, according to which the "expression [ti ên einai] originates from questions which ask for a definition: .. e.g. *ti ên anthrôpôi anthrôpôi einai*: 'what does it mean for man to be a man?' So Aristotle's way of arriving at this concept of a principle is very simple: he takes the formal structure of the question, dropping its specific substantive content, and puts the article in front of it." (Wieland, p. 138)

What is the significance of this? The answer is made clear in the *Metaphysics*. "In the abstract", Aristotle begins Z.4, the "essence [τὸ τί ἦν εἶναι] of each thing is what it is said to be in virtue of itself [καθ' αὐτὸ]." (1029b14) By 'καθ' αὐτὸ' predication, Aristotle means primarily "what it is to be something." (Kirwan, Δ.18 1022a24ff) In *Posterior Analytics* I.4, Aristotle defines καθ' αὐτὰ in terms of essence and λόγος:  
<One thing belongs to another> in itself both if it belongs to it in what it is -- e.g. line to triangle and point to line (for their reality depends on these and they belong in the account which says what they are) -- and also if the things it belongs to themselves belong in the account which makes clear what it is -- e.g. straight belongs to line and so does curved, and odd and even to number, (Barnes, (1975) trans. 73a34)

This is the first of three (depending on the outcome of the debate) definitions of *kath hauta* in the *Posterior Analytics* I.4. The other definitions are that something belongs to another thing *kath hauta* if it is not said of another subject and if it is not accidental.<sup>30</sup> Sorabji comments that this means that all definitional connections can be found between

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<sup>29</sup>Yet Dr. Scaltsas has also found an anticipation of the 'τὸ τί ἦν εἶναι' in Plato, at *Phaedo* 102e.

<sup>30</sup>Cf. *APo.* II.13 96b23.

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subject and predicate in either of two ways: they "are said to have an 'in itself' relation, if either belongs in the definition which says what the other is (τί ἐστί)" (1981, p210). One is part of the essence of the other.

The other feature Aristotle emphasises about *kath hauto* relations is necessity: summarising the notion of *kath hauto* Aristotle says that of things which belong to other things which are understandable in themselves, they belong from necessity. "For it is not possible for them not to belong, either simpliciter or as regards the opposites -- e.g. straight or crooked to line, and odd or even to number." The necessity of this relation is not explained in the context, but it is possible to explain it by appeal to positions taken earlier. First Aristotle argues for an epistemic necessity, that:

We think we understand a thing simpliciter (and not in the sophistic fashion accidentally) whenever we think we are aware both that the explanation because of which the object is its explanation, and that it is not possible for this to be otherwise.(I.2 71b10-12; Barnes, trans.)

Second, in *APo*. I.4 Aristotle follows this initial claim with the consequent that:

Since it is impossible for that of which there is understanding simpliciter to be otherwise, what is understandable in virtue of demonstrative understanding will be necessary (I.4 73a21; Barnes, trans.)

Hintikka uses this passage as evidence of a different notion of necessity than "ours", by which the use of an assertoric sentence is connected with necessity. (1973 p. 93)<sup>31</sup> Whatever "ours" is, this claim suggests that for Aristotle, the process by which a positive statement is demonstrated is crucial to its modal qualities.

Further, the definitions of substantial essences are *kath hauto* because one of the fundamental attributes of Aristotelian substances like Socrates is the fact that they are not said of something else. In the *Posterior Analytics*, Aristotle argues that "deduction proves something of something through the middle term. But what a thing is both is proper [ἰδιόν] to it and is predicated in what it is" (91a14-16; Barnes, 1975, trans.). In *Posterior Analytics* I.6. Aristotle argues that since necessity is a fundamental attribute of demonstration in science, this must hold true of the middle term, too. If this were not the case, the scientist "will not understand either why or that it is necessary for that to be the case" (75a12-18; Barnes, trans.).

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<sup>31</sup>Further on the notion of necessity in Aristotle, see Sorabji (1980) and (Waterlow-) Broadie (1982b). At 73b16, the first and second senses of *kath hauto* are said to be necessary.

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But what does this prove about the inherence<sup>32</sup> of the essence of something as a *kath hautō* property of it? Aristotle allows for at least two possibilities: either the cause of a thing is distinct from it, or it is not (*APo.* II.9, 93b20).

Hence it is evident that there are essential natures which are immediate, that is are basic premisses; and of these not only that they are but also what they are must be assumed or revealed in some other way. This too is the actual procedure of the arithmetician, who assumes both the nature and the existence of unit. On the other hand, it is possible (in the manner explained) to exhibit through demonstration the essential nature of things which have a 'middle', i.e. a cause of their substantial being other than that being itself; but we do not thereby demonstrate it.(93b21-27)

From this, we see why it is possible to explain the unit as "what is quantitatively indivisible"(72a23, Barnes, 1993, trans.), mentioned above. The essence of the unit is the immediate posit of the arithmetician, because no middle term or other explanation from which the nature and existence of the unit can be deduced or divided is to be found.<sup>33</sup> This is said to be the case for the immediates, and for the definition of substances.

Yet the definition of essence is arrived at by a process of division; by this method the definition of an essence by genus and *diaphora* is achieved. In *APo* II.13, Aristotle explains how we come to these definitions: this is by the method of division familiar from the Academy.

### iii. Platonic Division and Definition

The method of division was in some form a practice by Plato and his colleagues in the Academy and possibly earlier: in the *Phaedrus*, Plato has Socrates make the claim that

I am myself a great lover of these processes of division and generalization; they help me to speak and to think. And if I find any man who is able to see "a One and Many" in nature, him I follow, and "walk in his footsteps as if he were a god."(*Phaedrus*, 266b3)

Many philosophers who comment on Plato's theory of division mention that for Plato, division was *the* method of definition (e.g. Shorey: it was "at least" this, p.156). This section about Plato's theory of division, and whether division, construed in Plato's theory, results in definition.

Division and definition imply the existence (in some sense) of an object that can be analysed, which leaves us in a difficulty when examining

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<sup>32</sup>Cf. Possibly Aristotle allows forms as substantial essences to inhere by *Met.* Z.3 1029a23: they inhere in the matter. Cf. *Cat.* 1 1a22, 5 2a26-2b6.

<sup>33</sup>This statement is not intended to suggest that the nature of the unit is otherwise fully contained in the definition, as given: for example, a great controversy surrounded the nature of the unit and other mathematical notions, some of which are addressed in *Metaphysics* M.

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the Platonic corpus. My examination of Platonic division will pursue what Plato says in his putatively "later" theory. The reasons for distinguishing the early, middle and later theories centre on the role of the Forms in the theories which Plato expounds. In the so-called 'early' texts, in which most commentators think we have a presentation of the views of the historical Socrates, definitions of things like piety and virtue are pursued, and the object of definition is not clearly a separate Form as Plato would describe it in the "middle" period<sup>34</sup>. The middle period dialogues show commitment to the theory of Forms. Each such entity *F* is

the source of any *f*-thing's being *f*, where *F* is a certain characteristic or nature (*Ph.*100e)

a true being (*Rep.*477a) in itself (*Rep.*597a, c) and thus an object of science not mixed with its opposites (*Rep.*479a)

posited "in the case of the various multiplicities to which we give the same name" (*Rep.*596a5)

[putatively] made by God (*Rep.*596c) but not by man (*Rep.*597a)

unitary (*Rep.*597c)

not a concept or thought (*Parm.* 132b)

"one and always the same in all cases" (*Parm.*132c)

The enquirer who has knowledge of the Forms, in themselves, will be able to provide an accurate definition of what the Form is, for he knows what it is (rather than having an opinion about it, which is the best awareness one can have about a sensible thing); his ability to define a Form will rely upon his ability to recollect (*anamnesis*) the Form in itself as he cognized it apart from bodily sensation, for in perception it is mixed with other sensible forms and is thus impossible to know in itself. As Moravcsik remarks, "we find each form characterized as self-sufficient, and having a simple unique characteristic that sets it apart from all of the others" (p.160)

In the *Philebus*, a different method is emphasized. Plato says that the method of division of "the one into the many" is a gift of the Gods. It is the *dialectical* skill of finding infinity in unity (16d1). The example is the letters of the alphabet and the sounds made from them: according to Stenzel, the specialist

knows the unity of speech -- μία φωνή, 17b -- and knows moreover that his same speech is 'infinite', inasmuch as there are an infinite number of sounds. But neither the knowledge that sounds are infinite, nor the knowledge that they are one, is enough to make a man a specialist and give him possession of the τέχνη. In order to be an expert in the science of speech, one must know *how many* kinds it has, and which they are (p.141)

Plato contrasts this with the method of the wise men of his own time, who have made division into a method of disputation without appropriately

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<sup>34</sup>Ferguson provides an exhaustive anthology of all of the texts in which the historical Socrates is mentioned (or indeed used!). I follow Vlastos's division of the texts.

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appreciating the Promethean<sup>35</sup> fire that had been betrothed to them: they abused the method by failing to appreciate the appropriate procedures.

The first procedure of proper dialectic is collection. This seems to be the first stage of the enquiry, according to Plato, because he says in the *Philebus* that "we too ought in every enquiry to *begin* by laying down *one idea* [μία ἰδέαν] of that which is the subject of enquiry; this unity we shall find in everything" (16d1ff., my italics). In the *Phaedrus*, a (debatably) middle period dialogue, Socrates says that collection is

the comprehension of scattered particulars in one idea; as in our definition of love, which whether true or false certainly gave clearness and consistency to the discourse, the speaker should define his several notions and so make his meaning clear.(265d3-5)

Thus, we anticipate a unity which is our subject of collection (and division). What kind of unity is this? The term used in these passages is 'ἰδέα', popularly translated as Idea, or Form.

Following Stenzel, this should be interpreted as a presentation of Plato's new theory of Ideas: the Idea is "the 'universal' which is *torn asunder* in its instances, and yet always remains itself"(p.154, my italics)<sup>36</sup>. In the middle period, Plato argued that the Form (*F*) was the source of a thing's *f*-ness, but not a constituent in it. The Idea is a unity, in which we seem to find the particulars, although in the *Phaedrus* passage, definition (ὀριζόμενος 265d4) is said by Plato to comprehend the particulars. Yet Plato defends the view in the *Statesman* that collection must always work with division, to embrace a kind (277b; see Stenzel p.150).

However, what is the principle according to which one can evaluate a proper collection? Referring to the *Phaedrus* passage, Cornford remarks that

Here no methodological procedure is possible. The generic Form must be divined by an act of intuition, for which no rules can be given. The survey will include the Form we wish ultimately to define, with others that may be 'widely scattered' and have little superficial resemblance to it or to one another (1960, p.186-187).

Similarly, Moravcsik argues that "Underlying the whole procedure is an undefined, intuitively introduced notion of naturalness" (1973, p.262). Plato does tell us that one is liable to fail in collecting the right things under one idea (*Statesman* 285a), but also that one can study the procedure (285b5). Some light is shed on the question of collection principles by

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<sup>35</sup>Stenzel argues that this refers to Pythagoras (p.143). On Pythagoras as a God, see Owen (1983), especially pp.24-5.

<sup>36</sup>Cf. Minardi (1983).

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a restatement of the view of previous existence which was given in the *Phaedo*. In the *Phaedrus*, Plato argues that

But the soul which has never seen the truth will not pass into the human form. For a man must have intelligence of universals, and be able to proceed from the many particulars of sense to one conception of reason;-this is the recollection of those things which our soul once saw while following God (249b).

This suggests a problem in Plato's theory, because the role of Forms was supposed to have "changed": I agree with Stenzel, who defends the analysis of von Arnim that the implicit abstraction from "the many particulars" is inconsistent with the "*a priorist*" doctrine of Recollection from the middle period (p.150, ref. to von Arnim p.198). Whether or not the habit of distinguishing things into real classes occurs because of some prior existence of the soul, it seems that some exercises in abstraction from particulars are required if the collection is to be carried out properly. Again, however, the change from the middle theory which is implied by this view is notable: in the *Parmenides*, Plato argued that the Forms are not 'νόηματα',<sup>37</sup> objects of the mind (132). This would be their status on a plausible theory of abstraction<sup>38</sup>. On the other hand, division is the "division into species according to the natural formation, where the joint is, not breaking any part as a bad carver might" (*Phaedrus* 265e1). According to Ross, Plato's purpose for division is no longer deduction from the truths of the transcendent Forms, but

a more modest and a more realizable one -- one with which Plato at least succeeds in making a beginning -- that of tracing the relations of assertability and deniability that exist between Ideas and the relations of genus and species that exist between them.(p. 118)

What use is Plato making of the method of division? Is it dependent on the theory of Forms? In the *Phaedrus*, Plato says that the division results in species [εἶδη]. The principle is repeated in the *Statesman*: the Stranger says "I think that we had better not cut off a single small *portion* [μόριον] which is not a *species* [εἶδους], from many larger portions; the part should be a species [εἶδος]" (262a8-b1, my emphasis)<sup>39</sup>. In themselves, these

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<sup>37</sup>Sharples has mentioned privately an alternative interpretation which was put forward by Proclus, according to which Plato is not arguing that the Forms are not objects of the mind, but that they are not the objects of finite, individual minds; this is not the context to pursue this Aristotelian sounding hypothesis (see *Metaphysics* Λ).

<sup>38</sup>The use of abstraction as a method is also consistent with the appeal which Plato makes to the method of example (παραδείγματός) in the *Statesman*, 277e-278c.

<sup>39</sup>In his edition of the *Statesman*, Skemp translates the last phrase "ἀλλὰ τὸ μέρος ἅμα εἶδος ἔχεται" as "The section must always possess a specific form"(262b1-2). "Specific form" is not justified by the text; on this point, Skemp's footnote concerning Plato's lack of technical distinctions between *meros* and 19

*eidos* terms appears inconsistent with his translation (130fn1). Further on this, see below.

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statements suggest to us a type of classification. For example, the identification of a species with a part implies that a greater whole exists, a genus which embraces the species.

Moravcsik rightly points out that such a model is crude: it doesn't match the examples, nor are the metaphorical "scissors" well understood (1973, p.168)<sup>40</sup>. Yet there is another problem in the fact that Plato uses the terms *eidos* and *genus* interchangeably for the things divided. In a footnote to 262b2ff, Skemp remarks that in translating the *Statesman*,

It is hardly possible to be more precise than Plato himself in the use of the terms 'class', 'species', etc. γένος is sometimes used with a wider connotation than εἶδος, sometimes it is virtually identical in meaning. μέρος (part, section) is carefully distinguished from εἶδος at 263b, and yet at 2789b Plato chooses μέρος rather than εἶδος to speak of the divisions into species concerned with weaving. Of course a μέρος can be an εἶδος and so this is not inconsistent; but it is remarkable evidence of Plato's avoidance of technical terms. (130n.; Cf. Ackrill 1970)

We've examined the change in theory suggested by the thesis that a Form can have parts, whereas they are simple in the middle theory. In light of the fact that the thing being divided is a unity which has parts, an answer should be provided to us of how the *eidos*, *meros* and *idea* are related. The best account of the use of these terms is what Moravcsik calls "intensional mereology": a form is divided into parts, the natural kinds, and the differentiae of its definition show/are guides to where the cuttings are to be made; rather than participation, the relation between kinds and subkinds are part-whole relations, whatever the Greek terms used (1973, p.175-76; cf. Bernardette, III.83-9). The suggestion is that the kind is composed of but not reducible to the sub-kinds.

Another issue arising from the *Phaedrus* passage occurs because the division is done "according to the natural formation": there is some proper way of dividing according to the nature<sup>41</sup> of the things divided (or divided into). But what is the so-called "joint" within the divided thing? The Stranger cautions that the division should cut through the middle of the unity rather than into disproportionate segments; this "is also the more likely way of finding classes [καὶ μᾶλλον ἰδέαις ἂν τις προστυγχάνοι]" (262b7-c1). This statement is important for later purposes because it proves

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<sup>40</sup>Yet on behalf of the theory under attack, notice that it is not implausible: Balme has summarized the method as though a group of common objects is separated from others, then broader genera are pursued; he warns us, however, that the genus/species distinction came after the dialogues but was used in the Academy. The "division by scissors" analogy suggests the theory attributed to the Akademiks of attempting to define a pumpkin, about which see Owen (1983).

<sup>41</sup>David Charles describes this passage as the defence of an "objective" theory of division (1994b).

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a qualified commitment to dichotomy, the division into members possessing and not possessing a characteristic. Yet dividing in half seems to have nothing more in favour of it than dividing in three, without some principle to justify it. The example given of a bad division is between Greeks and barbarians, the latter being an "indeterminate class" which many people lump together -- the better criterion being mankind should be divided into those who have some intercourse and share a common language (263d6).

Why might one think that dichotomy is a sufficient method of division? Joseph argues that

At every stage also we proceed by dichotomy because we are only interested in the line that leads to the subject we are defining; all else contained within the genus we thrust aside together, as what does not exhibit the differentia characterizing that subject (1916, p. 127).

The problem with this theory of qualified-division is that it doesn't divide things into natural groups. Plato wavers on precisely this point: in the *Statesman*, the division of animals into horned and hornless is said to be natural (265); yet he also says that the name "barbarian" (i.e. "non-Greek") doesn't designate a form (262d)<sup>42</sup>, so not every class which has a name has a Form. Again, Plato does say that a division of humankind into male and female is "better"(263e5); yet this division is disputed by Aristotle on the ground that division should be specifications of the same criterion or axis (See *Metaphysics* Z.12 1038a10-11 and I.8).

A problem frequently arises because an arbitrary group is given a particular name: the Stranger gives the example of what humans call beasts, whereas a vocal crane could lump all non-cranes together under the same name, in contradistinction. Each grouping is equally illegitimate if the justification is only that they are non-*f* s. To accurately represent the view of Joseph, however, I note that he argues that the negative characterisation of the class divided from the group we are attempting to define is unsatisfactory, "for a negative notion furnishes, .. no basis for any further specification"(Joseph, op. cit.). Plato's reason for disclaiming a bad division is the undefended principle that "a portion and a subdivision are not identical", put into the mouth of the Eleatic Stranger (263b5; see 262e ad loc.). The Greek sentence for this passage runs "Εἶδος τε καὶ μέρος ἕτερον ἀλλήλων εἶναι", which is more simply "the subdivision and the part are truly different", treating "εἶδος" extensionally. A better

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<sup>42</sup>Cf. Prior (p.60)

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interpretation of this passage can be developed from that of Moravcsik, who argues (about *Sophist* 229d1ff.) that "what are named are kinds -- or at least certain kinds -- and not classes defined by these kinds"(p.161; see also 162). That is, the criteria are intensional rather than extensional. This would render the passage "a kind [we have divided a larger kind into] and a portion [of the larger kind] are different". The difference could be a difference in population, but the ongoing suggestion of division is that the output will be a definition or *logos*, so the contrast Plato is making in this text is between a segment of a class taken as a subclass -- such as "a tiny percentage of the Scots" -- and a segment of a class taken as bearers of a certain property named by the division, such as "*Benbeculan* bipeds".

Yet Socrates in the *Philebus* allows a broader quantity of divisions, saying that once we have collected things into a unity

Having found it, we may next proceed to look for two, if there be two, or, if not, then for three or some other number, subdividing each of these units, until at last the unity with which we began is seen not only to be one and many and infinite (indeterminate/ἄπειρά), but also a definite number (16d3-7)

We have first a unity by collection; but this collection can apparently be divided into more than two sub-groups: these could include a character and its negation but this is not a necessary division, because subsequent groups must be separated according to other characters. Ross regards this as a principle of the world of Ideas, that "the absence of a positive characteristic does not in itself constitute a class"(1951, p. 118).

Yet there is also some significance in having grasped the "definite number"(ὀπόσα) of divisions which have been found. Stenzel comments that

only a division known to be exhaustive can lead to true knowledge of the 'unities' in their higher and lower classes, and this fact is confirmed as soon as we consider the examples of letters and tones; if, for instance, I had only made the distinction between vowels and consonants I should have misunderstood the διαφοραί ... ὀπόσαιπερ ἐν εἴδεσι κείται (*Statesman*, 285b) -- I should inevitably find myself in confusion not only about the half-vowels, but also about the vowels and consonants from which I had failed to distinguish them.(p.145-6)

For this reason, in the *Philebus*, Socrates insists on the proper grasp of the intermediate forms: "the infinite must not be suffered to approach the many until the entire number of the species intermediate between unity and infinity has been discovered"(16d7-e1)<sup>43</sup>. The commitment to an exhaustive division as a precondition of knowledge is similar to Plato's commitment in middle period works to knowledge of the Form of the

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<sup>43</sup>Recall the mention of 16d3-7, above: there is said to be a definite number/ ὀπόσα (d7).

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Good as the only source of true knowledge, and which will entail knowledge of everything else: the interrelations will be exhaustive.

The "intermediates" are somehow subordinate to the initial collection, used to aid the isolation of the thing to be defined. But the question comes up whether the intermediates are Forms, in the more robust sense of the middle period, or concepts. The answer to this depends whether the collection from which we are dividing, or the item we are trying to define is taken to be the original item. The last option seems out of context from the passage<sup>44</sup>. But then how is the collection 'ἄπειρά'? This description is not something normally said of Forms, if our collection is something which is an *eidos* or genus itself. Following Gosling's "Interpretation 2", this description is best understood as an appeal to the unlimited number of particulars which could be described by a collection, although there will be a finite number of divisions into which the original collective unity will be resolved (1975 p.158).

The methodological point of a finite number of divisions is mentioned again in the *Phaedrus*: Socrates argues that the dialectician forming an account of something must meet certain criteria in being able to argue.

Until a man knows the truth of the *several particulars* (ἐκάστων εἰδῆ) of which he is writing or speaking, and is able to define them *as they are* (κατ' αὐτό), and having defined them again to divide them until they can be no longer divided, [ὀρισάμενός τε πάλιν κατ' εἶδη μέχρι τοῦ ἀτμήτου τέμνειν ] ...he will be unable to handle arguments according to rules of art (277b5-c4)

All that follows immediately from the repetition of division insisted upon in this passage is many divisions, but the divisions are presumably thought to terminate somewhere. The content to flesh this out is that each form of the particulars is to be treated as a unity, to be divided unless we have individuals such as the colour of Van Gogh's sunflowers or the Queen Mum.<sup>45</sup>

Yet once discerned, Plato apparently says that the intermediate forms can be disregarded, or left as indeterminate:

the infinite must not be suffered to approach the many until the entire number of the species intermediate between unity and infinity has been discovered-then, and not till then, we may, rest from division, and without further troubling ourselves about the endless individuals may allow them to drop into infinity.(*Philebus* 16e1-2)

Of this speech, the Greek text is the following:

τὴν δὲ τοῦ ἀπείρου ἰδέαν πρὸς τὸ πλῆθος μὴ προσ-

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<sup>44</sup>See Gosling 1975 p.158.

<sup>45</sup>This may be what gave rise to Aristotle's thesis that at the end, we define in terms of the proximate genus and last difference.

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φέρειν πρὶν ἂν τις τὸν ἀριθμὸν αὐτοῦ πάντα κατίδη τὸν  
μεταξὺ τοῦ ἀπείρου τε καὶ τοῦ ἑνός, τότε δ' ἤδη τὸ ἕν  
ἕκαστον τῶν πάντων εἰς τὸ ἀπείρον μεθέντα χείρειν ἔαν.

ε.1

The translation given by Jowett is deficient on a few counts: the initial subject should be the idea of the infinite, which should not be attributed to the many, until the number of the many forms has been found. But what, exactly, is being dismissed to what? "Each of the many" intermediate forms seems to be a thing which is dismissed. But the indeterminate/infinite poses a problem: is the antecedent of Jowett's "them" the "endless individuals" or the intermediate forms? Gosling's translation of the passage suggests that the many intermediate forms get disregarded<sup>46</sup>. Interpreting this passage is helped by figuring out exactly what is being done: "χείρειν ἔαν." means to put away from one's mind, or renounce in the bad sense; but also to bid farewell to something. Now in either of these senses, what the context requires is that the dividing is finished, so the last division is left to apply to individuals: we can now ignore the intermediate forms<sup>47</sup>.

Yet one of the most daunting questions surrounding the theory of division in the later theory is "what is being divided?" Given Plato's own metaphysical theory of Ideas, one would think that these are the likely candidates. However, two possibilities are open: Forms are divided under kinds, or things are divided under Forms. But if Forms are divided under kinds, what kinds of Forms are they? Would they be substantial forms, or things like equality and largeness? If things are divided into kinds, does this include things like animal species, or qualities, quantities and other categories? What Plato gives as examples include love, the kinds of souls, the nurture of herds (*Phaedrus* 265ff.); the alphabet and the sounds of the letters (*Philebus* 16ff.); mankind and numbers (*Statesman* 262dff). These include substantial forms, affections, quantities, etc.: there seems to be no restriction in this regard. (In the *Laws*, Plato discusses our knowledge of things, of which the examples are numbers and the types of soul.)

In the *Statesman*, the Stranger summarises the methods of division and collection as follows:

Whereas the right way is, if a man has first seen the unity of things, to go on with the enquiry and not desist until he has found all the differences contained in it *which form distinct classes* [ἐν εἶδεσι κεινται]; nor again should he be able to rest contented with the manifold diversities which are seen in a multitude of things until he has comprehended all of them that have any affinity within the bounds of

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<sup>46</sup>Cf. too his 1975 p.155

<sup>47</sup>This interpretation is shared with Stenzel 146; cf. Stenzel 146fn.

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one similarity and embraced them within the reality of a single *kind* (γένους) (285b1-10; my italics).

The Stranger assumes that the enquirer has established a unified collection before starting the division; then the division into all of the real classes can begin.

We must evaluate the theory of (collection and) division as a guide to definition. The difficulty is that Plato uses the term 'ὀρισώμεθα' in both technical and non-technical ways: in *Phaedo* 102, ὀρισώμεθα was used to express the delimitation of a class; similarly, at *Phaedrus* 265, noted above, the definition (ὀριζόμενος) is said by Plato to comprehend particulars. Yet again in the *Laws*, Plato argues that the knowledge of things is of three types: "we know the essence, and .. we know the definition of the essence, and the name ( "Ἐν μὲν τὴν οὐσίαν, ἔν δὲ τῆς οὐσίας τὸν λόγον, ἔν δὲ ὄνομα·)(895d4-5). The *logos* is taken to be exactly what would be given by a definition.

But whether we have unique reference or an account of the *logos*, does this method have results which *equal* definitions? Scholarly opinion falls into two camps: those who answer in the affirmative, and those who answer in the negative. Of those who think that division is helpful to definition, Wedberg argues "Plato thinks of definition as being essentially definition by *genus proximum* and *differentia specifica*", citing *Phaedrus* 265d-266b, 277b-c, and the definitions in the *Sophist* and the *Statesman*. This seems to be the view of Joseph and Ross, mentioned above. Similarly, Balme argues that

Plato's aim in division seems not to have been primarily to set up a classification scheme, but to track down a given *definiendum* by marking it out from other objects and showing the forms in which it participates (i.e. its defining characteristics). (p.183)

This is consistent with the model seen above in which the intermediates are disregarded after resolving the unity into an infinity. Yet Moravcsik, on the other hand, argues that "The 'logos' that is produced at the end is an 'interweaving' (e.g. *Sophist* 268c5-6) of the names arrived at in the course of the division"(p.265) but it is not definition. We can also find examples of what might be called the intermediate position, which is:

the original idea of 'definition', as a quasi-literal 'drawing of boundaries' that will in principle 'include' what is defined and 'exclude' all else; also related is the notion of obtaining definitions by the 'dividing' (*diairesis*) or 'cutting' (*dichotomê*) of kinds (Furth, 1988, p. 50-51)

I call this intermediate because definition accordingly is the distinction between separate groups according to a principle which explains the

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boundary condition between the groups: recall the "natural joint" of the *Statesman*.

The problem of the relation of division to definition is one with which Plato wrestled for a long time -- particularly in the *Sophist* -- but didn't ever solve to his own satisfaction. For example, in the *Statesman*, the Stranger recalls for the young Socrates how the definition of the ruler must explain the manner of the rule: without this the definition could be true, but "cannot be regarded as the whole truth or as a clear and sufficient description [οὐ μὴν ὅλον γε οὐδὲ σαφὲς ἐρρήθη]"(275a4-8). The point is, Plato wants to isolate the qualities of the types of ruler, rather than set or prove the identity conditions, whether essentialist or otherwise. But then, where does one's division stop? At the ruler? Having set the thing to be defined as the lower boundary, Plato's advice is well taken that we need to establish the number and level of intermediate divisions, but how can the quantity of these be established, without setting any limit to the variables which are worth concern? Many parallels to the "manner of the rule" are possible, in which Plato could indulge without being able to establish a need to stop. For this reason, I believe that the method of division was for Plato minimally a method by which particulars can be identified, through a set of criteria, but division did not have the technical use for the sake of definition which it was later to take on.

The method (whatever its use) was philosophically current at the time Aristotle was studying at the Academy, and he makes many comments about it. We turn to one potentiality for his own theory of division and definition, as found in the biological texts: does he believe that a division is done for the isolation of particulars, and requires an exhaustive division, in the way that Plato did?

**Chapter V**  
**Aristotle's Use of "Genus" and Animal Taxonomy**

In the often quoted Chapter 5 of the *Parts of Animals*, Aristotle calls his students to the study of biological creatures, remarking that the science has its own special charm.

Having already treated of the celestial world, as far as our conjectures could reach, we proceed to treat of animals, without omitting, to the best of our ability, any member [of the kingdom]<sup>1</sup>, however ignoble. For if some have no graces to charm the sense, yet even these, by disclosing to intellectual perception the artistic spirit that designed them, give immense pleasure to all who can trace links of causation, and are inclined to philosophy (645a4).

In other texts, Aristotle had drawn the contrast between the unchanging things in the celestial sphere which neither come to be nor perish, and the terrestrial things which are subject to these processes. The natural philosopher might enjoy the relative purity of the former, but the behaviour of both shows purposiveness, which the biologist can experience in studying nature.

However, the student of nature must formulate the rules appropriate to her study of natural changes in order to understand the generation and corruption of living things, and these provide the student with a new set of puzzles. Thus, Aristotle asks whether we ought

to begin by discussing each separate species—man, lion, ox, and the like—taking each kind in hand independently of the rest, or ought we rather to deal first with the attributes which they have in common in virtue of some common element of their nature, and proceed from this as a basis for the consideration of them separately?(639a16)

This question is provided by Aristotle as an example -- introduced by *hoion* -- of the type of question which the student of zoology must answer in order to judge whether the proofs of the scientist are correct, because it provides a methodological principle guiding the exposition of the data. However, the question whether we deal first with the generic properties or the particular properties of animals (639b6) is significant for Aristotle in his exposition of the method because of the importance of methodological economy. He argues that there are many common phenomena, such as sleep, respiration, growth, decay, and others, whose explanation would involve frequent repetition if they are studied in each particular occurrence. So should one study genera, and if so, how?

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<sup>1</sup>This phrase is not found in the Greek text.

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Aristotle addressed a similar question in the *Topics*, concerning how one should refute universal affirmative or negative statements. His advice is to

Look at them species by species [κατ' εἶδη], and not in their infinite multitude: for then the inquiry will proceed more directly and in fewer steps. You should look and begin with the most primary groups, and then proceed in order down to those that are not further divisible (109b14).

In the *Topics* passage, Aristotle is translated as saying that we come to the *eidê* by division, such as the division of the knowledge of opposites into the knowledge of relative opposites and of contraries and of terms signifying privation and possession, and of contradictory terms (109b17-20). If we find one counterexample from among these, then the universal statement is refuted.

The passages exemplify a number of controversies in the interpretation of Aristotle and of the role of classification in biology. To Aristotle's *aporia* about the method of research, the answer seems to be that we should study the generic characteristics of animals. Is this a purely pragmatic choice, taken in order to save effort, or are there theoretical reasons why this should be done? Yet the *Topics* passage includes the recommendation that we divide a larger group until we reach its indivisibles. What does this division consist in and does it have theoretical importance for Aristotle's zoological theories? The examples suggest the method of "dichotomy", according to which a class is divided into members which have some quality and those which do not, as we examined in the previous chapter. Is this the method defended by Aristotle, and whichever method he adopts, is the procedure something valuable for the classification of animals? I will argue that Aristotle's notion of genus is central to the answer to these questions: he does not defend a method of classification, but believes that a genus is a higher determination of the forms which it embraces.

### i. The Use of "Genus "in *PA* I

Many interpretations have been given of Aristotle's purposes in biology. Ross comments that Aristotle was the first to collect the known data about animals, and the first to "undertake the problem of their classification"(Ross, 1964, p.114). The classification resulted in a "*scala naturæ*" from the least developed to the most developed creatures (ibid., p.116). In the *Parts of Animals*, Book I, Aristotle is thought to be providing the theory of this new classification scheme, a theory which

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would replace the method of division which was popular in the Academy. So conceived, the notion of genus which Aristotle seems to be using is the class notion of the logic texts, according to which the genus is putatively the potentiality of a group of individuals for a form which is differentiated in it and is hence divisible into its differentiated species.<sup>2</sup> David Balme refers to this as the absolute use of genus, in contrast to the relative use in the texts, and finds it in several places in the biological works<sup>3</sup>. In this absolute use, each species of animal fits into a grand scheme which locates it in relation to its successive wider classes, and ultimately relates it to all other creatures of any of the *megista genê* or greatest classes. If this is the case, then Aristotle was a direct precursor of Linnaeus, whose method of classifying animals is the basis of our classifications into kingdoms, phyla, classes, orders, families, genera and species. In the relative use, the relation between an *eidos* and genus is one of inclusion, occurring at any level of a descriptive classification.

Balme argues that because each Aristotelian substance is *tode ti*, "this something", the absolute use is more important than the relative use, which is found in the biological works apart from the *PA* I. The absolute use of the terms genus and *eidos* makes them classes in a serial order, the genus being the larger, inclusive class, and the *eidê* being the classes into which the genus is divisible. For example, "herring" is a species of "fish". Having catalogued 413 instances of genus, and 96 instances of *eidos*, in biological works other than *PA* I, however, Balme finds that the terms do not play a taxonomic role. For example, "dog" names a genus at 658a29, but the breeds of dog are called genera at 574a16. There are the genera tortoises (654a9), oysters (654a3), gnats and mosquitoes (721a10), chicks (730a8), cows (782b7), lions (785b17), leopards and peacocks (785b23), and many others. These classes constitute kinds, rather than genera: Balme notes that many such genera would be called an *atomon eidos* in the *Metaphysics*. About *eidê*, Balme found that the term does not seem to have a technical use, but is applied to some of the same things as genera, or to animals in general, or to particular types of animal. *HA* 593b8 seems to be the only text in which Aristotle distinguished genus and *eidos*: "Moreover, the family [*γένος*] of the

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<sup>2</sup>Following Balme (1972), p.34.

<sup>3</sup>Such as *GA* 784b21; Balme argues that *genos* is at the base of analogous comparisons. He recommends further references from Bonitz 151a12-40: these mention the *Topics*, and *Metaphysics*, but there are no references to the biological texts.

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kingfishers live by the waterside. Of kingfishers there are two varieties [εἶδη]; one that sits on reeds and sings; the other, the larger of the two, is without a note". However, Balme interprets the use of "εἶδη" to mean 'forms', "mainly for literary variety"(1962, p.86)<sup>4</sup>.

Instead of the absolute use, genus and *eidos* are explained by Balme as follows:

γένος means a "kind" at any level from the most abstract group to the immediately visible type. Εἶδος is far less commonly used, and represents no group that γένος does not also represent. If they differ in meaning, the difference is not that of higher and lower rungs on the same ladder. They belong to different ladders, and the original difference sometimes shows through, γένος being a statement about kinship and εἶδος a statement about shape or form.(1962, p.87)

The number of sensible species which are called a "genus" proves the variability of the term in these texts, and the contrast between the use of them in the biological texts is metaphysical rather than logical. This distinction will be explained below<sup>5</sup>.

However, Balme comments that the use of genus and *eidos* to distinguish levels of comparison is readily found in *PA* I. Rightly so, thinks Balme, because the "real significance of the distinction between genus and species lies not in its relative use at all levels, but in its absolute use at the level of the infimae species" (1962, p. 84). However, care is required to interpret the first book of the *PA* in this way. The distinction between genus and species in the classification would presumably be translated into Greek using the corresponding words "γένος" and "εἶδος", but to say simply that there are groups or kinds of things does not imply the technical distinction which taxonomists make between levels of comparison. Thus, when we read "a generic differentia must be subdivisible [into εἶδη]; for otherwise what is there that makes it generic [τῶν καθόλου] rather than specific [τῶν καθ' ἕκαστον]?" (642b25), we must note that Aristotle here differentiates the εἶδη from the universal rather than the genus, so this passage cannot be used to prove the absolute distinction, without further premisses identifying the genus with the universal.

In pursuit of this distinction I will review passages in which both "γένος" and "εἶδος" are used. In the course of this, we will coincidentally

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<sup>4</sup>Balme examines a number of passages which more likely use the absolute distinction, but argues plausibly that some of these passages are later additions; others will be examined below. He later repudiated the theory that any taxonomic classification was to be found in Aristotle's work. This chapter is partly an extension of his magisterial work.

<sup>5</sup>Note that in the *Topics* Aristotle says we commonly refer to a thing by its genus, the genus being closer to its reality.

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receive the answer to whether the genera or the *eidê* should be the object of study. In *PA* I.3, Aristotle offers his solution to the question of the starting point of animal research. The text is as follows:

Ἄλλὰ δεῖ πειρᾶσθαι λαμβάνειν κατὰ γένη τὰ 643b10  
ζ᾽α, ὡς ὑφήγηθ' οἱ πολλοὶ διορίσαντες ὄρνιθος γένος καὶ  
ἰχθύος. Τούτων δ' ἕκαστον πολλαῖς ὠρίσται διαφοραῖς, οὐ  
κατὰ τὴν διχοτομίαν. Οὕτω μὲν γὰρ ἦτοι τὸ παράπαν οὐκ  
ἔστι λαβεῖν (τὸ αὐτὸ γὰρ εἰς πλείους ἐμπίπτει διαιρέσεις  
καὶ τὰ ἐναντία εἰς τὴν αὐτήν), ἢ μία μόνον διαφορὰ ἔσται, 15  
καὶ αὕτη ἦτοι ἀπλή, ἢ ἐκ συμπλοκῆς τὸ τελευταῖον ἔσται  
εἶδος.

Now if we read the version by Ogle in the *Oxford Translation*, we can putatively answer in the affirmative whether or not Aristotle absolutely distinguishes between genus and *eidōs* as classificatory terms, as follows:

The method then that we must adopt is to attempt to recognize the natural groups<sup>6</sup>, following the indications afforded by the instincts of mankind, which led them for instance to form the class of Birds and the class of Fishes, each of which groups combines a multitude of differentiae, and is not defined by a single one as in dichotomy. The method of dichotomy is either impossible (for it would put a single group under different divisions or contrary groups under the same division), or it only furnishes a single ultimate differentia for each species, which either alone or with its series of antecedents has to constitute the ultimate species (643b10-17).

Accordingly, the "natural groups" or genera divide into their ultimate "species" -- not by dichotomy, as Aristotle is arguing -- but according to differences between groups which make "species" of the genus. The use of dichotomy presents a dilemma, because both cross-division and the isolation of one characteristic from everything else (by negation, rather than simply implying the higher genera) lacks rigour.

Ogle's translation is an example of the difficulty one faces with the Greek text: the additions made to the Greek will be apparent from a strict translation of the Greek:

But one must try to take the animals by genera, as the many have guided, distinguishing the bird genus and the fish. But each of these is defined by many differentiae, not according to dichotomy. For thus, on the one hand, either it is altogether impossible to take them in this way, (for the the same thing falls into more than one division and opposites in the same), or it is only one differentia, and either simply or out of a combination, this will be the last *eidōs*.

The question which needs to be addressed is whether *eidōs* must be translated "species", as a subgroup of the genus. Ogle's text adds terms and subordinate clauses which require the *eidōs* to be a class concept. But does the Greek require these extra terms and subordinate clauses?

Aristotle introduced the criticism of dichotomy with the phrase "Λαμβάνουσι δ' ἔνιοι τὸ καθ' ἕκαστον, διαιρούμενοι": "but some take the

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<sup>6</sup>One thesis of Charles (1988) is that in order to find the 'common natures', an amount of classificatory work is accomplished in the HA as a whole.

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particular by dividing" (642b5). Aristotle wants to explain how to grasp particular things. He seems to say that by dichotomy, some (Academics) attempt to obtain the particular, and he argues that they fail. If this is the case, one can plausibly translate the "*eidos*" of my first passage -- 643b10ff -- with "form"<sup>7</sup>. Aristotle argues that the *differentia* is the substance of the thing, and identifies the substance with the form in a number of places. He uses the criticism of dichotomy as a heuristic for explaining how we grasp the particular by attending to the *differentia* which is its particular form, rather than the universal which can be predicated of it.

Similarly, one might appeal to a passage which is given shortly later in *PA I*:

Ἴσως μὲν οὖν ὁρ- 644β1  
θῶς ἔχει τὰ μὲν κατὰ γένη κοινῇ λέγειν, ὅσα λέγεται καλῶς ὠρι-  
σμένων τῶν ἀνθρώπων, καὶ ἔχει τε μίαν φύσιν κοινὴν καὶ  
εἶδη ἐν αὐτῷ μὴ πολὺ διεστῶτα, ὄρνις καὶ ἰχθῦς, καὶ εἴ τι  
ἄλλο ἐστὶν ἀνώνυμον μὲν, τῷ γένει δ' ὁμοίως περιέχει τὰ ἐν  
αὐτῷ εἶδη· ὅσα δὲ μὴ τοιαῦτα, καθ' ἕκαστον, οἷον περὶ ἀν- 5  
θρώπου καὶ εἴ τι τοιοῦτον ἕτερόν ἐστιν.

Ogle translates this as:

Perhaps, then, it will be best to treat generically the universal attributes of the groups that have a common nature and contain closely allied subordinate forms, whether they are groups recognized by a true instinct of mankind, such as Birds and Fishes, or groups not popularly known by a common appellation, but withal composed of closely allied subordinate groups; and only to deal individually <with the attributes of a single species, when such species>, man, for instance, and any other <such, if such there be-stands apart from others, and does not constitute with them a larger natural group>(I.4 644b1).

(Note: my Greek text is not that of Peck, which was used by Ogle.) Again, the additions made by the translator contribute to the genus-species interpretation: for line four, Ogle's translation has groups composed of groups of attributes.

However, the term "genus" is not given in the nominative case in this quotation, but rather "things" is the assumed subject because of the nominative plural definite article in line two<sup>8</sup>. Leaving the transliteration of "*γένος*" and "*εἶδος*" (and their derivatives), I translate the passage:

Perhaps, therefore, on the one hand, it is right to speak of some things had in common by *genê*, as are well defined by mankind, and have both one nature in common and *eidê* in it not much differing, as birds and fish, and if any others are

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<sup>7</sup>The second edition of Balme's *De Partibus Animalium* is ambiguous on this point, leaving the translation 'species' for the last use of 'εἶδος'; however, Gotthelf argues in his 'Report on Recent Work' Balme's desire to see all uses translated as 'form' (p. 168). I thank Dr. Andrew Mason for discussing with me this text.

<sup>8</sup>I thank Dr. Scaltsas for drawing my attention to this; the translations are, of course, my own. A problem arises because of the lack of parallelism in the use of μὲν..δὲ.. However, a δὲ answering the first μὲν is offered in the subsequent lines.

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unnamed, <to speak> similarly of the genus, which also embraces in itself *eidê*. On the other hand, of things not like this, <it is right to speak> in accordance with particulars, such as of man and any others which are such as this.

The question arises how "εἶδος" is to be translated: must the *eidê* be subgroups of the genus? This is a plausible interpretation, according to the model of animal taxonomy making an absolute use of genus: common attributes are shared by different species of animals. However, to read such a model into Aristotle on the basis of this text alone would require us to make sense of the "things not like this". The phrase is ambiguous on the relative model, because either it could refer to things by genus which don't have one nature and/or different *eidê*, or it could refer to things by genus which do not embrace *eidê*. What is the distinction Aristotle is attempting to invoke? The example of man (a *genos*, HA 490b16-19) suggests that the latter alternative is meant: man does not differ in form because all men are rational souls as their substance, and this does not differ in form as the form of man differs from the forms of all other animals, (perceptive souls), and from plants (nutritive souls).

Thus, we must follow Ogle in translating "εἶδη" in line four as "forms", and retain the word "form" for line six. Following Balme, "γένος" is to be translated as "kind". The sense of the passage which results from this reading is that we should study the common characteristics of a variety of otherwise different animals, following the popular distinctions, and we should study particular characteristics, which are not had by animals which differ in form, as the characteristics occur: in accordance with the particular animal forms which possess them.

Thus we should first deal with the common *attributes* of animal kinds, rather than with each separate form. The stated justification for this is similar to that used by Aristotle in the *Topics*, above; here, Aristotle says that studying each indivisible species "will result in speaking frequently about the same affection because it belongs in common to more than one species, [so] to this extent it is somewhat absurd and lengthy to speak about each separately" (644b33; Balme, 1972 trans.).

The emphasis in this statement should fall on "the same affection", for this notion of identity occurs throughout the biological texts. In the following section, we will explore this notion of sameness.

### ii. Analogy v. the More and the Less

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In *HA I*, Aristotle explains how animals differ from each other. In I.6, he writes that

we must look to the constituent parts of animals. For it is in a way relative to these parts, first and foremost, that animals in their entirety differ from one another: either in the fact that some have this or that, while they have not that or this; or by peculiarities of position or of arrangement; or by the differences that have been previously mentioned, depending upon diversity of form, or excess or defect in this or that particular, on analogy, or on contrasts of the accidental qualities. (Thompson, 491a14ff).

Apart from differences in form and accidents, Aristotle recommends the examination of the previously mentioned differences of excess and defect -- the so-called "more and less" -- and differences between parts which are similar by analogy. In *HA I.1*, Aristotle had explained that among animals of the same *eidos*, the parts have the same *eidos*, based on empirical evidence (*HA I.1* 486a16).<sup>9</sup> This contrasts first with the parts of animals belonging to the same genus, for whom the properties and some accidental parts differ by excess or defect. The example provided is different lengths of bill had by "species" of the "genus" birds<sup>10</sup>.

Secondly, the resemblance of the parts of animals can be "in the way of analogy": for example, "bone is analogous to fish-bone and nail is analogous to hoof"(486b20). In general, the similarity is that in functions<sup>11</sup>: the relation of *A* to *B* is the same as the relation of *C* to *D*. Analogical comparisons hold between the parts of animals which belong to different *genê*. This thesis is justified by appeal to Aristotle's claim in the *Topics I.17* that similarity between things belonging to different genera is studied by means of analogy:

Likeness should be studied, first, in the case of things belonging to different genera, the formulae being 'A:B = C:D' (e.g. as knowledge stands to the object of knowledge, so is sensation related to the object of sensation), and 'As A is in B, so is C in D' (e.g. as sight is in the eye, so is reason in the soul, and as is a calm in the sea, so is windlessness in the air).(108a7ff.)

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<sup>9</sup>Thompson translates that the parts are identical "in form or species"; in Barnes (1984) the 'or species' is removed.

<sup>10</sup>Taken to be defining "genus", Aristotle says here that he means something like "Bird", which "is subject to difference in respect of its genus". This is the sense we read in  $\Delta$ .28 1024a36, of a subject which can take on different forms.

<sup>11</sup>Commenting on *APo* II.14, Barnes says that "Aristotelian analogies are almost invariably functional", in that parts "all fulfil some function F"(1993, p.251). I have used "function" to denote the logical entailment of one term by another, and not necessarily the converse entailment. This qualification is necessary because an  $\text{\textit{\iota}\delta\textit{\iota}\textit{o}\nu}$  will entail its subject, but an accident need not entail its subject. However, it is the case that the teleological view is predominant in the use of functions. Aristotle argues that not only are the parts of animals had because of the function which they perform in the life of the creature (*PA* 645b16-20), but also the animals are distinguished by life functions (*HA* 596b21-4, *PA* 645b33-5). (See Charles 1988).

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In this statement, the examples are not exclusively functional, but this use is more common in the biological texts. Yet it is not clear, however, whether the examination of parts by means of analogy is exclusive to *inter-generic* studies, rather than *intra-generic* studies. In the *Parts of Animals*, Aristotle says that

It is generally similarity in the shape of particular organs [τοις σχήμασι τῶν μορίων], or of the whole body, that has determined the formation of the larger groups. It is in virtue of such a similarity that Birds, Fishes, Cephalopoda, and Testacea have been made to form each a separate class [τὰ γένη]. For *within the limits of each such class*, the parts do not differ in that they have no nearer resemblance than that of analogy -- such as exists between the bone of man and the spine of fish -- but differ merely in respect of such corporeal conditions as largeness smallness, softness hardness, smoothness roughness, and other similar oppositions, or, *in one word*, in respect of *degree* [the more and the less] (644b8, Ogle, trans., with the translator's additions put in italics).

In this passage, Aristotle implies that closer similarities exist within the genus than analogues, but he does not say that the similarities between members of genera cannot be analogical<sup>12</sup>.

The clearest explanation of analogy is provided by Aristotle in the *Poetics* XXI, as follows: "Analogy or proportion is when the second term is to the first as the fourth to the third"(S.H. Butcher, trans., 1457b16). The context of this statement is a discussion of metaphor, about which Aristotle explains that:

We may then use the fourth for the second, or the second for the fourth. Sometimes too we qualify the metaphor by adding the term to which the proper word is relative. Thus the cup is to Dionysus as the shield to Ares. The cup may, therefore, be called 'the shield of Dionysus,' and the shield 'the cup of Ares.'<sup>13</sup>

On the assumption that analogy is a sound type of comparison, what, we need to know, justifies the scientist who wants to say that two animal parts are analogously the same? Presumably, one would have to defend the premise that the relation between the first and second terms is identical to the relation between the third and the fourth terms. In the case of the metaphors, this would require us to take literally the terms used to relate the objects explained.

Defending the use of analogy by Aristotle is required because some commentators find it to be an imposition of mind on nature: Bourgey argues that this use is an example of

the classical antithesis, proof from reason ... proof from fact, expressed by varying but equivalent and easily recognisable formulae. (The commonest are 'in accordance

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<sup>12</sup>Statements about *intra-generic* analogues can be found at 486b20 and 516b14.

<sup>13</sup>I will examine below a distinction made by Hesse between analogous properties of parts and analogous relations between parts, which Hesse finds to be confused in this quotation (1965, p.330).

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with reason (*logos*) ... in accordance with observation (*aisthesis*), and 'in reason (*logoi*) ... in fact (*ergoi*)'. (1975, p.181).

The method of analogy is a "proof from reason", which seems to be an imposition of theory onto nature.<sup>14</sup> Noting that Aristotle's ability to "coordinate biological facts" is of "profound value", Bourgey claims that

In any case, this implicit acquiescence in a commonplace is a new sign that not only the philosopher, but the writer too, had been unable to separate out and display the different elements in the response of the researcher and scientist to his material ... [thereby] encouraging passivity and the casual handling of empirical proofs, and at the same time .. encouraging the proliferation of arbitrary explanations.(1975, p.182)

"Encouraging passivity", "casual" and "arbitrary" are quite loaded phrases, suggestive of intellectual laziness on Aristotle's part; however, the implicit question is whether appeals to analogy are of theoretical value.

In a sense, Bourgey's appeal to the intellectual "commonplace" is warranted. In Plato's *Statesman* 257b3, Socrates takes issue with Theodorus for finding of equal value three things which "differ to an extent that defies all .. mathematical expressions of proportion (*ἀναλογία*)". Our term 'analogy' is connected with the early Greek use of the term to express mathematical ratios. Pellegrin agrees with Aubenque that there is only one notion of analogy, "analogy 'of proportion,' doubtless of mathematical origin"(1987, p.322)<sup>15</sup>.

Socrates's statement suggests that a proper analogy should find equal, things which are not different<sup>16</sup>. This is confirmed by Plato's explanation in the *Timaeus* of proportion (*ἀναλογία*), "the fairest bond .. which makes the most complete fusion of itself and the things which it combines":

whenever in any three numbers, whether cube or square, there is a mean, which is to the last term what the first term is to it; and again, when the mean is to the first term as the last term is to the mean-then the mean becoming first and last, and the first and last both becoming means, they will all of them of necessity come to be the same (*τὰ αὐτὰ*), and having become the same with one another will be all one (*ἓν*) (31c4-).

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<sup>14</sup>Charles (1988) provides a useful summary of the debate between the empirical and the *a priori* readings of Aristotle's biological methodology (see particularly nn 28-30), arguing that Aristotle is guided by some theoretical assumptions about life functions.

<sup>15</sup>In Plato's *Gorgias* 465b7, the source of analogous reasoning is said to be in mathematics. Cf. Dodds, p.231. Ashworth notes that "proportionalitas" was the translation of the Greek into Latin by Robert Grosseteste of the *EN* passage (1991, p.93); "the word '*analogia*' seems to become established in logic texts round about 1250, though it is used earlier in theological sources"(1991, p.96-7).

<sup>16</sup>Socrates claims in the *Protagoras* that one criterion of a subject being scientific is that its units are measurable.

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For example, the sequence '2:4:16' has '4' as the mean; it is the square of first term, and the third term is the square of it. Thus, the relation of 2 to 4, with 4 as the last, is the same as the relation of 4 to 16, with 4 as the first. If the relations embrace the terms, we have the identity and unity which Plato takes the analogy to bind. (Below, we will examine another use of analogy by Plato in his approximation of what would be the *megista gene* of Aristotle.) Aristotle accepts that the relations are identical, as confirmed by his quantitative analysis of analogy in *EN* V.3 1131a31: "proportion [ἀναλογία] is equality of ratio". He follows this with a clarification of Plato's theory of "the first" and "the last": symmetrical relations must hold between four terms, although one term can be used twice, once as the last term of a ratio, and once as the first term of a ratio (1031b1)<sup>17</sup>.

Aristotle uses analogical explanations throughout his works<sup>18</sup>, and does not confine the use to problems of numbers. In the *Topics* passage, he uses analogy to explain the similarity between functions of the soul, and of weather patterns. He warns us in the same text to be careful when drawing analogies from "terms that are far apart", because they will hamper our ability "to see in one glance the points of likeness [τὰ ὅμοια συνορᾶν.]"(108a12-14)<sup>19</sup>. In the case of comparison between genera, Aristotle has found the problem:

Of the basic truths used in the demonstrative sciences some are peculiar to each science, and some are common, but common only in the sense of analogous, being of use only in so far as they fall within the genus constituting the province of the science in question.(Ross, trans., *APo* II.10 76a37)

The problem is the importing of a principle from one scientific domain, where it has paradigmatic use, into another, where its use might be unwarranted. In the *Parts of Animals* I.4, he states that "almost all animals present analogies in their corresponding parts"(644a23): possibly too many analogies can be found. In a similar vein, Margaret Macdonald appeals to the misuse of analogy by philosophers -- including Aristotle in his theories of matter/form and change -- to putatively "correct and enlarge our ordinary and technical vocabularies"(1965, p.106), whereas according to her,

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<sup>17</sup>In the context, Aristotle argues that justice is the proportional (1131b17), involving the proper distribution of good things.

<sup>18</sup>See Bourgey (1975), Bonitz (1955, 47b41ff.). Sundry references to the *Metaphysics* and later texts include also 1048a35-b7, 1457b9-17, 1016b32-1017a2, 1018a13, 1096b29, 1070a32,b18 1071a4,26 1093b18.

<sup>19</sup>In this essay, I will not explore Aristotle's theory of 'intuitive induction'. See Hesse (1965, p.336), Irwin (1988, §79), Peikoff (1985).

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these deductions are never empirically verifiable, [so] we can test them only by considering how the words in which they are expressed are otherwise used and what uses of the propositions from which they are said to be derived have tempted philosophers to these alleged deductions (1965, p.105).

I say that the two philosophers are similar because Aristotle directs our attention to the difficulty of applying a certain vocabulary from one science, into another, and Macdonald directs our attention to the difficulty of such linguistic practices *tout court*. What makes legitimate the use of analogy?

To defend Aristotle against these objections, I shall adopt a distinction defended by Mary Hesse, between two senses in which terms are "analogous": first, terms (or for Aristotle, the things they signify) are analogous when there are properties which are shared "between parts of the members of different species"(1965, p.330). The example given is between the "osseous nature" of spine and fish-bone. Second, terms are analogous when "there is similarity in the *relation* of the parts to the whole in each species"(1965, p. 330). An example of this similarity is the similarity between scales in relation to fish and feathers in relation to birds as types of covering.

Plausibly, cases of basic holistic truths which are common to different sciences are at least subject to analogous relations, because the items within each domain stand *mutatis mutandis* in analogous relations. That is, each science deals with a particular set of objects, which must be different from the objects of another science or there would be no need for two fields of inquiry (see Plato's *Charmides*). What, then, is the relation between analogous terms? One suggestion is that the relation between the terms of an analogy is one of unity: in Met. Δ.6, Aristotle compares types of unity:

some things are one in number, others in species (εἶδος), others in genus, others by analogy; in number those whose matter is one, in species (εἶδει) those whose definition is one, in genus those to which the same figure of predication applies, by analogy those which are related as a third thing is to a fourth (1016b31).

Aristotle amplifies this by claiming that in each case of unity, the next type of unity (in the sequence he has provided) will also be found, but the previous type will not be found: for example, "things that are so <one> in genus are not all one in species but are all one by analogy; while things that are one by analogy are not all one in genus"(1017a2)<sup>20</sup>. This is consistent with the Platonic view mentioned earlier: *analogia* makes a

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<sup>20</sup>Tredennick translated 'εἶδος' here as 'form', in the Loeb edition.

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fusion of the things related. However, this is not as much an explanation of how analogy relates the things it unites than a restatement that the things are united. (Hence Hesse: 1016b is simply a restatement of the same problem (p.334).)

Perhaps the justification of analogies is in the nature of the parts? Because analogical explanation is used to compare discrete things, it cannot be the case that the terms of the analogy are similar; that is, if they were numerically, formally, or qualitatively the same, or the same in kind, we would have other ways to explain their similarity. What about the relation between the things? In *APo.* II.17, Aristotle argues that "Items which are the same by analogy will have their middle term the same by analogy too"(99a16; Barnes, trans.). This quotation occurs in the context of an examination of explanations: depending on the thing to be explained, comparisons can make use of synonymous terms if the features being explained are common to a form of things, or homonymous if the features being explained differ between the forms of things<sup>21</sup>. Thus it is fair to interpret Aristotle's reference to the middle term as the relation between the items compared. However, this entails that the justification of analogical reasoning is not found in the parts of analogies.

On the premise that an analogical explanation is justified either by the terms, or the relations being compared, or by the use of the analogy as a whole, it follows that there must be something about an analogy as a whole which justifies its use. Aristotle justifies the use of analogy by noting the identical relation of the things related to things of other genera discovered elsewhere in his scientific enquiries<sup>22</sup>. He notices an apparent similarity between various entities, and realizing that one of them stands in a particular (internal) relation to something, he explores the occurrence of the same relation for the second entity. In *Met.* Λ.4, he argues that "The causes and the principles of different things are in a sense different, but in a sense, *if one speaks universally and analogically*, they are the same for all"(1070a31ff; Ross, trans., italics mine). For example, in *APo* II.14, Aristotle remarks that

Again, another method is to excerpt by analogy: you cannot take any one identical thing which pounce and spine and bone should be called; but there will be items

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<sup>21</sup>See Barnes, (1993) p.250, 255.

<sup>22</sup>Martin comments that expressions of analogy are "neither purely univocal nor purely equivocal", being important for most of the important philosophical terminology (1996, p. 103).

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which follow these features too, as though there were some single nature of this sort.(98a20, Barnes, trans.)

(The single nature of these things is later named "osseous" by Aristotle.) There is no genus which can combine creatures with all of these characteristics, nor *a fortiori* a natural kind term for them. However, they have each a corresponding feature because of the relations they stand to the creatures which possess them, and a pseudo-nature named "body-structurers" can be conceived by the analogous relations the original properties stand in to squids, fish and men. According to Patzig, "Aristotle thought that analogy holds between objects when (a) they are described by the same words and (b) they can be defined by their *identical* relationship to something *different*" (1979p.49)<sup>23</sup>. On my reading of this, analogy is defensible on the grounds that since we know the relationship  $aRb$ , and that another thing  $c$  is similar to  $a$ , the  $d$  in the same  $R$  to  $c$  as  $b$  is to  $a$  entitles us to infer that  $cRd$  is the same type of relation as  $aRb$ . Although we do not yet know how to justify  $cRd$ , the awareness of  $c$  as a variable standing potentially in the relation  $R$  can lead us to discover that  $d$  completes the relation. For example, the awareness that <feathers are a covering for birds> and that <birds=fish>, in some sense of identity, entitles the hypothesis that <feathers are a covering for birds in the way that scales are a covering for fish>. The principle according to which this inference is permitted is the formal principle that an animal has covering.

Does this have theoretical value? Analogy is acceptable at least as a way of comparing things for which no other scale than their likeness to other things is available. This does not mean that analogies express necessary truths: notably, analogy can be called upon when we don't know the fourth term. Given that  $aRb$ , and  $c=a$ , we can reason by analogy that there is a  $d$  to which  $c$  is related by  $R$ . In this case, we must find out what  $d$  is. In this way, verification is important to the scientist who makes use of reasoning by analogy. Rather than "arbitrarily extending our theoretical vocabulary", analogy is not dispensable to science. Similarly, reasoning by analogy will enable the scientist to determine the truth conditions according to which the analogy can be established<sup>24</sup>. For example, a

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<sup>23</sup>Patzig's article includes a defence of the thesis that the method of analogy was adapted from Plato, but used by Aristotle to replace explanation in terms of a first  $X$  (whether  $X$  is matter, a movement, an actuality or potentiality, a soul, etc.).

<sup>24</sup>Macdonald and Hesse make a contrast between scientific and metaphysical uses of analogy, which I'll not address in this study; I am here concerned with the use of analogy by Aristotle in biological studies.

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candidate for  $d$  can be tested to determine whether it actually fulfils the function of  $b$ , such as by tests of resistance or collapse, in the case of spine and pounce. For the present scientific context, we note that the scientist is explaining phenomena for which there is no mathematical scale. The truth conditions of a scientific analogy will vary according to the cases, because the terms can be anything from the parts of organic beings to the elements of which these parts are made. However, we are in a position much like Aristotle's in relation to his theoretical simples: we haven't got variants of litmus tests for all of our quarks, neutrinos, or quantum phenomena, either. In this sense, it behoves us to show that in a scientific analogy, the objects of the theory are not there to be found. Similarly, the analogy can be appropriate although there is no similarity between the cases, if by this one means that the meaning of the analogy is not apparent to all audiences: in the case of scientific analogies, it could well be the case that the analogy is significant to a select population.

How do we answer the puzzle about the use of analogy to explain the similarities between the parts of individuals with the same form, or of different animals belonging to the same genus? Referring again to the passage from *Metaphysics*  $\Delta.6$ , Aristotle would argue that we could make analogies between individuals and creatures with the same form, etc. because these things are one in form, and genus. However, of parts which differ by more and less, the use of analogy to explain them will be less informative than the use of the more and the less. To my knowledge, there is no prohibition on this, apart from Aristotle's emphasis on proper demonstration. Analogy is also appropriate concerning accidental attributes had by individuals, as would also be used in literature.

An example of the use of analogy is his summary of the material parts of blooded creatures, which amounts to their proximate matter (see my chapter VIII). He explicitly refers to the analogies to be found, which he examines in Book III of the *HA*. He says that:

In sanguineous animals the uniform part most universally found is the blood, and its habitat the vein; next in degree of universality, their analogues, lymph and fibre, and, that which chiefly constitutes the body of animals, flesh and whatsoever in the several parts is analogous to flesh; then, bone, and parts that are analogous to bone, as fish-bone and gristle; and then, again, skin, membrane, sinues, hair, nails, and whatever corresponds to these; and, furthermore, fat, suet, and the excretions -- dung, phlegm, yellow bile, and black bile.(511b4-10)

In the first lines we are given the triple relation 'some blooded creatures: blood: vein' with the analogous 'other blooded creatures: lymph: fibre', the middle terms being the agent of heating the

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body and the last terms being their channel. This is an example of an analogy within a quasi-genus, 'blooded creatures', yet Aristotle finds that even among the blooded creatures, the flesh is not always the same, nor some of the other parts: he gives as an example the differences found in fish which are sometimes considered a genus unto themselves (as we have seen) and includes parts which would not be found in all blooded creatures if these must include fish and birds: for example, the hair. Yet even among these variations will be found, i.e. those according to the more and the less (781b30). The notions of the excess and defect are the other major bases of comparison, which we'll examine now.

Aristotle's appeal to the more and the less has been interpreted in a variety of ways. D'Arcy W. Thompson argues that "Aristotle was thinking, *more Platonic*, of all the fowls of the air as mere visible forms or εἶδη, mere imperfect representations of or approximations to their prototype the ideal Bird" (1940, p.213). He thinks this is the case because of the original use of the distinction for the theory of numbers, according to which the irrational numbers differed by one, or "a little more/a little less" than similar operations performed upon rational numbers<sup>25</sup>. (Incommensurable segments were the problem.) We will examine the use of "the more and the less" by Plato in due course; as Thompson notes, we will want to see if the use of the terms for numbers is analogous to the use of the terms about animals.

Lennox would attribute to Thompson the view that Aristotle was a "typological essentialist", holding that "there is some one identical feature or set of features in which individuals of a kind share or 'participate', and in virtue of which the individuals are said to belong to the kind" (1987,p.340). This thesis would presumably work most appropriately with the Academic view that for any natural kind there is a Form, or paradigm according to which instances of that Form get their nature<sup>26</sup>. Instead, Lennox argues that the terms "*genos*" and "*eidos*" are used in the biology because many attributes are only distinct by the more and less: his hypothesis is that "Aristotle treats variations between one form of a kind and another as differences of degree"(1987, p.340). Like Lennox, Boylan

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<sup>25</sup>For early uses of the more and the less by Aristotle in the *Categories*, see 3b33-4a9, 6a19-25, b19-27, 10b26-11a14, 11b1-8.

<sup>26</sup>I realize that the "according to which" and "get their nature" mask the tremendous complexities involved in the one/many problem which Plato uses the Forms to solve; such matters are do not determine the result of this chapter; I chose that phrase because it is the least biased.

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argues that the contrast of differences in degree and analogous differences provides a distinction between *eidos* and genus: "Aristotle, in his philosophy of biology, was laying the theoretical foundations of taxonomy"(1983, p.57). The thesis which Lennox says Aristotle could have adopted is the following:

For two individuals to differ in degree, they must both be the same general sort of thing. With respect to that *sort* they do not differ in degree. But the general sort is constituted of *features with range* - any sub-kind may have those features exemplified by different specifications of that range (1987, p.346).

According to this thesis, the sort or genus embraces individuals which share some features which have measurable differences, such as longer, shorter, hotter, drier, et cetera<sup>27</sup> but whose attributes are qualitatively and functionally the same.

I think the appeals to parts which differ by the more and the less and parts which differ by analogy are used by Aristotle because he found in these analyses answers to how abstract terms refer in biology: differentiation by genus into *eidê* will be a *consequence* of this. In *Topics* I.18, Aristotle provides a startling statement which encapsulates his philosophy of science:

The discovery of the differences of things helps us both in reasonings about sameness and difference, and also in recognizing what any particular thing is. That it helps us in reasoning about sameness and difference is clear: for when we have discovered a difference of any kind whatever between the objects before us, we shall already have shown that they are not the same: while it helps us in recognizing what a thing is, because we usually distinguish the expression that is proper to the essence of each particular thing by means of the differentiae that are proper to it.(108a38)

I say this sentence is startling because in his statement, Aristotle unites both his philosophical commitment to the knowledge of essences and his scientific interest in case-studies. He affirms that differences will be found between particular individuals, but I think that because the differences will be numerical differences, comparable differences, or analogical differences, it is possible to explain the respect in which the individuals are similar.

Aristotle's use of comparison by the more and less differs from the use made of the notions by Plato. In the *Philebus*, we find the following dialogue:

Soc. Be on the look-out, then. What I am asking you to consider is difficult and controversial, but you mustn't let that deter you. First of all, see if you can discern any determinant in relation to hotter and colder; or is it true that so long as the

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<sup>27</sup>Part of the justification for this is found by Lennox in the thesis that matter is genus, which will be dealt with in the last chapter of this dissertation.

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greater and less that inhabit these categories continue there they would not permit any end to come about? Indeed any such ending would be the end of them?

Prot. True enough.

Soc. Now, we agree that hotter and colder always contain more and less?

Prot. Yes.

Soc. The argument suggests that these two are always without end. Being without end they are completely indeterminate [ἀπείρω] (24a6-b7; Gosling, trans.).

Plato draws attention to the indeterminacy of the more and the less. It seems that Plato appeals to the use of these relative terms in the sense that we say "gold weighs more than silver, yet silver weighs more than aluminium, which itself weighs more than ...": his appeal to the infinite draws on the fact that there putatively should be a stable reference point according to which other things are comparable as more or less heavy, but because there isn't a reference to be found in experience, the relatives are indeterminate. I will show that Aristotle's use of these expresses an internal relation between the items being compared, allowing us to find the common quality which gold is more of than silver<sup>28</sup>.

An interesting example from the texts is Aristotle's comparison of the intellects of different types of animal in *PA* II.4:

Some at any rate of the animals with watery blood have a keener intellect than those whose blood is of an earthier nature. This is due not to the coldness of their blood, but rather to its thinness and purity; neither of which qualities belongs to the earthy matter. For the thinner and purer its fluid is, the more easily affected is an animal's sensibility. Thus it is that some bloodless animals, notwithstanding their want of blood, are yet more intelligent than some among the sanguineous kinds. Such for instance, as already said, is the case with the bee and the tribe of ants, and whatever other animals there may be of a like nature. (650b19ff).

Aristotle has correlated the greater cognitive keenness of some animals with the fact that they also have blood which is more "coagulated" than the blood of other animals. Aristotle explains this by the fact that the blood of the less intelligent animals contains more dry elements, the so-called "earthier" nature. Fluidity of the blood heightens the creature's sensibility, if it occurs in the right measure: the contrast is drawn between variations in the bloodless -- or non red-blooded -- animals, first, the bees and ants, whose fluids are more receptive of change, and second, other bloodless creatures, which are less able to deal with threatening situations because the lack of fluids restricts their responses. Aristotle thus provides three contrasts: there are variations of more and less within the bloodless kind, and the same variations hold between the bloodless and blooded creatures. This example is interesting because it exemplifies that not only are there quantitative differences between different animals, but these

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<sup>28</sup>*Philebus* 25c5-8 and from 25a-c See Lennox (1987) p.342, and Pellegrin (1982) p.110.

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differences are differences in the constituent elements, which are used to explain behavioural differences.

The division of animals into red-blooded and 'bloodless', and the latter into ants, bees and others, however, requires us to address a question which has engaged the commentators a great deal, recently: does Aristotle think classification a worthwhile scientific pursuit? Does the population of bloodless creatures form a group which Aristotle uses for classificatory purposes? Does it divide into species like bees and ants, in the sense that the groups of these individuals form a different classification within the larger group?

### iii. Taxonomy: the *megista genê*

The issue which confronts us with the translation of Aristotle is whether *genus* and *eidos* could be used for classification. Many scholars have noted that it was Porphyry who first used the terms *genos* and *eidos* in the sense which they are used by modern taxonomists, who translate *eidos* as species. Pellegrin quotes Porphyry's theory in the *Isagoge* that the defining sense of genus is "that to which the *eidos* is subordinate" (I.8, trans. Warren, quoted in Pellegrin, p.74)<sup>29</sup>. This is the sense of genus which some interpret as the first constituent of a definition, which has differentiae as its qualities in *Metaphysics* Δ.28 (1024b4).

However, we need to know whether this involves a commitment on Aristotle's part to the classification of animals. On this construal, the *genus-eidos* relationship is fixed, the genus being the class which is composed of the *eidê*. Great controversy arises on this topic. Ross construes the *genus-eidos* relation as fixed. A. C. Lloyd argues that classification by genus and species is done "to exhibit and explain the nature of material substance" (1962, p.86). On his account, classification will be by formal and final causes: these will allow us to demonstrate how the matter and the form are a substantial unity (p.81).<sup>30</sup> Now G. E. R. Lloyd records

unanimity on the minimum fact that a comprehensive systematic classification of animals proceeding *from* the highest groups *via* their principal divisions to end with the *infimae* species all clearly identified is nowhere to be *found* (1990, p.8; my italics).<sup>31</sup>

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<sup>29</sup>See also Balme 1987, p.296.

<sup>30</sup>I have constructed this thesis from Lloyd's argument about the nature of p-series.

<sup>31</sup>See note 6 about Charles.

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The work of Balme is consistent with this (1961/75, p.188; 1962, p.85); he comments that a systematic classification was not even *planned* by Aristotle.<sup>32</sup> Balme examined many cases of genus and *eidōs*, as mentioned above, and established that the use of genus and *eidōs* is generally relative, rather than fixed: in his terms, it is not absolute. A genus, in his view, is the bearer of a form, in the "substratum" view of genus mentioned by Aristotle at *Metaphysics* Δ.28 1024a36, which allows for the possibility of naming various populations a genus for the sake of studying the different properties which it can have. Lennox agrees with this (1987, 349) as do Pellegrin (1986, p.59, 68 etc) and Boylan (1983, p.53): a notable precursor to this view is Aquinas, although he doesn't mention it regarding the biological texts<sup>33</sup>. Both G.E.R. Lloyd (1962, p.74-5) and Balme (1961/1975 p.190-1) note that a variety of criteria are used to distinguish animals, usually according to the parts, or the functions of these parts, of the animals. For the moment we must notice that if there is no taxonomic classification of animals in the texts, then A.C. Lloyd's forecast of causal demonstration by means of classification is not to be found.

I have focussed on a few passages from the *PA* I above which some take to be signs of the absolute taxonomic role of genus and *eidōs*. However, another body of texts to which some appeal are those which refer to the *megista genê*. There is a precedent for Aristotle's use of the phrase in Plato's *Timaeus*: he provides an account of how the non-human animals were generated from deformed men. The classes of creatures which Plato mentions are the birds, wild pedestrian animals (quadrupeds and polypods), snakes, and aquatic animals. Having explained the upright posture of men by noting that the separation of the head from the body by the neck facilitates the noble aspiration of men to divine thought (90a-d), Plato accordingly explains the generation of women and other creatures. Women were generated from men "who were cowards or led unrighteous lives"(90e6ff.). Still aspiring to knowledge of astronomy, birds were generated from the men who "imagined .. that the clearest demonstration of the things above was to be

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<sup>32</sup>Pellegrin 1981 takes issue with the earlier work of Balme which implied a classificatory aim in Aristotle; Balme later agreed with Pellegrin. Diogenes Laertius reports that there was a book of divisions attributed to Aristotle in the extant literature of his time, although Diogenes is not always reputable as a source, and someone else's work might be included in the list of Aristotle's work, as occurred with Theophrastus's works.

<sup>33</sup>See Rowan, trans. *Commentary on the Metaphysics of Aristotle*. v. 1, bk. 5 Lesson 22 §1121.

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obtained by sight"(91d8-9). Men who cared little for philosophy became land animals; they had "ceased to use the courses of the head", so they have their front legs on the earth "to which they were drawn by natural affinity"(91e4-6). Snakes are "the most foolish" of the land creatures, and so are without feet but able to move on the earth (92a4). The most ignorant men became fishes and oysters, who no longer needed to respire the fine air, but were made to breathe the impure water (92b5).

Some of these types of creatures are called genera -- the polypods and quadrupeds (92a1), the water-dwellers (92b1) -- but none is called a great kind, nor is the term *eidos* used of these animal types. The main extant use of the notion of *megista genê* concerning animals is in Aristotle's *HA* I.6. Aristotle begins by claiming that "Very extensive genera [Γένη .. μέγιστα] of animals, into which other subdivisions fall [διήρηται], are the following: one, of birds; one, of fishes; and another, of cetaceans. Now all these creatures are blooded"(490b7). The use of the verb "διήρηται" implies that these are classes into which animals can be divided. By translating "μέγιστα" as "very extensive" rather than "the greatest", Thompson attributes to Aristotle the thesis that the greatness of a genus consists in its ability to subsume many classes of animals, the passive verb "διήρηται" telling us that the genus has been divided (at least by us) into many kinds. According to Balme, "μέγιστα" must be translated as "largest" rather than "highest", because it puts emphasis on the quantity of animals, rather than the hierarchy of divisions (1962, p.89n.)<sup>34</sup>. Setting aside questions of division for the moment, we find that Aristotle has not called "blooded" a kind, although he has been able to distinguish the great groups within blooded animals<sup>35</sup>. He continues by listing the "bloodless" (or cold-blooded) kinds:

There is another genus of the hard-shell kind (τὸ τῶν ὀστρακοδέρμων <γένος>), which is called oyster; another of the soft-shell kind (τὸ τῶν μαλακοστράκων <γένος>), not as yet designated by a single term, such as the spiny crawfish and the various kinds of crabs and lobsters; and another of molluscs (τὸ τῶν μαλακίων <γένος>), as the two kinds of calamary and the cuttle-fish; that of insects (τὸ τῶν ἐντόμων <γένος>) is different. All these latter creatures are bloodless, and such of them as have feet have a goodly number of them; and of the insects some have wings as well as feet (490b9-15).

(Later, Aristotle refers to the genus of animals which are viviparous quadrupeds, possibly including man (490b33); however, he notes that man

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<sup>34</sup>See Lennox (1987) for an intensive interpretation of *megista gene*.

<sup>35</sup>Recall that Aristotle uses the term "ἔναιμά" where we would say "red-blooded" or "warm-blooded". See Boylan in note 34.

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overlaps many classes -- at least regarding the number of offspring (one/few/many), (GA IV.4 772b1) but also being blooded, terrestrial, and footed). Each of these classes has a membership criterion, the description, such as "soft-shell", used to identify the members; for Aristotle, it wasn't necessary that a genus has a name<sup>36</sup>. I have added the nominative "<γένος>" in each case because it is implied by the description put in the genitive case.

Aristotle contrasts these genera with those which are not "τὰ γένη μεγάλα"(490b17). This should mean that the genera are no longer *great* kinds. Balme comments that this group of kinds should be taken as a warning to those who want to attribute a great classification to Aristotle: that there are creatures which cannot be classified in an exhaustive schema of greatest classes shows that the schema has limited use (1975, 188; cf. Boylan, p.54). Aristotle explains:

Of the other animals the genera are not extensive. For in them one species does not comprehend many species; but in one case, as man, the species is simple, admitting of no differentiation, while other cases admit of differentiation, but the forms lack particular designations(490b16-20).

These genera do not contain many *eidê* in an *eidōs*. Abiding by the translation of "megista" as "extensive", Thompson makes this passage mean that these other genera do not contain many *eidê*: this is the translation of

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δὲ λοιπῶν ζώων οὐκέτι τὰ γένη μεγάλα· οὐ γὰρ περιέχει  
πολλὰ εἶδη ἔν εἶδος, ἀλλὰ τὸ μὲν ἐστὶν ἀπλοῦν αὐτὸ οὐκ  
ἔχον διαφορὰν τὸ εἶδος, οἷον ἄνθρωπος, τὰ δ' ἔχει μὲν,  
ἀλλ' ἀνώνυμα τὰ εἶδη.

Presumably the last use of "εἶδη" is translated "forms" because the lowest level of putative classification is reached: the atomic form. However, what justifies the earlier reference to species which comprehend species? On the absolutist view of classification that was mentioned above, this passage would be a problem because an *eidōs* must occupy a fixed position within the classification scheme. Even Pellegrin, otherwise an arch-anti-absolutist, maintains that there is here a classificatory use of *eidōs*: he sees "in this statement a negative definition of *eidōs*: in a given context, an *eidōs* is not divided into *eidê*" (1986, p.101). However, he argues that at b31, Aristotle classifies the *eidōs* "man" in the genus of "oviparous quadrupeds". Pellegrin's translation of the b16-20 is rendered:

For none of the other animals there are (sic) great families (*genê megala*), but sometimes the *eidōs* is simple and does not include a specific difference -- for

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<sup>36</sup>Balme argues that a *genos* -name must be a noun, rather than adjective (1962, p.90-1).

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example, man; sometimes the groups have in them the specific difference, but the *eidê* are anonymous (1986, p.100).

His translation is used as evidence of the variability of Aristotle's use of *eidōs*, as opposed to the absolute taxonomic use of *eidōs*. Thompson considers the uses of "genus" and "*eidōs*" to be relative here (see Balme 1962, p.90). A different interpretation which Pellegrin attacks is Gotthelf's hypothesis "that the 'anonymous' *eidê* are the containing and not the contained classes": according to Pellegrin, this would entail the attribution to Aristotle of the view that "a class [is] an *eidōs* because it is divisible"(1986, p.100), which is not to be found in the extant corpus. Although Pellegrin admits that it is "probably impossible" to settle this issue in favour of Gotthelf or himself, I would challenge this. Pellegrin's translation takes the "τὸ εἶδος" of line 19 as the subject of "ἐστίν" in line 18, and "τὰ εἶδη" of line 20 as the subject of "ἔχει" in line 19, both sentences introduced by *plural* articles, with μέν and δέ (elided) in the second. However, the Greek text has the singular article for the first clause, and "εἶδος" has its own article, another "τὸ". If these uses of "εἶδος" have their own articles, what is the role of the articles beginning the clauses? It seems to me that they must be taking the role of subjects for their respective clauses, leaving the articles governing the εἶδη as markers that the εἶδη are the objects of the verbs (in the accusative case), rather than the subjects (in the nominative case)<sup>37</sup>. As a result, the subjects are still assumed to be the animals of the other γένη of line 17, which take forms as follows:

But of the remaining animals, no longer are the *genê* great. For one *eidōs* does not contain many *eidê*, but one <animal or genus of animals> is simple and not different in *eidōs*, i.e. man; others have this <simplicity and lack of difference>, but the *eidê* are unnamed.

This interpretation does not risk of the objection Pellegrin raised against Gotthelf, but at the same time, it supports Gotthelf's view that the *anonyma* are the containing classes, being genera of animals and not *eidê* as Pellegrin reports<sup>38</sup>. Thompson's translation is misleading for the same

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<sup>37</sup>Balme argues that "ἐν εἶδος represents γένε μεγάλα .. while πολλά εἶδη is on the same level as γένη κερκίωον" (from the previous lines). They are thus used interchangeably for 'kind' and 'form' (1962, p.90). Boylan disagrees with Balme's statement, in favour of a four-tiered classification of large *genos* (blooded, non-blooded), *genos* (birds, etc.), *eidōs*, and *atomon eidōs*; his defence of this is that "it is just as fair to see the *genos* of line 16 as simply 'other kinds not mentioned in lines 7-15'"(1983, p.54).

<sup>38</sup>I apologise for the oblique references to Gotthelf's interpretation; to my knowledge, it is not yet published, and my mention of it is based entirely on Pellegrin's report. At least, this continues one Aristotelian tradition. David Balme's interpretation of the passage is consistent with Gotthelf's interpretation, (1962 p.90ff.).

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reason, i.e. for misplacing the subjects and objects: this leads him to change the subject from the genera to the *eidōs* 'man' and to an indeterminate subject ("other cases") in the second last clause: the other cases could be cases of genera if one reads the subject from the first sentence, or *eidê* if one reads the subject from the third sentence. (Thompson comments that "The whole passage is very troublesome, and Aristotle seems to juggle with the terms *genos* and *eidōs*" (Quoted by Balme, 1962, p. 89).) On my reading, the genus-classes of the remaining animals are the grammatical subjects of the entire passage, which differ in *eidê* as the grammatical objects.

If this interpretation is to work, it must make sense of the subsequent passages<sup>39</sup>. Aristotle explains that quadruped, wingless creatures are all red-blooded, but can be viviparous or oviparous: if they are the former, they are hairy; if they are the latter, they are scaly, the scales being similar in position (ὅμοιον χώρῳ) to the hairs (490b20-24). However, immediately he adds that there are land creatures which are blooded, and scaly but not oviparous: the adder is viviparous, as are some fishes. Thus, one cannot conclude that all viviparous creatures are hairy. At most, one can say that all hairy creatures are viviparous. Balme argues that this is a case of cross-over between genera which Aristotle has used to show the impossibility of the dichotomous division between "quadruped-viviparous-hairy" and "footless-oviparous-scaly" creatures, as some would have it (1975, p.189; cf. 1987, p.84). In the *Parts of Animals*, Aristotle had used cross-over as a counter-objection to division by dichotomy as it was practised by Academics (642b10): if one divides by dichotomy, one divides between classes whose members possess a characteristic and classes whose members do not possess that characteristic. (See *PA* I.3 642b21ff.) For example, birds cannot be divided into wild and tame (*PA* I.3 643b23), because some will be water dwellers and some not, some will be vegetarian and others carnivores, etc. Aristotle refers here to the genera that are established by these multiple criteria -- such as the adder -- but which have no name. For example, *we* could give a name to the class of "quadruped-viviparous-hairy" creatures, but as he has shown, it must be a nominal class because it will cross over between groups of otherwise dissimilar yet established groups.

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<sup>39</sup>Thompson begins the next sentence with "for instance".

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Now even the *megista genê* are relative in the sense of "relative" used by advocates of the Balme/Pellegrin interpretation. This is shown by Aristotle's other uses of "*megista genos*," which describe a genus as *megista* at higher and lower levels of abstraction than those given in *HA* I. In the first, Aristotle argues that all the *megista genê* are blooded creatures; non-great classes are not blooded (*HA* II.15 505b26-28). As examples, Aristotle gives

the oviparous and viviparous quadrupeds, birds, fishes, cetaceans, and all the others that come under no general designation by reason of their being no genus but a simple species covering the individual cases (ἀπλοῦν τὸ εἶδος ἐπὶ τῶν καθ' ἕκαστον), e.g. man (505b28-31; Thompson, rev. by Balme in Barnes, ed.).

We noted above that in *HA* I.6, Aristotle did not consider the viviparous quadrupeds to be a *megista genos*, which suggests to us that the examples given in this chapter are examples of blooded creatures, rather than genera. This is confirmed by the fact that Aristotle says that of some of them there is no genus but a simple *eidos* (505b31). But if all the blooded creatures can be grouped together in such a way that includes the great classes, clearly there should be a class greater than the *megista genê*, which is absurd on the taxonomic reading. Aristotle is not saying that for any creature which is blooded there is a great genus. However, he is implying *ex hypothesi* that there is a genus of genera (and *eidê*) i.e. blooded (τῶν ἐναίμων).

In a second use, Aristotle says of crustaceans that there are four "γένη τὰ μέγιστ' αὐτῶν" (683b26). These are the crayfish, lobsters, prawns, and the crabs. If one interpreted Aristotle as having a fixed classification this passage would cause considerable problems: first, the crustaceans are not mentioned in the list of great classes in *HA* I.6, so why are there great classes of crustaceans? Second, Aristotle says crustaceans are "bloodless"<sup>40</sup>, but at 505b26-28 (above) he says that the great classes are blooded"; how is this possible?<sup>41</sup> The solution to these problems is simple according to the Balme/Pellegrin interpretation: the *megista genê* are those classes in which smaller classes can be distinguished, because they do not occupy fixed places in a classification, but rather, genera are called "*megiston*" when they embrace other classes, each of which shares a visible form. Accordingly, I follow Pellegrin who explains the notion of "*megista genê*" as "those *genê* of animals which are *important* because

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<sup>40</sup>*HA* IV.1 523b1, *PA* IV.5 678a30, *GA* I.14 720b4; cf. Pellegrin, p. 328.

<sup>41</sup>Third, in *PA* II.8 654a3 Aristotle referred to "the several species known by the general name of oysters (τὸ τῶν καράβων γένος)"; why did he not say this was a great class?

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they have many *eidê*: the superlative *megista* does nothing beyond signifying this profusion of *eidê*" (1987, p. 328).

What then can we conclude from Aristotle's use of the *megista genê*? Aristotle accepts the division by the mass of men, as "afforded by the instincts of mankind"<sup>42</sup>. He does this because classification is not central for scientific demonstration: in a similar passage in the *Topics*, Aristotle argues that

you should determine [διορίζεσθαι] what kind of things should be called as most men call them, and what should not. For this is useful both for establishing and for overthrowing a view: e.g. you should say that we ought to use our terms to mean the same things as most people mean by them, but when we ask what kind of things are or are not of such and such a kind, we should not here go with the multitude: e.g. it is right to call 'healthy' whatever tends to produce health, as do most men: but in saying whether the object before us tends to produce health or not, we should adopt the language no longer of the multitude but of the doctor (110a14 ff.).

LeBlond attributes to Aristotle a "habitual conformism" in classification (1945, p.176n.; quoted by Pellegrin 1986, p.16) noting that "Aristotle does not appear to us to have been primarily a great classifier"(1939, p.28; quoted in Pellegrin, 1986, p.16). Controversy surrounds the relation between demonstration and division for Aristotle, focusing on the comments about division he makes in *PA I*, and the relation of these comments to the methods advocated in the *Organon*. I will address the debate following my own interpretation of the logical texts. Aristotle's use of the *megista genê* does seem consistent with LeBlond's attribution to him of third-hand knowledge, so we must review the place of genera in demonstration.

In the *Posterior Analytics* II.14, Aristotle argues that to formulate proofs about things, we must take our commonest group and abstract all the features which belong to every member. Then we characterize the next "proximate" genus, abstracting its essential properties. This can be formalized as

Let A be animal, B what follows every animal, C D E individual animals. Well, it is clear in virtue of what character B belongs to D; for it does so because of A. Similarly in the other cases too, and the same account will always hold for the others.(98a10-12; Barnes, trans. 1984).

What we have done is to find a middle term, A, which allows us to syllogistically explain the properties of C D or E. This process of abstraction can be carried out at any level of abstraction: if we know that all A's are B, and that some A's are C, we know that all C's are B. It is important to realize what can be proved according to this method: the parts of animals

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<sup>42</sup>*PA I.3* 643b10ff.; see also *PA I.4* 644a16 and 644b2.

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which are necessarily possessed by any animal can be proved of any particular type of animal, but we cannot derive from the characteristics of all animals that any possible characteristic must be had by some animal: what we establish are the *idia*, properties of animals in general, some of which will be only analogues. (For concrete biological applications of this principle, see Balme 1961/1975 p. 190.)

In the *Prior Analytics*, Aristotle argues that the method of classification is not explanatory (I.31). The minimal explanatory value of classification has been given in the previous paragraph, but in *APr.*, Aristotle argues that

It is easy to see that division into classes is a small part of the method we have described: for division is, so to speak, a weak syllogism; for what it ought to prove, it begs, and it always deduces something more general than the attribute in question (46a31).

The particular problem is that others (i.e. Academics, as we saw in my previous chapter) had "attempted to persuade men that it was possible to make a demonstration concerning substance and essence" by the method of division (46a36ff.). Now in the first five chapters of the *Parts of Animals*, Aristotle showed precisely the respects in which these people had failed. In the language of the logical texts, what people had attempted to prove by division was the substance of a thing, but they were destined to fail because the use of division by dichotomy cannot demonstrate the essential properties of any genus, apart from those which could be deduced from the properties which hold true of the higher classes. They could not reach the substance of a thing, nor reach it in a distinct way. Of a particular genus, establishing the substantial attributes cannot be done by division without begging the question. At *Prior Analytics* II.16, Aristotle explains what it means to beg the question: "whenever a man tries to prove by means of itself what is not known by means of itself, then he begs the point at issue" (64b36). The example given by Aristotle in *APr.* I.31 is the mortality of man:

In demonstrations, when there is a need to prove a positive statement, the middle term through which the syllogism is formed must always be inferior to and not comprehend the first of the extremes. But division has a contrary intention: for it takes the universal as middle. Let animal be the term signified by A, mortal by B, and immortal by C, and let man, whose definition is to be got, be signified by D. The man who divides assumes that every animal is either mortal or immortal: i.e. whatever is A is all either B or C. Again, always dividing, he lays it down that man is an animal, so he assumes A of D as belonging to it. Now the true conclusion is that every D is either B or C, consequently man must be either mortal or immortal, but it is not necessary that man should be a mortal animal-this is begged: and this is what ought to have been proved syllogistically (46b36).

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To establish the mortality of man, we need a middle term between the "man" and "mortal" which would allow the first to be brought within the domain of the second. In the case of the essential properties of all animals, this allows us to demonstrate that a particular property is had by any particular animal because the middle term, say, "animal", will be true of all animals, so that we can establish that our case subject, a minor term such as "duck rabbit", will have those attributes. However, if we were to explain the duck-rabbit's red eyes by appeal to the carotene in its diet, knowing that rabbit diets consist in many high-carotene foods, we would beg the question whether the properties of a duck-rabbit can be explained with the attributes of what we take to be its genus. That is, an explanation by appeal to the classification of, say, a duck-rabbit, will be question-begging because to put the duck-rabbit into the class of oviparous quadrupeds would tell us only that it had been classified so, not why. The problem arises because "Always dividing then in this way it turns out that these logicians assume as middle the universal term, and as extremes that which ought to have been the subject of demonstration and the differentiae"(46b19): if one takes the universal "rabbit" to be true of duck-rabbits, then one assumes without justification that a carotene rich diet is true of it, and is unable to prove this in the particular case of duck-rabbits<sup>43</sup>.

Instead, Aristotle would want to know what it is to be a duck-rabbit: in the *Parts of Animals* I.1, he insists that

the true method is to state what the definitive characters are that distinguish the animal as a whole; to explain what it is both in substance and in form, and to deal after the same fashion with its several organs; in fact, to proceed in exactly the same way as we should do, were we giving a complete description of a couch (641a15-17).

(The context of this statement is Aristotle's rejection of the view that an animal can be characterized by shape and colour: this was the view of Democritus<sup>44</sup>.) Balme translates the passage to say that the orthodox view "ought to say that the animal is *such*, and to speak about that -- what it is and what kind of a thing, and the same with each of its parts, just as in speaking of the form of the bed"(ad loc., 1972).

To explain the form of a thing, the common groupings may help us to find parts of duck-rabbit that are analogous to the parts of other creatures of its genus, but the data we gather about duck rabbits will

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<sup>43</sup>On question-begging, see Bolton (1987), p.149-50.

<sup>44</sup>On Democritean Atomism, see Barnes (1987), p.244-59.

## Chapter V

determine whether the classification of duck-rabbit within that genus is appropriate. The gathering of such data was important, and whether third hand or first hand, the plethora of information contained in the texts on animals is comprehensive. As examined above in chapter III §4, in *GA* II.8 Aristotle shows why we must attend to the particulars, too, for the general principles are empty: given the general principles that from male and female of the same *eidos*, a male or female of the same *eidos* is produced, and that from parents of different *eidê* a different *eidos* is produced, one can construct the argument that mules are infertile<sup>45</sup>. Aristotle does not accept this reasoning because "this theory is too general and empty. For all theories not based on the special principles involved are empty; they only appear to be connected with the facts without being so really" (748a7ff.). Thus, we find that an examination of the particular facts about horses and asses is required if we are to explain the case of mules; knowledge of the universal is insufficient to allow our deduction of the form of the mule<sup>46</sup>.

What, we must ask, is the role of classification in this? We noted above that the right method of the study of animals is to study them according to genus; this has textual support in the logic, too. In *A.Po.* II.13 Aristotle argues that

The author of a hand-book on a subject that is a generic whole should divide the genus into its first infimae species-number e.g. into triad and dyad-and then endeavour to seize their definitions by the method we have described-the definition, for example, of straight line or circle or right angle. After that, having established what the category is to which the subaltern genus belongs-quantity or quality, for instance-he should examine the properties 'peculiar' to the species, working through the proximate common differentiae. He should proceed thus because the attributes of the genera compounded of the infimae species will be clearly given by the definitions of the species; since the basic element of them all is the definition, i.e. the simple infima species, and the attributes inhere essentially in the simple infimae species, in the genera only in virtue of these (96b15).

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<sup>45</sup>A parallel problem occurs with the spontaneous generation of creatures. In *GA* I.2 Aristotle argues that if the offspring of animals generated from rotting matter could themselves produce offspring, the generation of infinite new kinds of animals would ensue, because the offspring would be generated in a way different from their parents (715b4ff.). See also 723b3, where Aristotle uses a parallel case to prove that the semen does not come from the whole of the body.

<sup>46</sup>Similarly, in *DeCausis Plantarum*, Theophrastus argues: "that plants have several modes of generation has been said earlier in the *History*, Where we have also enumerated and described them. Since not all occur in all plants, it is proper to distinguish (διελείν) the modes that occur in the different groups and give the reason why, resting the explanations on the special character of the plant (τάς ιδίας ουσίας), for the explanation must first of all accord with the account given there" (I.1 ll.1-7).

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We must notice that this is the work of an "author", someone who possesses the requisite knowledge to see the subject as a generic whole. However, to understand the topic as a generic whole requires one to have understood what one is working with. For this, Aristotle requires that

We must start by observing a set of similar-i.e. specifically identical-individuals, and consider what element they have in common. We must then apply the same process to another set of individuals which belong to one species and are generically but not specifically identical with the former set. When we have established what the common element is in all members of this second species, and likewise in members of further species, we should again consider whether the results established possess any identity, and persevere until we reach a single formula, since this will be the definition of the thing (97b8).

By this method, we will be able to understand why the substance of the thing, its last differentia, is captured in a definition which is different from the definition of other species.

The method just described, I submit, is the same as the one with which we see Aristotle operating in the study of animals. In the *Parts of Animals*, we find our attention drawn first to the genera. This is not simply for the sake of preserving our energy, but because we will be able to rely on the energy of the "doctors" of the *Topics* passage mentioned above: in the case of animals, this will be the beekeepers, fisherman, hunters and such who have a certain expertise in the studies to be undertaken<sup>47</sup>. From their *endoxa*, the student can scrutinize the claims made about the animals and to deduce the common characters. Then she is able to examine the particular *eidê* more closely, to determine whether the *endoxa* and conclusions drawn from them are true. Then the particular *eidê* of animals can be explained, and related to their fellows. Our duck-rabbit will be found to be an oviparous quadruped, noted for delivering its progeny at Easter.

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<sup>47</sup>See Boylan, p.47, p.78n.11. See also Lloyd (1987).

## Chapter VI Division and Definition in Aristotle: Why Aristotle was a Realist

Aristotle was familiar with the method of division from being a student and lecturer in the Academy, and as we will find in this chapter, he criticised the standard practice which was presented to him. He explains the process of division as follows:

When you are dealing with some whole, you should divide the kind [τὸ γένος] into what is atomic in sort [τὰ ἄτομα τῶ εἶδει] -- the primitives --(e.g. number into triplet and pair); then in this way attempt to get definitions [ὀρισμοὺς] of these (e.g. of straight line and circle and right angle); and after that, getting what the kind [τὸ γένος] is (e.g. whether it is a quantity or a quality), consider [θεωρεῖν] the proper affections through the first common items.(96b15-21; Barnes (1975), trans.)

We noted earlier that Plato also talks about starting with some whole, which in Plato's theory was the result of collection: Aristotle says that we have collected *into* a genus, and goes on to explain division further in terms of parts and wholes. From this genus, division is undertaken until we reach what is indivisible in *eidōs*. (I leave this term untranslated so as not to prejudice further discussion on the relation between genus and *eidōs* in Aristotle's work: we have yet to decide whether *eidōs* must mean "species", as Barnes translated it in earlier work, and following the tradition, or "form" -- or indeed "species-form"). Returning to the kind, it is possible to scientifically determine the properties belonging to the indivisible in *eidōs* (τὰ ἄτομα τῶ εἶδει), which are indivisible in that further criteria of distinction within that *eidōs* cannot be discovered. But does "θεωρεῖν" mean "determine", as I have used it? It is here used as a technical term, otherwise pertaining to a scientific analysis or supposition, which can be tested. Aristotle argues that this is a legitimate procedure because the definitions we reach will allow us to deduce the properties of individuals (96b21). The fundamental reason for this is that "definitions and what is simple are principles of everything, and what holds belongs in themselves to the simples alone, and to the other things in virtue of them".(96b22; Barnes, trans.)<sup>1</sup> What is the rôle of division in such research?

### i. Division and Definition in Aristotle

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<sup>1</sup>Cf. the sixth ἀπορία mentioned in *Metaphysics* B: in Ross's words, "Is it classes, or the constituent parts, that take the first principles of things?", for which he puts the solution in Z.10.(Ross, (1929) v1. p. xvi)

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The type of definition given in these passages is the definition of essence in the primary sense, used in cases in which we isolate the thing to be defined. Yet in the definition of "definition" from the *Posterior Analytics*, the notion has an immediate ambiguity: Aristotle argues that "Since a definition is said to be an account of what a thing is, it is evident that one type will be an account of what the name, or a different name-like account, signifies -- e.g. what triangle signifies."(93b30; Barnes (1975) trans.). Barnes mentions that this is the origin of the term "nominal definition"(1975, p.212): Philoponus was one of the authors who regarded it as such (Ross, 1957, p.634).<sup>2</sup> The primary contrast between all definitions is between real definitions and nominal definitions.<sup>3</sup> Aristotle's definitions of "definition" are explicitly statements that the object of definition is a thing; paraphrasing Richard Robinson's phrase, this is word-thing definition. In nominal definitions, by contrast, the object is words, which we mean, intend, hope, or propose to explain; this is word-word definition. Yet we shall find that Aristotle describes definition in a way suggestive of nominal definition. This *appears* anomalous because of Aristotle's adherence generally to realism about universals: if it is the case that universals are real, then it is plausible to suggest that definitions are real; so in what sense would a realist advocate nominal definitions? The apparent difficulty in Aristotle's theory is the confusion between sense and reference. It seems that for Aristotle, we can define *things*; but then how is it that a *thing* is defined, when generally it is taken to be the case that we define words, the reference of the words possibly being taken into account in the process of concept-formation, but not being the actual *definiendum* of the definition?

The issue will become clearer after we note the other definitions of "definition" given by Aristotle. In *APo* II.10, the types of definition are provided:

I an account of what the name, or a different name-like account, signifies (93b30-1; Barnes, (1975), trans.)

mentioned earlier; causal definitions which are explained as

II an account which makes clear why a thing is (93b38; Barnes, (1975), trans.);

Aristotle provides definition as the conclusion of a demonstration:

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<sup>2</sup>Ackrill, on the other hand, specifies that what Aristotle is talking about in almost all cases is the things signified.(Ackrill, 75) See Edel p. 84 on whether it makes a difference.

<sup>3</sup>For a comprehensive, although not exhaustive list of definition types, see Robinson, p.7.

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III a definition of thunder is noise in the clouds; and this is a conclusion of the demonstration of what it is. (94a7-9; Barnes, (1975), trans.)<sup>4</sup>;

finally, Aristotle says that the

IV definition of immediates is an undemonstrable positing (θέσις) of what they are.(94a9; Barnes, (1975), trans.)

Before discussing these in detail, a controversy must be mentioned that each analysis, including mine, should decide. As it stands, the text from 93b29-94a10 seems to introduce four types of definition, introduced by the phrases 'Ὁρισμὸς .. λέγεται'(93b29) for definition: the various types are brought in by the phrases 'ὅτι .. μὲν' (93b30), then 'ἄλλος δ' (for 'δὲ'), and following that 'ἔτι', (94a7) and finally 'δὲ'(94a9). But scholars note that the subsequent lines mention only three of these types:

Ἔστιν ἄρα ὀρισμὸς εἷς μὲν λόγος τοῦ τί ἐστὶν ἀναπό-  
δεικτος, εἷς δὲ συλλογισμὸς τοῦ τί ἐστὶ, πτώσει διαφέρων  
τῆς ἀποδείξεως, τρίτος δὲ τῆς τοῦ τί ἐστὶν ἀποδείξεως συμ-  
πέρασμα.(94a11-14; my underlining)

In this text, Aristotle clearly states that 'one definition, on the one hand, is ...', 'one, on the other hand, is ...', and 'the third is ...', and doesn't state that there are more. Barnes correctly comments, *pace* Ross, that Aristotle doesn't claim that the list of definitions is exhaustive (Barnes, 1975, p.212). The phrases introducing a contrast must be respected unless there is some statement to the effect that the distinction is bogus. So how can the three types of definitions mentioned here be reconciled with the list of types in the previous paragraph, and just how many are to be found there?

Ross argues that the difference from the first and third of the second type of 'definition' is that the second gives the cause (1957, p.634-5); yet the third is identical with a nominal definition, for it contains no implication of the existence of the thing defined (ibid.); but, Ross notes, Aristotle does not recognise nominal definition; instead, interpreters take his phrase 'ἕτερος ὀνοματώδης' ('other name-like expression') to contrast with 'λόγος τοῦ τί σημαίνει τὸ ὄνομα' ('account of the meaning of the name'). On this view presented by Ross, all definitions become nominal definitions. Ross insists, in contrast, that the 'ἕτερος' passage contrasts with 'τὸ ὄνομα,' to mean "or another noun-like expression"(ibid.). Thus, the third type of definition is simply a statement that definitions of the second type can be given without the causal explanation, akin to the first

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<sup>4</sup>Cf. Sorabji, and Gomez-Lobo (p.40) who argue that this is a partial statement of the real definition -- betrayed by the τις locution.

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type<sup>5</sup>. There are thus accounts of the meanings of words, causal accounts, and definitions of substances, "the subjects of indemonstrable definition"(ibid.). These are repeated in reverse order in the passage starting at 94a11. Thus, according to Ross, there are three types of definition in both passages, the second of which summarises them in reverse order.

Barnes, in contrast, argues that Ross "does not show that 93b29 has nothing to do with nominal definition"; with the early commentators, Barnes states that "'what a name ... signifies'" is nominal definition; and if the phrases "a definition of thunder is noise in the clouds; and this is a conclusion of the demonstration of what it is"(94a7-9) are simply a restatement of 93b29-37, then that passage is about nominal definition, too. Thus there are four types of definition.(1975, p.213) However, Barnes argues against Aristotle that the theory that "one type of definition is a conclusion of a demonstration" is "merely a part of a definition of the second [i.e. causal] sort"(ibid.) and the fourth "undemonstrable positing" of immediates type of definition "is the product of an Aristotelian confusion"(ibid.). Directing the reader's attention to *APo* II.9, Barnes argues, I take it, that Aristotle conjoins the fact that this type of definition is not demonstrable with the fact that it is a 'positing'. This is a "muddle" because there is nothing incompatible between the method of definition given in *APo* II.10 and the 'positing' or 'supposition' of a definition. In summary, Barnes takes the view of the ancient commentators that there are four types of definition offered in *APo* II.10, although Barnes argues that two of these types are fallacious.

Finally, Alfonso Gomez-Lobo argues in favour of the fourfold definition theory, because of distinctions he makes between types of real and nominal definitions. Gomez-Lobo argues that real definitions are presented in three ways in *APo* II 8-10: first, the "undemonstrable account of what something is"(93b22), in the case of which a middle term does not exist to explain the essence; second, the syllogism of the essence differing in grammatical form from a demonstration (94a12), for which we have a middle term; and third, the former type, with the middle term left out, as "thunder is noise in the clouds" (94a8). (Each of these has corresponding types of nominal definition.) Nominal definition is given as "an account

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<sup>5</sup>Sorbji agrees with Ross (and Bolton, 1976; against Barnes 1975, p. 209, 213) on this point (215, n24).

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of what the name or another noun-like expression signifies"(93b30). Emphasising that Aristotle continues the statement of this type of definition with a distinction between our knowledge that something is, and our knowledge what it is (i.e. the essence), Gomez-Lobo argues that the nominal definition must be understood to be given in a circumstance in which we know the meaning of a phrase, such as "goat-stag", but there are no things of which the phrase can be used as a name or a description. Thus, the essence of goat-stags cannot be found. If we have a meaningful phrase and don't know whether there are instances, then we must await the instances to know the real essence; in this sense, Aristotle says that the knowledge *that* something is *F* is accidental to *F*. Finally, a nominal definition of *F* could include "something of the thing itself,"(93a22) and instances of *F* could be found-- these types are given in *APo* II.8. From the position of having something of the thing and instances, the scientist can examine the thing and come to the realisation that the nominal definition is equivalent to the real definition. An example of this would be the hypothesis that "thunder is noise in the clouds". In summary, Gomez-Lobo argues that in *APo* II.10, Aristotle offers three types of real definition and one type of nominal definition, each of which admits of a correlative of the other type.<sup>6</sup>

One good reason for exploring the question of nominal vs. real definitions is that the account of these definitions as they are given by other philosophers seems to accord them an entirely different role. For example, Kant distinguishes them in the following way:

By mere *explanations of the name* or *nominal definitions* are to be understood those which contain the meaning arbitrarily assigned to a certain name, and which therefore designate only the logical essence of their object, or merely serve to distinguish it from other objects. *Material explanations* or real definitions, on the other hand, are those which are sufficient for a cognition of the object as to its inner determinations by setting forth the possibility of the object out

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<sup>6</sup>The difficulty, it seems to me, is that Gomez-Lobo's thesis doesn't allow one the certainty that the definition they have formulated is real. The distinction between one type of real definition and of nominal definition is that the question about whether the definition is real or nominal is to be decided by the scientific context in which the definition is given: i.e. if the definition has something of the thing, is presented after the study of cases, *which are known to exist*, and if the appropriate syllogism of the essence can be given, then the definition is real; if not, the definition is nominal. Now in some cases we know that we have not undertaken the appropriate research, yet offer definitions of things nonetheless. If the definition we give of something is equivalent to the definition given by an authority, what made the original definition which we provided become a real, rather than a nominal definition? This problem seems to me to be about propositional attitudes, Aristotle's theory of which is beyond the scope of this dissertation. See also Charlton (1975), who argues that the meaning of a term doesn't change according to context.

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of inner characteristics.(1974, p.144; trans. Hartman and Schwartz; italics are those given in the text).

In a note to this, Kant argues that objects of experience can have only nominal definitions. Real definitions, however, are given of the essence of the thing, the first ground of possibility. Yet at the same time, he argues that of mathematical objects, real definitions can be provided because "the definition of an arbitrarily made concept is always real"(ibid., p. 145). Thus, it follows from Kant's view that both nominal and real definitions can be arbitrary, and all definitions of natural objects will be nominal, hence arbitrary. It seems that the only type of things for which real definitions can be provided are logical constructions.<sup>7</sup> The immediate contrast with Aristotle's view of definitions is that the example of nominal definitions which Aristotle provides (and which the commentators appeal to), is a mathematical object, the triangle.

The apparent contrast in *APo* II.10 between definitions of the first, so-called "nominal" and third "conclusion of the demonstration of what it is" types is that the third has left out the causal middle term, but is the result of the relevant demonstration. The explanation of the first type of definition continues as follows:

And when we grasp that this is, we seek why it is; but it is difficult to grasp in this way why a thing is if we do not know that it is. The explanation of the difficulty has been stated already--that we do not even know whether it is or not, except accidentally.(*APo* II.10 93b32; Barnes, trans.)

That is, if we have instances of the thing which is nominally defined, an explanation is required; but we may not have instances. Aristotle explains the accidental nature of our knowledge of instances in *APo*. II.8, his chapter devoted to the nature of demonstration. He argues that an analogous relation holds: as the need for an explanation is to instances so grasp of the essences is to instances (93a16). The explanation and the instances can "become clear together [δῆλα γίνεται]" (93a18); but the essence *cannot* be known unless instances exist. Yet the knowledge of instances can be concealed in two ways: we can "grasp this accidentally", or by "grasping something of the object itself", examples of the latter sort being thunder as "a sort of" noise in the clouds, and eclipse as "a sort of" privation of light, and *man* as "a sort of" animal, etc. These are called "sorts of"(τις) their kind because we have here definitions of the type that would be put in the second class of definition as ordered in *APo*. II.10.

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<sup>7</sup>See Russell *Mysticism and Logic*, "On the Relation of Sense-data to Physics". Yet we might call nominal definitions 'artefacts', in the Aristotelian sense.

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With Gomez-Lobo, these will be initially nominal definitions, until the scientific study is complete. The accidental knowledge we can have of the object involves the failure to recognize even *that* some thing exists, the knowledge *what* that thing is being impossible.

For cases of grasping something of the object, we possess awareness that the object exists and that it falls under a partial description, such as "eclipse is a deprivation of light". But if we conjoin each of these with the middle term "screening by the earth"(following Barnes, p. 219), then the syllogism follows that the deprivation of light belongs to the screening of the earth, the screening of the earth belongs to eclipse, thus the deprivation of light holds of eclipse. In possession of the causal middle term, the definition of eclipse is formulated as deprivation of light by the screening of the earth.

The occurrence of eclipse is something which happens to something (a heavenly body) because of something else (another heavenly body positioned between the sun and the first heavenly body). But Aristotle points out that: "Of some things there is something else that is their explanation, [i.e. we use these latter things to explain the other things, and] of others there is not"(APo II.9, 93b21; Barnes, trans. with my insertion). Aristotle repeats the example of the arithmetical unit as an example of things which are *not* explained by something else, but whose existence and essence are supposed. Ross explains that the examples for each case would be properties or accidents, and substances, respectively (1949, p.633) although the examples of quantities or qualities show that his analysis is too restrictive. In contrast, for things we explain by appeal to something other than themselves, "one can, as we said, make them clear through a demonstration, but not by demonstrating what they are"(APo II.9, 93b28; Barnes, trans.), as in the eclipse example. The factor which enters into the definitional context in the case of real definitions is what Charles calls "form transference": by abstracting from or studying the individuals of a kind that we encounter, our definitions signify things because of the transference of the form of the natural kind into the signification of our term, the essence of which is expressed in a definition, which can later be tested for accurately capturing the essence of the thing (Charles, 1994b). The type of demonstration being appealed to is, I think, the method of division. In APo II.13, Aristotle surveys the rules used to "establish a definition through divisions [τὸ κατασκευάζειν ὄρον διὰ τῶν

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διαιρέσεων]"(97a23, Barnes 1975, trans), having claimed their usefulness for the pursuit of definitions. As was explained in the previous chapter, division will not be demonstrative, because it begs the issue to be proved (*APr* I.31 46a31). Yet this is precisely the type of method Aristotle was describing, the pursuit of the definitions of things whose explanation does not lie outside of themselves, whose essentially qualities can be laid out in a division, but which doesn't have these qualities *demonstrated* by division. For the proof of the definition, we must examine the instances, as Aristotle had said. This hypothesis is consistent with Charles's claim about the transference of form, but does not require the placing of the object "as occupying some definitive place in a genus/species tree", if this must include occupying a position in "an intelligible world"(1994b, p. 65). I mention this caveat because Aristotle said that one is not required to know "everything there is"(*APo* II.13 97a7; Barnes, trans.) in order to divide properly.

Thus we have one ground for the realism of Aristotle's theory of definition, i.e. the fact that the definition can be established as an expression of the actual essence of the thing, whether demonstrable or not. In the *APo* II.10 passage examined, these characteristics are sufficient to allow the last three definition-types to be realist definitions. Yet there is still the problem of the goat-stag<sup>8</sup>, appealed to by many commentators because it is a significant yet non-referring term. Is the use of it a thought-experiment or intuition pump? Aristotle says:

Again, how will you prove what a thing is? For it is necessary for anyone who knows what a man or anything else is to know too that it is (for of that which is not, no one knows what it is--you may know what the account or the name signifies when I say goatstag, but it is impossible to know what a goatstag is).(92b4-8; Barnes, trans.)

Gomez-Lobo points out, *pace* Bolton (1976), that the example of the goat stag proves that nominal definition has no existential import (1981, p. 36n.47; cf. Sorabji, 1981, p.218, 222: empirical investigation is required). Once we have instances, he argues, we are in a position to give a causal definition stating the essence of the object we are defining, but without instances, we cannot know the thing; as Aristotle says, we know what the name signifies, but not what the thing is (1981, p. 39).

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<sup>8</sup>The goat-stag (τραγέλαφος) occurs at 16a16, 49a24, 92b7 and 208a30, none of which are in the *Sophistic Refutations* or *Rhetoric*. Other examples to which one might appeal are the "siren" or "centaur."

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The goat-stag presents us with an example, I think, of the type of fallacious reasoning which Aristotle argues against in the *Sophistical Refutations* 20. Aristotle argues that many fallacious refutations "depend upon the division and combination of words: for if the expression means something different when divided and when combined .. one should take the expression in the contrary way"(177a33-6). Although examples such as 'Was X being beaten with that with which you saw him being beaten?' suggest that the subject is about loaded questions, the examination suggests also that the problem pertains to terms: the combined expression seems to have a meaning, which is clearly not the same as the meanings of the uncombined expressions. It is not a problem of ambiguity, Aristotle claims. In the case of the 'goat-stag', we know the accounts of 'goat' and 'stag', yet the conjoined phrase is given only a fictional account. We might facetiously claim that the explanatory middle term for the account of the 'goat-stag' is 'fictional creature', denying thereby that such creatures exist. Crucial, too, is that the definitions cross divide, not allowing any hypothesized definition to express a real essence: the differentia doesn't form a combined whole with the genus, because it is not a differentiation of it. Thus Aristotle has offered three types of real definitions and one type of nominal definition in *APo* II.10. In the next section, I shall examine types of Aristotelian definition in detail.

### ii. Causal Definitions , Substantial Definitions and Definitions by Matter and Form

In the course of this examination of the definition of essences, we have mentioned that the type of definition which is given particular emphasis in the *Posterior Analytics* is causal definition: this is definition through the middle term. In the *Posterior Analytics*, the middle term is asserted to be *the* explanation of essence. In II.8, Aristotle argues that:

Since, as we said, to know what something is [τί ἐστί] and to know the explanation of whether<sup>9</sup> it is [τὸ αἴτιον τοῦ τί ἐστί] are the same--the argument for this is that there is some explanation, and this is either the same thing or something else, and if it is something else it is either demonstrable or non-demonstrable--if, then, it is something else and it is possible to demonstrate it, it is necessary for the explanation to be a middle term and to be proved in the first figure; for what is being proved is both universal and affirmative.(93a3-9, Barnes, trans.)

In Aristotle's syllogistics, an argument in the first figure is an argument containing only positive (assertoric) statements about all members of a

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<sup>9</sup>In the 1981 re-edition of this by Princeton, Barnes replaced "whether" with "the fact that" at 93a5.

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class as premisses, and a conclusion which is also assertoric of all members of a class. Thus, the argument that the explanation must be in the middle term *in the first figure* is independently true by definition: the explanation, like all arguments in the first figure, will be universal and will involve a positive assertion about the class under discussion (which is in the major premiss). But again, why is the explanation in the middle term when explanations in this context are statements of the essence of something? That is, why does the middle term's connection with the thing show that thing's essence and explanation? The immediate difficulty which confronts the scholar with this argument is that the explanation described in the second premiss is said to be by "something else", i.e. something other than the thing itself; yet we examined the arguments, above, in which Aristotle argues that the essence is something true of the thing in itself, or which it is said to be *kath hauto*. (See *APo.* I.4) Aristotle's apparent summary of the preceding argument includes the statement that this is "proving what a thing is through another definition"(93a10; Barnes, trans.). Although this is introduced by the statement that this has been "just examined", Ross comments that this is a summary of an attempt made earlier at II.4 91a14-b10 (1957, p. 629)<sup>10</sup>, in which Aristotle criticised the attempt to prove something through a definition as a *petitio principii*. (Recall such an argument in chapter V.iii)<sup>11</sup>

The fact that Aristotle bases his argument here on things whose explanation is outside themselves entails that we are not talking of things which are *kath hauto* : Ross argues that

This is no doubt a reference to the distinction between substance, on the one hand, and properties and events on the other. A substance is the cause of its own being, and there is no room for demonstration here; you just apprehend its nature directly or fail to do so (cf. 93b21-5, 94a9-10). But a property or an event has an αἴτιον other than itself.(1957, p.629)

Yet Barnes argues that no evidence can be found for the view that "substances are self-explanatory and non-substances non-self-explanatory"; instead, the "denotata of the primitive terms used in any science are self-explanatory, ... and e.g. that there are men, which are substantial, *can* be explained by the fact that there are featherless bipeds"(1994, p.217; cf. 1975, p. 208). Barnes correctly points out, *pace* Ross, that the subject under

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<sup>10</sup>See also Barnes, 1994, p.218; Barnes comments that the error by the ancient commentators of identifying this with the argument at 93a16-35 has made much of the discussion ineffective.

<sup>11</sup>On II.8, cf. Granger (1976), Bolton (1976), Sorabji (1981), and Gomez-Lobo (1981).

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discussion is not restricted to properties and events. Yet how does the wider domain comprehend the other criteria mentioned by Ross? Is Aristotle forced to argue that this type of definition is only appropriate for properties and events, and is not appropriate for substance? Here we are faced with a dilemma, because if no distinction is required, then like substantial essences, the essences of properties and events will hold of them *kath hauto*. Alternatively, if the argument at 93a3-9 is intended to cover not only properties and events but also substances, then as the argument says, there is an explanation of substances which lies outside of themselves. On behalf of Barnes's interpretation, evidence could apparently be found in *APo* II.2, in which Aristotle argues that:

For the middle term is the explanation, and in all cases that is sought. Is it eclipsed?--Is there some explanation or not? After that, aware that there is one, we seek what this is. For the explanation of a substance being not this or that but *simpliciter* [ἀπλῶς], or of its being not simpliciter but one of the things which belong to it in itself [καθ' αὐτὸ] or accidentally [κατὰ συμβεβηκός] --that is the middle term. I mean by *simpliciter* the underlying subject [ὑποκείμενον] (e.g. moon or earth or sun or triangle) and by one of the things eclipse, equality, inequality, whether it is in the middle or not.(90a7-14; Barnes, trans.)

In this text, Aristotle's cases are not only an eclipse, which is like thunder in being one thing happening to something else, but also substance. Of note is the fact that Aristotle explains the substance *simpliciter* as the underlying subject, to which change occurs. The dispute between Ross and Barnes over the scope of such explanations by middle terms continues over this passage. Ross argues that

A substance does not inhere in anything; there are no two terms between which a middle term is to be found. [Aristotle] .. gives no example of what he means by the μέσον in such a case, and in this chapter the application of the questions εἰ ἔστι and τί ἔστι to substances is overshadowed by its application to attributes and events, which is amply illustrated (90a15-23).(1949, p.612)

Ross argues that the only clue to the discovery of the middle term which Aristotle is mentioning is that it is the explanation or explanatory principle (αἴτιον). Yet Ross comments also that Aristotle was not always faithful to the view that the explanation of substance is given in the final or efficient cause (p.612). Barnes does not find such comments sufficient to justify the restriction of scope: this text provides compelling evidence for the case that the questions addressed in *APo*. II.1 concern the existence and nature of a subject (1994, p.206)<sup>12</sup>.

The problem of whether the theory of definition given above covers both substances *and* the things whose explanation lies beyond

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<sup>12</sup>Barnes mentions Gomez-Lobo's position is an alternative to his own (1994, p. 204).

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themselves is solved by making the distinction between those natural objects which are substances and those natural objects which are not substances: Aristotle raises this distinction in *Metaphysics* H.4. Discussing the causal accounts which must be given of things, Aristotle distinguishes between *generable* natural substances, natural but *eternal* substances, and things which exist by nature but are not substances. Of the last group, Aristotle says that they have no matter<sup>13</sup> and their substratum is the *substance*. The example which is provided is the eclipse. Aristotle argues that

E.g. what is the cause of an eclipse? What is its matter? There is none; the moon is that which suffers eclipse. What is the moving cause which extinguishes the light? The earth. The final cause perhaps does not exist. The formal principle is the definitory formula, but this is obscure if it does not include the cause. E.g. what is eclipse? Deprivation of light. But if we add 'by interposition of the earth', this is the formula[λόγος] which includes the cause. (1044b8-14).

In this text, Aristotle attempts to provide an analysis of the eclipse by the four types of explanation from the *Physics*: but there is no something out of which the change is made; the source of change is the earth; there is no clear reason or end for the sake of which eclipse occurs; and the thing which is made to be is the deprivation of light. But, as we read, this is insufficient to provide us with the formula: we must combine the act of the efficient cause with formal explanation<sup>14</sup> to derive the proper essence of the eclipse. And the eclipse is like thunder in the relevant respects of being something happening to something else; the first something being a property or event which can happen only to things of the second type. Furthermore, the explanation of the eclipse requires mention of the subject upon which the phenomenon is dependent, but requires us to discover something beyond the phenomenon itself in order to find this subject. As I argued above, this type of exploration is not sufficient for the explanation of organic substances, which *are kath hauto*, rather than *in* something else *kath hauto*.

This does not imply that Aristotle in the *Metaphysics* thought that causal accounts were abhorrent; on the contrary, as Sorabji has mentioned, in Z.17, 1041a20-32, "the essence of thunder is simply the cause of there

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<sup>13</sup>We shall further explore issues related to non-substantial natural objects in chapter 4.

<sup>14</sup>In *Physics* II.3, Aristotle explains the formal cause of a thing which has come to be as an account of what the thing would be, including its genera (194b27-9). By this he does not mean that the account by us is the cause of the thing, but that the model is what we explain in giving the account; this explanation makes use of the vocabulary used to explain 'defining'. See also Chapter III §2.

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being a noise in the clouds".(1980, p.192n29). In that passage<sup>15</sup>, Aristotle argued that:

It is clear, then, that what is sought is the cause -- and this is the what-being-is, to speak logically -- which in some cases is that for the sake of which the thing exists (as presumably in the case of a house or a bed), while in some cases it is that which first began the change; for this latter is also a cause. But such a cause is sought in cases of coming to be and ceasing to be, while the former is sought also in cases of being.(Z.17 1041a27-31; Bostock, trans.)

The source of change (or 'efficient cause') is suitable for the explanation of generated things like attributes and events; while the existence of some substances are suitably explained by the end (or 'final cause') which it does. Aristotle's appeal to the example of artifacts is notable in this regard, because they are manufactured for some purpose. If this type of explanation is unavailable, then the default explanation is by the efficient cause.<sup>16</sup>

In answer to our previous question, the middle term's connection with the thing shows its essence and explanation because it is not *kath hauto* but something caused by the action of one thing on another: the middle term is the explanation in being the universal connection between the efficient cause and its effect. In these cases, like the eclipse, the definition requires reference to the other thing which caused the change, or to the subject undergoing the change.

However, I would venture that it was in recognition of the deficiency of explanations by efficient cause in explaining the essence of something that Aristotle offered another type of definition, that by matter and form. Definition by matter and form is most appropriate for the definition of substances. For example, one could explain the Queen by stating the occurrence of the impregnation of the Queen Mum by George. However, this statement would not capture the essence of the Queen in the sense of 'what it is to be' her, because it appeals to things beyond her, and does not explain her continued existence, but only explains the beginning of her existence. Definition by matter and form would seem to solve the problem, for Aristotle argues in the *Metaphysics* that "a defintory formula predicates something of something, and one part of the definition must play the part of matter and the other that of form"(H.3

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<sup>15</sup>Cf. Ross *ad loc.* 1949, p.612.

<sup>16</sup>Similarly, Aristotle still held the value of division: in Z.12, 1038a25-6, the last differentia reached in the process of division will be the form (i.e. the essence) of the thing, as we shall see below.

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1043b31-3).<sup>17</sup> Definition by matter and form is defended in the preparatory principles examined in *De anima* I.1: recall that Aristotle argues that "e.g. anger should be defined as a certain mode of movement of such and such a body (or part or faculty of a body) by this or that cause and for this or that end,"(403a27) thereby using many of the metaphysical principles mentioned. The movement is the form; the body is the matter/subject; the cause is the essence we seek; and the end is the explanation of the 'for the sake of which'. The example is what we would call a property -- particularly an affection -- which occurs to a subject as its bearer. Another example of definition by matter and form in that text is a house, an artifact.<sup>18</sup>

Thus the essence of a house is assigned in such a formula as 'a shelter against destruction by wind, rain, and heat'; the physicist would describe it as 'stones, bricks, and timbers'; but there is a third possible description which would say that it was that form in that material with that purpose or end (403b6-7).

The view that the essence of a house is 'a shelter ..' gives the formal account; the view that puts it as 'stones, bricks ..' gives the material account; and the combination of the two provides the account in terms of matter and form. Aristotle asks who proposing these various definitions is "to be regarded as the genuine physicist?"(403b8).<sup>19</sup> Not the one mentioning just the material, nor the one mentioning just the form but "rather the one who combines both in a single formula. ..The physicist is he who concerns himself with all the properties active and passive of bodies or materials thus or thus defined"(403b9-12). LeBlond comments that definition by matter and form is the ideal for metaphysics(p.70). Aristotle would accept this attribution, because it is only in this way that the definition can be a unified statement of essence. We will now turn to this issue.

### iii. The Unity of Definition and Division

In *Metaphysics* Z.12, Aristotle returns to the problem stemming from his theory of definition in the *Analytics*, to answer the question which he raises for himself, "The problem I mean is why a thing whose formula we call a definition is a unity"(1037b10-12). This is a problem

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<sup>17</sup>I shall postpone a complete examination of this type of definition until the ninth chapter, which deals more exhaustively with the relation between matter and form.

<sup>18</sup>For a problem with Aristotle's examples of artefacts, see my "Infinite Regress Arguments in Aristotle's *Metaphysics*: the Regress of Matter and Form". The house example is particularly important in II.3 195b5, the chapter in which Aristotle explains his principles of explanation cf. 193b9.

<sup>19</sup>Cf. Hicks, p. 202-3.

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because one could in principle raise the question why the formula, which consists of parts, combines those parts into a unity rather than a plurality. For instances, the example is provided of the definition of man as 'two-footed animal': some might argue this is a heap<sup>20</sup> of 'two-footed' and 'animal'.<sup>21</sup> For Aristotle, this is unacceptable because he defends the thesis that a substance is a unitary thing, a 'this something' which is a non-mereological, organic whole. If a substance is a unitary thing, the formula of substance must be unitary, and this is the definition. Thus, if the unity of a definition is undefendable, the unity of substance is jeopardised.

Aristotle provides an initial contrast case to set the context of the type of formula which causes the problem: 'man' and 'pale' form a unity because the man underlies his qualities, that is, he has pallor as an attribute, so that the pallor belongs [ὑπάρχῃ] to him (1037b14). But the parts of a definition are not thought to be of this type, for if the definition defines an essence, then the property attached to the genus is not thought to be accidental. But if the items combined are not even that of a substratum and an accident, then they are a plurality.

Aristotle explains the contrast case as it pertains to definition, saying that in the case of the genus and species, "the one does not participate [μετέχει] in the other"(1037b18; Bostock, trans.). Here, two alternatives are possible, the genus not participating in the differentiae, and the differentiae not participating in the genus. Aristotle offers an argument to resolve this based on the principle that "the differences which differentiate the genus are opposites": if the genus participated in the differentiae, then "the same thing would participate in opposites at the same time", which is impossible (1037b19; Bostock, trans.). Aristotle then addresses the thought experiment in which the genus does participate in the differentiae: even

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<sup>20</sup>In *Metaphysics* H.6, Aristotle uses the example of a heap with the description that heaps are things which have parts but in which the whole is not something besides the parts (1045a7-8); that is, they are mereological wholes. See Scaltsas 1994, (mss. p. 6) Cf. Ross (1929, v.2, pp.206-207).

<sup>21</sup>In *Phaedo* 100d, Socrates explained that the reason why anything has attribute X is because of the presence in it of the absolute X. In *Parmenides* 130e, Socrates agrees that "there exist certain forms, of which ... other things come to partake and so to be called after their names; by coming to partake of likeness or largeness or beauty or justice, they become like or large or beautiful or just"(trans. Cornford). In the *Sophist*, Theaetetus and the Stranger examine the combination and participation of many forms in one thing because of the many descriptions which one thing can have, deciding that some things are able to blend, ie. those which do not contain opposites (251a-252e). See also *Sophist* 253d-e *ad loc*, *Phaedrus* 265e; and Aristotle's *Topics* VI.6 143b24.

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then, if there are more than one differentiae -- which is plausible, given that there is usually a population greater than one which is encompassed by the genus -- the problem of unity is not solved, because an argument must be provided to explain why the differentiae form a unity. Aristotle argues that the unity of the differentiae cannot be explained by simply stating that they belong to the genus, for on that principle, everything would be a unity, and no explanation has been given for the fact that they are a unity.

To find a solution Aristotle examines definition by division, which "consists only of what is called the primary genus and the differentiae, the other genera being the primary genus taken with certain differentiae"(1037b28; Bostock, trans.). The example given is the division of animal into a class which is 'two-footed', 'wingless two-footed', plus further differentia as the case may be. Aristotle argues that it does not matter how many differentiae there are, because there will be one genus and one differentia, as in the case of the 'two-footed animal'. Bostock comments that the "moral of this would appear to be that the complex case of a genus followed by many differentiae can be reduced to the simple case of a genus followed by a single differentia, namely by taking all of the definition except the final differentia as introducing a (narrow) genus"(1994, p. 181).<sup>22</sup> But, we must ask, why do things divide so conveniently? Bostock takes the answer to lie in the subsequent, tremendously cryptic conclusion:

If, then, the genus does not, in an unqualified sense, exist apart from the forms of the genus, or if it exists but only as matter -- for voiced sound is the genus and the matter, and the differentiae made from this the forms of sound and the phonetic elements -- then it is clear that the definition is just the formula composed of the differentiae.(1038a5-9; Bostock, trans.)

To Bostock, this solves the problem *only for the initial genus*, but doesn't work for the subsequent differentiae of genus (which have been divided between the genus itself and the last differentia): according to him, it is absurd that the subgenus can be discounted at all (p.181). Aristotle needs to say that the subgenera can be omitted because they are entailed by the remaining parts of the definition; but he does not provide that argument here, Bostock argues.

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<sup>22</sup>Ross comments that this argument is intended to cover the case of definitions by division, but is not applied to the other type of definition, "ἐκ τῶν ἐνυπαρχόντων", which is mentioned at B. 998b13 and H. 1043a20.

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The simplest paraphrase of Aristotle's statement is that if the genus does not have a separate existence<sup>23</sup>, then the definition is a formula explaining the differentia. To understand this passage we need first to recall the statement made previously that the genus does not participate [μετέχει] in the things which are its differentiae, because of the reduction to absurdity which would result: the genus would contain opposites. If the genus participated in the differentia, and the genus contained opposites, the absurd conclusion would result that the differentiae contained opposites, and the definition of the thing would contain something which did not belong to it, and was indeed opposite to it. We can thus add the premiss that the genus does not exist apart from its forms, except in a qualified sense. From this, by *modus ponens*, we get the conclusion that the definition is out of the difference.

But why do things divide so conveniently? The distinction which solves the problem is that Aristotle says that the differentiae must not be *accidental* to its successor, as opposed to essential to the thing being defined (1037b26). One might argue that this contrast begs the question at this point in Aristotle's treatise, because the point of dispute is the constituents of the definition. However, Aristotle has argued that "the division [of the genus] should be continued by taking the differentia of the differentia"(1038a9). This requirement is not simply an addition to the theory of division but the crux of it: if it were not so, then the claim that one must not take qualities from different genera would be moot, and there would be no genera. Examined in a modern way, one could reinterpret Kirwan's argument for essences in an Aristotelian fashion, as follows. Kirwan uses *modus ponens* to argue in favor of essential truths on the grounds that "it is possible to reduce analytic to essential predications, and there are certainly analytic truths"(1970, p.51). Kirwan argues that it is analytically true that a blue thing is coloured, but not that a blue thing is essentially coloured; however, the *colour* blue is analytically *and* essentially coloured, and cannot fail to be coloured. Thus he thinks that:

analyticity (in the narrow sense) can be defined in terms of the essential properties of properties: to say that it is analytic that blue things are coloured is the same as to say that it is analytic that things which have the colour blue have colour; and latter is analytic because the colour blue is essentially a colour. (1970, p. 52)

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<sup>23</sup>In light of Kahn (1966), one might prefer to use another synonym for "being".

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That is, the relation between two things is expressed in an analytic truth when the first is essentially the second, but not the reverse: one must simply add an attribute e.g. an unfinished symphony is essentially thematic (or possesses a temporal structure) but only analytically unfinished (Cf. Z.6 1031a18-21). Thus, the *modus ponens* works, and one cannot establish a biconditional dependence. Using a vocabulary closer to Aristotle's, we could argue that the essential properties (e.g. thematic) into which we divide a genus (e.g. pieces of music) are said of the various things into which the genus is divided; but when an attribute is affixed to the last difference, the attribute can only be said of things with that difference. Thus, if we restrict the class of predicates under scrutiny to the essential predicates, there will be only one genus and one last difference because they all proceed from the one to the other, and Aristotle is right to say that we can disregard the intermediates as contained in the difference (see also Plato's *Philebus* 16e1-2).<sup>24</sup>

But what then is to be made of the genus and difference? Kirwan's argument is said by the author to hold of properties of properties. Is there an Aristotelian analogue to this? We must specify what is defined. In *Posterior Analytics* II.13, Aristotle argues that: "Every definition is always universal; for the doctor does not say what is healthy in the case of some individual eye, but either in the case of every <eye>, or determining some sort <of eye>"(97b26, Barnes, 1975). This is liable to mislead, because the fact that the definition holds universally *of* the objects which it defines, does not tell us about the nature of the thing being defined. That is, it could be a concept, logical construction, or expression of some general linguistic practice. The nature of the objects is indeterminate. Aristotle acknowledges this difficulty, following up the preceding conclusion with the statement that "it is easier to define the particular than the universal -- that is why one should cross from the particulars to the universals"(97b28-29; Barnes, 1975 trans.). The answer to the question of what is defined is given in the *Topics* I.4 passage which we examined earlier: Aristotle says that the *essential part* of anything is the subject of its definition, i.e. forms of the genus (1038a5).

However, we must clarify the point that the essence is the subject of definition, because if it is universal, then the particular being defined is essentially a universal, no equivocation on 'essentially' intended. The

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<sup>24</sup>Compare the 'indeterminable/indeterminate' thesis of Granger.

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ἀπορία being addressed in Z.6 is the following: "We must inquire whether each thing and its essence are the same or different"(1031a15-16). The argument in Z.6 to which I will draw attention is the indirect proof by *reductio ad absurdum* argument used to show that a substance and its essence are the same and one, the opposite view leading to an infinite regress. It is a thought experiment in which Aristotle explores the consequences of a gulf between a *kath hauta legomena*, or thing spoken of in itself, and its essence. The text is as follows:

The absurdity of the separation would appear also if one were to assign a name to each of the essences; for there would be yet another essence besides the original one, e.g. to the essence of horse there will belong a second essence. Yet why should not some things be their essences from the start, since essence is substance? But indeed not only are a thing and its essence one, but the formula of them is also the same, as is clear even from what has been said; for it is not by accident that the essence of one, and the one, are one. Further, if they are to be different, the process will go on to infinity; for we shall have (1) the essence of one, and (2) the one, so that to terms of the former kind the same argument will be applicable.(1031b28-1032a5)

This is the famous 'Second-Man Argument': if a thing, say man, and the essence of man are different, another essence would be required to be the essence of the essence of man. Part of Aristotle's use of this argument is polemical, against the position that there is a gulf between a thing and its nature: Aristotle attributes this problem to the Platonists because any Form *f* is the explanation of an *f-thing's f-hood*. The argument takes the following structure:

P1 Substances are self-subsistent.[καθ' αὐτὰ](1031a28)

P2 Essence is substance.(1031b32)

AP3 A substance is not the same as its essence.("Ἄτοπον") (1031b28) (Denial of the Conclusion)

P4 To the essence of horse, assign a name 'horse<sub>1</sub>'.(1031b29)

C1 Another essence, 'horse<sub>2</sub>' belongs to the essence of horse, i.e. 'horse<sub>1</sub>'.*ad infinitum* (1031b30)

AC2 Substances are the same as their essences.(Discharge A.P.3.)

If the consequence of this argument is solely a proliferation of essences, we might not think that the regress is a problem<sup>25</sup>. However, if the being of a substance always requires an essence which is a separate entity, then each substance is always severed from its essential nature. Aristotle emphasizes that the explanatory role of an essence would be forever removed from what it is to explain, if this nature is separate from its instances. If the being of a substance always requires an essence which is a separate entity, in each case we are a step removed from knowing that substance. But not only will that epistemological problem arise, the more fundamental metaphysical problem of the distinction between a thing and

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<sup>25</sup>See 'The Second Man's Vice' in Scaltsas (1994).

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what it is would entail that nothing is what it is, for there is nothing for it to be, in itself. Because each new essence is itself a substance, from P2, which again is not identical to its essence, from assumed P3, that new substance requires an essence. In this way, the regress is generated. And, Aristotle emphasises that even the new 'second' essence would not be the same as its formula (λόγος) (1031a32). As Scaltsas has argued, the separation between a substance and its essence leaves substance in search of a nature, because it does not have one in virtue of itself.<sup>26</sup> However, Aristotle repeats in Z.6 the remark he made in Z.1 that substance is self-subsistent, and is being in the primary sense (1028a14, 1031a28, etc.). AP3 makes it logically impossible for a thing to be in virtue of itself, and impossible for us to know what it is if it must always be another thing which is itself explained by another thing ... Thus, the regress is vicious, because the assumption is inconsistent with P1 and P2. Substance must be the same and one with its nature.

How does this help us with the problem mentioned about universals? As I said, it seems paradoxical that the essence of a particular is a universal. However, Aristotle holds that "there is knowledge of each thing only when we know its essence [ἐπιστήμη (τε)<sup>27</sup> γάρ ἐκάστου ἔστιν ὅταν τὸ τί ἦν ἐκείνῳ εἶναι γινώμεν]"(1031b7-8). This point is repeated in Z.6 (1031b21-2) and elsewhere in Aristotle's works. On the reasonable assumption that the definition of a thing is the statement (formula/λόγος) of the essence, we can combine this premiss with the assertion made above that definitions are always universal (97b26) and the Z.6 proof that the thing *kath' hauta* is identical with its essence, to generate the conclusion that the particular being which is defined is essentially a universal, but it is not a separate universal<sup>28</sup>.

I introduced this argument as an ἀπορία about the relation between universals and particulars. However, my other motive is shared with Aristotle: the argument casts considerable doubt on the Platonic position about the relation of a thing and its essence/ a particular and the universal of which it is an instance, because the theory of Forms of Plato's middle

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<sup>26</sup>See Scaltsas (1993), (1994b, pp.128-137).

<sup>27</sup>This is included in the text from which Ross's translation was done (1929) following the A<sup>b</sup> (Laurentianus 87.12, saec. xii) text and Alexander of Aphrodisias's commentary, although is absent from other modern editions, e.g. Tredennick (1933).

<sup>28</sup>In Chapter 1, I have addressed the issue that in the *Metaphysics*, Aristotle argues against the thesis that substance is a universal; in chapters VI and VII, I will address the issue that the substance is mixed with matter.

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period would not return a sound theory of definition. The Platonic effort must fail because the essence<sup>29</sup> of the thing being defined is always something outside of that thing and detached from it. Thus, the definition will not be of the thing defined, which is absurd. Aristotle puts his thesis to exactly this use in Z.6, with the following argument: if there is a cleavage between a thing and its essence, such as between the essence of good and the good, and between the essence of being and being, then there will always be a prior essence which is the essence of the initial essence (1031a31-b4). But each successive essence will have a prior one. With the successive generation of essences, there will never be knowledge of the initial thing, because the essence of it generates successive essences, always a further step removed (1031b4). There is no stopping the generation of essences, which entails the most significant stance that the essence of reality will not be real. To this, Aristotle argues that "if the essence of reality is not real, neither is any of the others"(1031b11), for the real (noun) (τὸ ὄντι) should be the fundamental case of a reality (adjective) (ὄντι). Thus, within the Platonic theory, essences could not exist, and could neither be defined nor known.

How is this a better solution than the Platonic solution? The difficulty stands that Plato could not explain the unity of the essence and the substance within the theory of transcendent forms; he did not, to my knowledge, ever come to a solution of this problem.

### iv. The Use of Genus in Definition

Yet why does Aristotle think that there is theoretical significance to the fact that things belong to genera? In the *Topics*, he argues that "The genus is what is predicated in the *ti esti* of many things differing in species"(I.5 102a31-33). (And differing from his theory in the *Metaphysics*, he argues in the *Topics* that one can destroy someone else's definition by examining "whether the differentia rendered indicates an individual rather than a quality: for the general view is that the differentia always expresses a quality [εἰ μὴ ποιόν τι ἀλλὰ τόδε τι σημαίνει ἢ ἀποδοθεῖσα διαφορά· δοκεῖ γὰρ ποιόν τι πᾶσα διαφορά δηλοῦν]." (VI.6 144a20-1). Granger (1984) mentions that this is evidence of the changed priority between genus and difference between the *Metaphysics* and *Topics*; however, Aristotle seems not to be committed to the statement that "the

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<sup>29</sup>Or for a more properly Platonic term, εἶδος, or μέρος; 'essence' is the translation given of τὴν οὐσίαν as used in the *Laws* 895d4.

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genus is more theoretically significant than the difference", for first, the statement is taken to be a popular view, and second, he follows this statement with the argument that "the differentia is never an accidental attribute, any more than the genus is: for the differentia of a thing cannot both belong and not belong to it."(144a24-7)) Now if the domain of a genus is wider than that of a *diaphora*, then one could plausibly argue that there will be some theoretical consequence of making scientific or deductive use of the genus. In the *Topics*, Aristotle defends the principle that "the genus has a wider denotation than the species and its differentia; for the differentia too has a narrower denotation than the genus."(IV.1 121b11) The scope of the denotation sets these notions apart, the genus having the broader scope. Similarly, Aristotle argues that if we "annul the genus and differentia, ... the species too is annulled, so that these are prior to the species"(141b35); and "of the elements of the definition the genus seems to be the principal mark of the substance of what is defined"(139a28-30). These statements are mentioned as evidence of the relation between genus and *eidos* which Aristotle believed to hold between them: the genus is prior, in being a condition which makes possible the difference of the form.

Earlier, I explained Aristotle's definition of genus in *Metaphysics* Δ.28 which explains it as "in definitions the first constituent element, which is included in the 'what', ... whose differentiae the qualities are said to be"(1024b4-7). The definition of "definition" is given in *Topics* I.4 as the part of that which is peculiar (τοῦ ἰδίου) to the thing "which indicates the essence [τὸ τί ἦν εἶναι]" (101b22-3); in *Posterior Analytics* II.2, Aristotle says that definition "is said to be the statement of a thing's nature [Ὁρισμὸς δ' ἐπειδὴ λέγεται εἶναι λόγος τοῦ τί ἐστί]" (93b29-30). The combination of these definitions entails that the genus is included in the nature of a thing, which is a form of realism. Realism, as I use it<sup>30</sup>, is the theory according to which (scientific) theories and terms pick out real entities. As explained above, Aristotle defended the thesis that a thing is the same as its essence, and there is no gulf between them. And, it was seen, this is particularly true of the example of real things: they are not to be severed from the essence according to which they are called real.

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<sup>30</sup>This qualification is important, because 'realism' has been defined in many ways by many different theorists; my definition is developed from the use by Hacking (1983). It is beyond the scope of this dissertation to engage in the dispute surrounding the meaning of the term 'realism'; see, for example, Charles and Lennon, eds. (1994).

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Realism is most clearly said of members of substantial genera because they are things said of themselves in the focal sense; but of non-substantial genera, the role of the genera in what the individuals are has changed only in the sense that reference must be made to the substances to which they belong as peculiarities. In Aristotle's theory, they are as real as their bearers.

Thus, I will examine a use to which Aristotle put his theories of definition, division, and genus.

### iv.i Case Study: The Definition of the Ψυχή

My case study of Aristotle's use of genus (as the first element of a definition which takes differentia as its qualities), is Aristotle's method used to define the ψυχή (or soul) in *De Anima* II.1. Having examined the attempts by his predecessors to define the soul, Aristotle undertakes his own study, and comes up with the definition of ψυχή according to which the ψυχή is "the first grade of actuality of a natural body having life potentially in it"(412b6). The procedure by which Aristotle arrives at the definition of the ψυχή is by division, and by reflection on the predicates according to which he has divided the classes.

<p>Substance</p> <p>(a)Matter      (b)Form      (c)Composite          =not 'a this'    ='a this'      = of (a) &amp; (b)          =potentiality    =actuality</p> <p>                    as knowledge                      as the exercise</p> <p>Thus,          soul is the actuality (in the sense as knowledge) of a body as having life potentially in it</p>	<p>We are in the habit of recognizing, as one determinate kind of what is, <b>substance</b>, and that in several senses, (a) in the sense of <b>matter</b> or that which in itself is not 'a this', and (b) in the sense of <b>form</b> or essence [μορφὴν καὶ εἶδος; ie. shape and form], which is that precisely in virtue of which a thing is called 'a this', and thirdly (c) in the sense of <b>that which is compounded</b> of both (a) and (b). Now matter is <b>potentiality, form actuality</b>; of the latter there are <b>two grades</b> related to one another as e.g. <b>knowledge</b> to the <b>exercise</b> of knowledge.(412a7-13)</p>
<p>Natural bodies</p> <p>Having Life                      Not Having Life</p> <p>=i. self nutritifying          and growing</p> <p>=ii. a composite (since i. -&gt; ii.)</p>	<p>Among substances are by general consent reckoned bodies and especially <b>natural bodies</b>; for they are the principles of all other bodies. Of natural bodies <b>some have life in them, others not</b>; by life we mean <b>self-nutrition and growth</b> (with its correlative decay). It follows that every natural body which <b>has life in it is a substance</b> in the sense of a <b>composite</b>.(412a14-16)</p>

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Here Aristotle argues that the body cannot be the soul since it is what the soul is attributed to, as the matter or subject; therefore "the soul must be a substance in the sense of the form of a natural body having life potentially within it [διὸ ἡ ψυχὴ ἐστὶν ἐντελέχεια ἢ πρώτη σώματος φυσικοῦ δυνάμει ζωὴν ἔχοντος. τοιοῦτον δὲ ὁ ἄνθρωπος ὁργανικόν]."(412a27-9) But because a substance is an actuality<sup>31</sup>, the soul is the actuality of the body. But actuality is a term used in two ways: it can refer to the possession of a trait and to the actual exercise of that trait. The soul, Aristotle argues, is actuality in the first sense, because the exercise of the life functions presupposes that one possesses those life functions.

In this text, and in the chart I have used to represent the text, Aristotle divides a genus into further genera. Aristotle explicitly refers to substance as a genus of being, saying "λέγομεν δὴ γένος ἓν τι τῶν ὄντων τὴν οὐσίαν", as we read above (412a6). But continuing the division of being into substance and things in the non-substance categories, (*Categories* 4, 1b25), substance is said to be in three ways: "ὡς ὕλην, .. ἕτερον δὲ μορφήν καὶ εἶδος, ... καὶ τρίτον τὸ ἐκ τούτων."(412a7-9), i.e. matter, form, and the things which come out of them (which is the composite or *συνολον*). Then Aristotle notes that the matter and form distinction corresponds to another metaphysical distinction which he has defended elsewhere, that between potentiality (*δυνάμεις*) and actuality/activity (*ἐντελέχεια/ἐνέργεια*) (from *Physics* II.1 193b7-8; *Physics* II.3 195b16-21; *Metaphysics* Θ).<sup>32</sup>

Aristotle notes that there are different kinds of soul, saying in II.2 that "ἄλλ' ἔοικε ψυχῆς γένος ἕτερον εἶναι", i.e. the 'mind' or power to think is one of the kinds of soul (412b26-27), implying that other kinds of soul are to be found; he explains that parts of different types of soul are analogous to each other, e.g. the roots of plants serve the same digestive function as the mouth of animals. (He more fully examines other types of souls in Book II chapter 3, etc.)

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<sup>31</sup>Ψυχὴ in general is defined in Book II chapter 1 as "the first actuality of a natural body which has organs"(412b4). Charlton disputes the division of *entelecheia* and translates the first phrase as "the soul is the actuality in the first way"(1980, p.174).

<sup>32</sup>The appeal to the *Metaphysics* is to the source in which I think Aristotle gives the clearest account of the potentiality/actuality distinction; however, much can be gleaned from Aristotle's various uses of it, e.g. in *Physics* III.1 change is defined as "the actuality of that which potentially is, *qua* such"(Hussey, 201a10). In the *De Anima*, Aristotle says that "everything [that is affected and moved] is affected and moved by something which is capable of bringing this [affection and movement] about and is in actuality"(417a18; my additions in brackets). See Bonitz 206a36 f., 251a2f., 253b35f.

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Yet these passages are ambiguous between whether the soul is the form alone or the composite of form and matter/faculty and body. But after providing the definition of ψυχή, Aristotle explains the relation between the physical and the psychological:

διὸ καὶ οὐ δεῖ ζητεῖν εἰ ἓν ἡ ψυχὴ καὶ τὸ σῶμα,  
ὡσπερ οὐδὲ τὸν κηρὸν καὶ τὸ σχῆμα, οὐδ' ὅλως τὴν ἐκάστου  
ὑλὴν καὶ τὸ οὐ ἢ ὑλὴ· τὸ γὰρ ἓν καὶ τὸ εἶναι ἐπεὶ πλεονα-  
χῶς λέγεται, τὸ κυρίως ἢ ἐντελέχειά ἐστιν. (412b6-9)

This text has given rise to a variety of translations, few of which are consistent with each other, and each of which places different emphasis in the last sentence. In the Clarendon translation, Aristotle is made to say that:

we should not ask whether the soul and body are one, any more than whether the wax and the impression are one, or in general whether the matter of each thing and that of which it is the matter are one. For, while unity and being are so spoken of in many ways, that which is most properly so spoken of is the actuality (412b6-9; Hamlyn, trans.).

In his translation of the last sentence, Hamlyn has drawn attention to the unity of the actuality (ἐντελέχειά). Yet in the Oxford translation, Aristotle is made to say that:

That is why we can wholly dismiss as unnecessary the question whether the soul and the body are one: it is as meaningless as to ask whether the wax and the shape given to it by the stamp are one, or generally the matter of a thing and that of which it is the matter. Unity has many senses (as many as 'is' has), but the most proper and fundamental sense of both is the relation of an actuality to that of which it is the actuality. (412b6-9).

In this translation, Smith emphasises the *relation* which most exemplifies the *senses* of 'unity', although the words for 'relation' [πρὸς τι] do not occur in the Greek, nor do the words in Smith's final clause.

Again, Hicks puts the passage that:

hence there is no need to enquire whether soul and body are one, any more than whether the wax and the imprint are one; or, in general, whether the matter of a thing is the same with that of which it is the matter. For, of all the various meanings borne by the terms unity and being, actuality is the meaning which belongs to them by the fullest right.(412b6-9; Hicks, trans.)

Hicks's translation expresses Aristotle's words with the English terms of semantics, 'meanings' which 'belong' to 'terms'; again, these terms are not found in the Greek. So we seem to be faced with a dilemma, on the one hand being told that the actuality is the primary unified being, which suggests the form and not the composite which Aristotle has just emphasised as being part of the unity; or we are told that the primary sense of unity is the relation of an actuality to its ground, which we can read as the composite, without complete justification from the Greek text; or we are told that 'actuality' is the primary meaning of 'unity' and

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'being', which suffers from the problems of both of the first two translations.

The interpretation which I adopt is one which reads 'τὸ ἔν', 'τὸ εἶναι' and 'ἡ ἐντελέχεια' elliptically, in need of an object: rather than Platonic forms, there is no 'τὸ ἔν' etc. which are said in respect of themselves, but each is always the unity *of* an *x*, being *of* a *y*, or actuality *of* a *z* (where *x*, *y* and *z* stand for variables which can stand in such relations). Thus I translate the last sentence "For while unity and being are said in many ways, the actuality <of a *z*> is the most appropriate <way>". On this reading, we are compelled to fill in the *z*, which in Aristotelian metaphysics is filled with a potentiality to be whatever the actuality is. This is the form which is compounded with the matter, as explained in the passage examined above; i.e. the actuality of a natural body which has life in it<sup>33</sup>. Thus I have opted for a variation on the second reading, reading into Aristotle's Greek the fact that the reciprocal of a relative is necessary for its meaning to be understood, which is justified by statements made in the *Topics* (VI.8 146a36, cf. VI.12 149b4); and by the fact that ellipsis is a common style of writing in Aristotle's Greek; and by the fact that the style of presentation would be consistent: as body is to soul, so wax is to impression, and matter to that of which it is the matter, i.e. they are unities, as actuality is to that of which it is the actuality. Thus I am also able to defend Aristotle's stated conclusion that the primary meaning of ψυχή is the composite, which was the result of Aristotle's division of the types of substance.

But what role did the division have in this proof? We read above that in a proper division, one must *a*) deal with some whole: this is the class of natural bodies; *b*) divide the kind into what is atomic in sort: these are the living<sup>34</sup> and non-living bodies; *c*) attempt to get definitions of these: the living are self-nutritive and growing; *d*) getting what the kind is, consider the proper affections through the first common items: Aristotle continues his division of living natural bodies which self-nutritive and grow with mention of the need by such beings for a digestive opening. One might argue that this analysis is not appropriate because the dichotomous division of natural bodies into living and non-living is not division into "τὰ ἄτομα τῶν εἶδων" (96b16). This objection is certainly well-

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<sup>33</sup>In H.6, Aristotle argues that the proximate matter and the formula are one: we shall return to this in Chapter VIII.

<sup>34</sup>"Living" is a popular example in the logical texts, e.g. *Topics* V.6.

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taken, if the account was intended to be an exhaustive description of each living natural body. Yet Aristotle says that he endeavours here to provide "something common [κοινὸν] to every soul"(412b4), and he continues the *De Anima* with analyses of the more atomic *classes*: the subject of the biological treatises is the more specialised work. And we must note that the pursuit is undertaken for the sake of defining what it is to be a living thing, rather than the division of living things into sub-classes: the division is done for the sake of the definition, as Aristotle had argued in the *Posterior Analytics*.

Thus we find Aristotle making use of the theory which was presented in the *Posterior Analytics* as a tool for the definition of members of genera, the type of genus being living natural bodies. It follows that the method works for natural science.

## Chapter VII On Matter

In the previous chapters, we saw the views of genus and matter which Aristotle gives in division and definition. In the third chapter we studied Aristotle's explanation of generation and how it involves the transmission of form from an agent to a patient, i.e. the first "use" of genus listed by Aristotle, and in the course of explaining this, we found Aristotle's defence of the substratum of change, which he states as a component of the third use of "genus". Yet when Aristotle summarises the uses of "genus", he gives a gloss which combines this with the use of "genus" to mean the first component in a definition, which was explored in chapter VI: this is the view that "genus" is used as matter. The genus as matter thesis will be examined in the last chapter, in preparation for which we must look more closely at Aristotle's theory of matter. This chapter will be divided into four sections: the first examines the domain over which matter as a technical term is used; the second examines the definition of matter; the third is a study of the characterisation of matter as potentiality; and the fourth examines the reducibility of substance to matter.

### i. On Matter: the Domain Problem

In chapter 1, Aristotle's introduction of matter as an explanatory principle was explored: recall that he argues that the opposite forms are insufficient explanations of change and natural things. The ancients prior to Aristotle faced a problem about the nature of and relation between being and not being -- see *Sophist* 238-240, for example -- which led Parmenides to argue that the concept of not-being cannot be said, or Heraclitus to argue that flux is the essence of what is. Aristotle thought that the opposites -- being and not being, or what he took to be variants of them (*Cat.* 10 13a37-b35, *Met.* A.2 1069b3-33) were insufficient to explain change. Instead, the material principle is required, which he says is "two in form": the matter is the stuff which is subject to change, and supervening on it is one of the opposites, which will be lost in the course of the change to the possession of the other opposite. In *On Generation and Corruption* I.5, Aristotle reaffirms this view, arguing that the most proper sense of matter is the substratum of generation, and matter is secondarily the substrata of the other changes, "because all these *substrata* are receptive of contrarities of

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some kind" (320a4-5). This view is expressed by Aristotle throughout the corpus, from which I will mention two passages. In chapter three of *On Length and Shortness of Life*, Aristotle argues that "all things are at all times in a state of transition and are coming into being or passing away"(465b26). He justifies this by arguing that the contrary qualities of natural things prevent such things from being eternal. Contrary qualities must be found in a thing because "their matter is an immediate source of contrariety"(465b30). But again addressing the question why the matter is the source of contraries, Aristotle argues that "it is impossible that anything containing matter should not have in any sense an opposite"(465b11). Take an (imaginary) object which is hot and straight throughout its parts: only if there is something else to the object (i.e. a substratum) than its heat and straightness would it be subject to change. But, Aristotle argues, substratumless characteristics are impossible or else the heat and straightness would be objects in themselves, and separate in the way of an organic substance which takes on opposite qualities but can exist without them. Aristotle summarises with a terminological change, concluding that change must occur because the active and passive occur together, the former acting on the latter. By the passive, in this regard, he means the matter, as we shall see, below. Thus in the case of all natural things -- things which change, and particularly animals (465a20) -- they are changing because they are all material. Even the heavenly bodies are implicitly included in this account, for their local matter gives rise to their change of location<sup>1</sup>. However, there will be the contrasting case of the matter of heavenly bodies which isn't subject to decay or anything *but* local motion: for an account of these we must return to the *Metaphysics*.

In H.1, summarising Z<sup>2</sup> of the *Metaphysics*, Aristotle lists the various types of matter that serve as the substrata for different types of change: he first introduces the topic by mentioning that he will review the agreed substances. Crucial to the enumeration of this class is that the substances are perceptible, Aristotle adding that if a substance is perceptible it will "have matter [ὑλην ἔχουσιν]"(1042a26; Bostock, trans.). This follows

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<sup>1</sup>Again, summarizing the previous work in *Metaphysics Z*, Aristotle recalls that the substratum was argued to "ὑπόκειται .. ὡς ἡ ὑλη τῆ ἐντελεχείᾳ"(Z.13, 1038b5-6) i.e. to underlie as the matter to the substance. Now if the substance is identified with the form, then the actuality referred to in this passage is the form which is combined with the matter: the matter *receives* the form; we will explore below how the matter is a unity with the form.

<sup>2</sup>See Ross 1929 v.2 p. 226 for a reckoning of the references to previous passages.

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according to Aristotle's theory of perception because only if a thing has matter does it contain within itself a principle by which its own properties can affect the properties of a sense organ, such as the colour of an object being able to reflect light onto our visual receptors (cf. below, for the relation to the elements). Aristotle summarises the various candidates for the underlying substance, i.e. the matter, the form and shape, and the combination of them. Pursuing the idea that matter is substance -- about which we shall have more to say in the next section -- he argues that matter *is* substance "since in all changes from one opposite [ἀντικειμέναις] to the other there is something which underlies the change"(1042a31-2; Bostock, trans.). Thus we get the list of some types of matter as subject:

in a change of place there is that which is now here and later there; in a change of size there is that which is now of such a size and later larger or smaller; in a change of quality there is that which is now healthy and later sick. Similarly in a change of substance there is that which is now coming into being and later perishing, and which now underlies as a this and later underlies by way of privation. This last kind of change implies all the others, but they — one or two of them — do not imply it. For a thing which has matter for change of place need not necessarily have matter for generation and destruction.(1042a32-b8; Bostock, trans.)

Thus we have a catalogue of the basic types of matter as the subject which undergoes change. Again, we find it to be the case that the substratum (or subject) of the change is capable of taking on contrary properties. Thus for any changeable thing, there is a material substrate.

Yet Aristotle is not a materialist, i.e. he does not believe that for anything in the world, an exhaustive account of that thing can be given by appeal to the fact that it has matter. Two reasons for this are the following: first, some things are immaterial. The case we shall examine is the active intellect (νοῦς), which is to some, the mind<sup>3</sup>. In *De Anima* III.4, Aristotle gives three arguments that the mind is immaterial. He explains the nature of *nous* on analogy with the senses. These take on the form of the perceived object without the matter. Similarly, *nous* "must be potentially identical in character with its object without being the object"(429a15-16). *Nous* is not a composite because simplicity is required "in order .. to dominate [κρατῆ], that is, to know" (429a18-20). Otherwise, "the co-presence of what is alien to its nature is a hindrance and a block"(429a20-

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<sup>3</sup>Given the debate, I shall use *nous* throughout, because the debate about whether this constitutes "mind" is beyond the scope of this paper. The non-equivalence view is well put by Wilkes, who notes, "Aristotle (and all Greek philosophers before him) lacked the concept of 'a mind' and would not have wanted it had it been explained them" (p.115).

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1).<sup>4</sup> This has parallels in the activity of the heavenly bodies, whose matter does not restrict their motion.

A second reason why Aristotle is not a materialist because he argues that the material elements within a thing do not have within themselves inner principles of change, since the matter is only potentially existing after the elements/compounds are united in an organic substance<sup>5</sup>. What is needed is the principle of the form, which carries with it the teleological features of the final outcome of the change: Aristotle argues in *Metaphysics* H.4 that "perhaps the final and formal causes of man are the same"(1044b1). That is, if we are to explain what it is to be a human being, then flesh and bones, or *sperma* and *katamenia*, will not be sufficient to explain how it is that humans *are*, especially in the variety of behaviours which they exhibit. The problem is the same as we found in the Introduction, which shows the need for teleological explanation.<sup>6</sup>

Thus we have established that the domain of matter includes all changeable things: this is matter in the physicalist sense. Yet an incompatibility arises: Aristotle frequently suggests that matter is substance, on the criterion that being the subject of change is sufficient for substantiality, yet he also regards the matter as insufficient to account for the changes which we see substances undergoing, on the criterion of possessing an essence. We will examine the plausibility of matter as substance in the next section.

### ii. On Matter: Is it Substance?

In his *Metaphysics*, Aristotle does not so much provide another defence of the material principle as explore some of the consequences which a "first philosopher" must address. One topic of Book Z which is paramount is "what is substance?", for which the material subject is a suitable candidate. Thus in the *Categories*, (e.g. 2b15-17) as we saw, one of the criteria for substance is being the ultimate subject of which all other

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<sup>4</sup>It is perhaps unjustified to give such a brief account of my interpretation of Aristotle's theory of the nature of *nous*; however, my effort is to show only that Aristotle is not a materialist, rather than to state what type of theory best names Aristotle's philosophy of mind. In what follows, it will be clear that the non-materialism I have just claimed does not rule out the interpretation that Aristotle's theory of mind is functionalist materialism.

<sup>5</sup>See Gill (1987).

<sup>6</sup>Aristotle's appeal to final causes on holist grounds is possibly related to the Hippocratic procedure recorded in Plato's *Phaedrus* 270c1-4 : one must understand the nature of the whole before one can understand the nature of the body (parts). This interpretation follows Hackforth and de Vries as reported by Rowe (1986), p. 205.

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things are said but is not said of anything else. Yet with the introduction of the distinction between matter and form, into which substance is analysed, (*Phys.* 1.7, 190b22) Aristotle faces the question about which of these parts, if either of them, is the one of which other things are said?<sup>7</sup> Do either of them have a claim to substance, or to being the substance of substance? In *Z.3*, he answers that substance is said of the matter. Thus it would seem (on the criterion that substance is that of which other things are said) that substance (*ousia*) is the matter (confirmed by his view in *Physics* 1.8 that the matter "is near to reality [οὐσίαν] and reality in a way" (192a5; Charlton, trans.)). It is a suitable candidate because we saw how the subject of change persists through some changes, taking on new qualifications, which suggests that material subjects are the things which most fundamentally exist. This forms the issue under examination in *Metaphysics* *Z.3*, which we will examine now. In the course of this, we will find a characterisation of matter which some scholars emphasise, and which we will need to evaluate for ourselves.

*Metaphysics* *Z.3* begins with a list of the candidates for substance, which are the essence (τὸ τί ἦν εἶναι), the universal (καθόλου), the genus (γένος) and the underlying thing (ὑποκείμενον) (1028b34-6). But a problem about the *hupokeimenon* immediately arises, given the account of the matter which we have seen in the *Physics*: Aristotle notes that the subject is "that of which other things are predicated while it itself is predicated of nothing further" (1028b36; Bostock, trans.), leaving us quite a gap between what we understand of its theoretical role and what it is as an occurrent phenomenon. So a further set of alternatives is introduced: the *hupokeimenon* could be the matter (ὑλη), the shape (μορφή) or the compound of these (ἐκ τούτων) (1029a3-4). We are given the following examples of them: "By matter I mean, for instance, the bronze; by shape, the figure of its perceptible form; and by the compound of these, the statue as a whole" (1029a4-6).

But Aristotle argues that the matter cannot be substance. He affirms that being the subject of predication but not said of anything else is a

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<sup>7</sup>A possible counter example to the predication of substance of something else occurs at 3a29: Aristotle accepts that the parts of a substance could be substance, because "in a substance" as parts does not *prima facie* rule out the substantiality of the parts. However, Aristotle would not find the substantiality of the parts an acceptable view: see 1039a3-4. (See §iv below) In *Metaphysics* *Z.2*, Aristotle says that "we say that animals and plants and their parts are substances" as candidates among the list: this shows that he regards it as a not implausible view.

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criterion of substance -- the position he defended<sup>8</sup> in the *Categories* -- but argues that this is only an "outline"(Tredennick's translation for "οὐ ἰκανόν", i. e. "not sufficient", 1029a9). The two reasons given for the insufficiency are that this criterion is unclear, and that from it follows the conclusion that matter is substance, which Aristotle believes implausible. The passage is a source of scholarly controversy, because the result of the argument is unclear: what is it that matter as subject/substance is taken to be? The characterisation given by Aristotle in this passage is the Platonic view of matter, i. e. the "nurse of all becoming" view of the subject which we examined in Chapter 1. Even this is a plausible candidate for substance because it is the thing which the Platonic Demiurge fashions the created Forms into in the creation of material things, which hence exists independently of its particular determinations and has all other natural objects predicated of it, in a comparable way to Aristotle's claim that "substance is predicated of the matter"(1029a23-4)<sup>9</sup>. In a thought-experiment in which Aristotle assumes the plausibility of this view, he conditionally argues that "if matter is not a substance, it is hard to see what else could be; for when all else is taken off, *nothing apparent remains* [οὐ φαίνεται οὐδὲν ὑπομένον]"(1029a11-13; Bostock, trans.). But then the substance doesn't fulfil the other joint criteria of separability and thisness, so matter cannot be substance. Thus we should explore the argument in more detail in order to find out why substance as subject (taken to be the matter) fails the criteria of separability and thisness.

The thought experiment of Z.3 is given from line 1029a11-22. Aristotle starts by distinguishing and reaffirming the distinction he made in the *Categories* between substances and the items belonging to the other categories.

For while other things are attributes, products, and capacities of bodies, length, breadth, and depth are quantities and not substances (for a quantity is not a substance) Rather, the substance is that primary thing to which these quantities belong.(1029a13-17; Bostock, trans.).

Having made this distinction, he ponders what would be left if all of the items from the non-substance categories are removed from the substance. (The stripping of these items accords with the traditional view of the stripping, although only length, breadth and depth are mentioned.) He presents the experiment as follows:

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<sup>8</sup>For problems encountered in the defence of this, see Dancy 1975.

<sup>9</sup>In *Categories* 2, Aristotle claims that "man is said of a subject, the individual man"(1a21). Reconciling these two statements is beyond the scope of this dissertation.

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And yet when length, breadth, and depth are taken away, we see nothing remaining unless there be something which is determined by these<sup>10</sup>. So on this view it must appear that matter alone is substance. (By matter I mean what is not said to be in its own right any thing, or any<sup>11</sup> quantity, or anything else by which being is determined.)<sup>12</sup>(1029a17-22; Bostock, trans.)

Aristotle offers further defence of the characterisation of matter given in this text. He argues that there is something of which things in their own right and their attributes are predicates, and which must be other than these things (1029a21). This is because "while others are predicated of substance, substance is predicated of matter"(1029a23-4; Bostock, trans.). Aristotle emphasises that it follows from this experiment that the matter (or subject) left at the end is neither a thing in its own right nor a quantity, nor "ἄλλο οὐδέν" (1029a25) -- an elliptical phrase which means that it does not belong to any of the other categories, either.(1029a24-6)<sup>13</sup> Yet being something in its own right or "καθ' αὐτο" is pre-eminently a property of substances, which is evidence that even sortal predicates are removed in the experimental abstraction of properties. This is significant because a controversy exists about the nature of the items being stripped. Aristotle mentions length, breadth and depth, which are not sortals but quantitative predicates<sup>14</sup>. Yet, appeal to a20-26 has been made to the effect that substantial predicates "must be stripped/changed too, for they are no less accidental to the matter of which they are predicated than predicates of size or shape"(Burnyeat, et al., p.13)<sup>15</sup>

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<sup>10</sup>In Ross's translation, the clause "but matter" was inserted here instead of the previous clause given by Bostock. However, Schofield (1972, p.98) points out that this part of Ross's translation has no equivalent in the Greek text. See also Furth, (1987, p.185ff).

<sup>11</sup>In Ross's translation, "certain" is added here, yet Schofield's translation excises it from the English text (1972, p. 97). Charlton renders it as "definite" quantity or thing (1970, p.137).

<sup>12</sup>Charlton mentions that according to Bonitz, this is Aristotle's definition of matter.(p. 137; see Bonitz p. 785a25ff) Gill claims that this is not Aristotle's ordinary locution for expressing his own view (1989, p.29). The description given here by Aristotle will be contrasted with what I believe to be Aristotle's best definition of matter in the next section.

<sup>13</sup>Some scholars, such as Zeller, see in this text an appeal to Prime Matter. I don't find it there, for reasons primarily that the Greek phrase is not used, and I don't think that the Prime Matter thesis held by scholars such as Zeller, according to which there is a totally indeterminate subject underlying (at least potentially) all natural things, is true. More mention of this problem will be given below.

<sup>14</sup>One should explore the possibility that the more and less are being stripped, i.e. particular quantities.

<sup>15</sup>See also Schofield (1972) and Loux (1991). Loux argues that "the facts about predication Aristotle invokes surely seem to identify ... as ultimate subject something that is not just intentionally but numerically different from the sample object with which we began."(1991, p.57) This justification is too strong, because we will find that the matter of organic wholes does not take its substantial predicables as "accidental". Bostock (1994) takes the opposite view, *ad loc.* The London group's analysis might be based on the analogy with the

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Generations of scholarly interpreters have identified the "what is not said to be in its own right any thing, or any quantity, or anything else by which being is determined" passage in Z.3 as Aristotle's definition of matter<sup>16</sup>. Yet this doesn't clearly tell us what we want to know, i.e. the definition of matter. To have a definition of matter, we want to have an affirmative account of what it is, ideally by the differentiating of matter from the other things in the genus to which it belongs. This poses a problem because we must know what genus matter belongs to. To belong to a genus is to be a token of type *f* things, all of which are an *f*, although none of which are numerically identical with other *f*'s. If matter is appropriately explained at 1029a20ff, then it could not belong to a genus because it is not distinct nor distinguishable from any other things. We are given only a negative characterisation of matter. Being outside of the categories, it doesn't exist in the way of things which can be said. For this reason, it seems that a definition is impossible to formulate.

For another reason, the portrayal of matter in the orthodox interpretation is paradoxical: the example provided earlier in Z.3 is bronze/copper (χαλκός). A paradox arises because bronze seems anything but characterless. For example, we can distinguish between the bronze alloy of a penny and the nickel alloy of a ten-penny coin, and Aristotle does provide an account of minerals such as copper and tin as being of water (or more particularly, the moist vapour (III.6 378a28); it also contains earth) as their basic element (*Meteor.* IV.10 389a8) because they are

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production of artefacts, because it is true of their matter that it could be used to build other things, e. g. the wood used to make a table-top might have been used to make a drum. I leave questions about the modality of this "might have" aside as being outside the scope of this treatise. Aristotle seems to say that the matter of organic unities is different than the matter of artefacts, for example that the arts "make their matter" (*Physics* II.1 194a33). Yet passages seem to be anomalies to the view that the substance is accidental to the matter: in Z.16, he comments that "it is not by accident that man has animal for one of its elements/οὐ γὰρ κατὰ συμβεβηκός ἐκ ζώου ἄνθρωπος."(1039b8-9): ignoring in this context the extra phraseology of Ross's translation, there is no other way to take this passage than as emphasis on the matter (as universal) in the essence of the things of which it is a part. But is this a biconditional relation? In one sense, evolutionary development seems to make it plain that there is no necessity that there should be instances of each possible type of animal, so the various differentiations of the genus are accidental. However, I'd emphasise that it is also necessary that the genus is differentiated into the kind of forms it is. For example, fish matter could not be the matter of a saw, except coincidentally or only in name. See also Lewis's case that "form is essential to the matter on which it supervenes"(1991, p. 253) which he'll later reject (p.258n25). See also Lewis (1991 p. 323, and 1994) about the predication of substance of a subject in *Cats.* and the later predication of substance of matter.

<sup>16</sup>Many following Bonitz (785a25ff.) whose index has it listed as *the* definition.

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meltable. Curiously, the translators don't provide a recipe for bronze in Aristotle's books: he does mention mixing "τὸν καττίτερον καὶ τὸν χαλκόν" in GC I.10 328b8-14, and argues that the qualities of the tin (καττίτερος) are barely evident when the metals are mixed, "having effected nothing but a change of colour"(328b13; Williams, trans.). Yet the tin is then like an affection of the bronze (τοῦ χαλκοῦ) without matter (328b12). I suggest that the 'χαλκός' in the first instance should be translated as 'copper' partly because bronze is an alloy of copper and tin, and partly in order to make the difference significant between the mixture of the ingredients and the ingredients taken separately. Other properties of the copper are that it can be melted by heat (because it is formed by the cooling of the watery vapour) (*Meteor.* IV.8 384b31); it is impressible (*Meteor.* IV.9 386a17) and malleable (*Meteor.* IV.9 386b18); it cannot be burnt (*Meteor.* IV.9 387b25).<sup>17</sup> Theophrastus also provides such features as that the melting of copper causes the stone within the mixture to melt too (*De Lapidus* 9a2), and that the earth contained within it also enhances its colour (*De Lapidus* 49a3): according to Eicholz, *De Lapidus* is Theophrastus's making good of Aristotle's promise at the end of book III of the *Meteorology* to undertake a study of the formation of metals and minerals (378a19) (Eicholz, p.3).

As a result of these characterisations, either the definition or the example must be revised if they are to be consistent, and the bronze seems the more statistically likely alternative, because it is appealed to often in the corpus<sup>18</sup>. However, the interpretation of the passage is controversial. The statement I have quoted follows the thought experiment in which Aristotle takes from substance its affections, products, capacities, length, breadth, depth: in short, all determinations are removed. The observation of Aristotle's experiment is that nothing remains.<sup>19</sup> We will find in a later section that Aristotle does claim that the matter is a nature, which casts further doubt on Aristotle's commitment to the view that matter is characterless<sup>20</sup>. As we noted, Aristotle says if this thought experiment were true, a difficulty would be faced because matter would be substance,

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<sup>17</sup>See Bonitz 845a8ff on 'χαλκός'.

<sup>18</sup>A search in Perseus generated 68 hits in the *Metaphysics* alone.

<sup>19</sup>I have adopted Schofield's reading of the mss, according to which Ross's addition of matter as the remnant of the experiment has no support from the text.

<sup>20</sup>For reasons of space, I won't exhaust the logical possibilities of a theory of prime matter. I believe that Charlton has dealt quite correctly with the issue; for contrast, see B. Jones or H. Robinson.

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but this would be impossible. The reasons given are that "separability and thisness" are criteria of substance<sup>21</sup>, for which the form and the matter/form composite are better candidates. But this is unclear, for the criteria mentioned are separability *and* thisness. If matter is as described, then it would pass the separability criterion and fail the thisness criterion. It would pass the separability criterion, construed epistemically, because separating the matter is what we have just done in this thought experiment: by the process of *aphairêsis*, we have *abstracted* the matter out of the material object to determine what is left after all of the properties of our composite have been removed. But the separability criterion is metaphysical, rather than epistemological, and the *aphairêsis* does not entail the metaphysical separation, *except* as conceived under the Platonic receptacle thesis. And matter fails the thisness criterion, because in so separating it, no determinate thing is left. As Lear argues, the answer to the question of "what is substance?" must be something intelligible, which calls matter into question, precisely because the determinacy of an entity is important for the intelligibility of our theories about it.<sup>22</sup> Indeed in the follow-up to this argument Aristotle argues that "it is of advantage to proceed by stages towards that which is more intelligible"; this is part of his general methodology which we examined in chapter IV. For a more suitable candidate according to the criterion of thisness as intelligible, Aristotle continues with the examination of the candidacy of form<sup>23</sup>. So matter is not substance, but what is its place in the metaphysical scheme?

Thus we have found that matter belongs to all natural, i.e. changeable things. However, in belonging to natural things, it does not belong to them as their substance. Matter will stand to substance conceived to be form as potentiality stands to actuality. Matter as potentiality is examined next.

### iii. On Matter: Potentiality

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<sup>21</sup>Aristotle defends the criteria of separability and being an individual this-something in Z.1, which are broader than the criterion of being a substratum of change from *Cat.* 5.

<sup>22</sup>However, one must be careful about the controversy existing in Lear's reconstruction of Aristotle's solution: substance is not the particular because it is not knowable; it is not the universal because it is not independent or separable (p.274). He quotes Z.11 1037b3-7 as proof that "No material particular is a primary substance" because matter is neither definable nor independent (p.280).

<sup>23</sup>The books on substance published recently explore this topic in detail beyond the relevance to this treatise. See Furth (1988), Gill (1989), Hartman (1977), Lewis (1991), Loux (1991), Scaltsas (1994), Witt (1989). Freudenthal (1995) and Spellman's (1995) books came out as this treatise was in completion.

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Throughout this treatise, much has been made of the potentiality/actuality distinction. Crucial to the understanding of matter is Aristotle's characterisation of matter as potentiality, in contrast to the actuality which is the form.

A good introduction to this issue is through the idea of passivity (*pathetikon*) which Aristotle also associates with matter (GC I.7 324b19; *Meteor* IV.2 380a6). In *De Caelo* IV.2, Aristotle argued that on the basis of lightness and heaviness<sup>24</sup>, four primary bodies can be identified: fire, air, water and earth (in descending order from the lightest), whose weight is determined according to whether its natural movement is directed toward the heavens or the earth. All things will tend to their natural place according to whether they are heavy or light (*De Caelo* III.2 301a23-4). These bodies are elements which correspond in function to what we would now regard as the elements of chemistry organised on the periodic table: we can analyse a natural object into them whether by dissection, experiment, or abstraction. (In *De Caelo* III.3, Aristotle defines an element (*stoicheon*) as "a body ( $\sigma\omega\mu\acute{\alpha}\tau\omega\nu$ ) into which other bodies may be analysed ( $\delta\iota\alpha\iota\rho\epsilon\acute{\iota}\tau\alpha\iota$ ), present in them potentially or in actuality .. and not itself divisible into bodies different in form"(302a15); in III.1 he argued that if generation is to occur anywhere, it is to these elements and things composed of them (298b10).) In GC II.2 329b24, he argues that the elements of these natural bodies are the sets of contrary properties hot-cold and moist-dry. The combinations of these bodies give rise to the ("analogous" GC II.3) earth, fire, water and air. That is, each of the contraries can be yoked with one of the other pair of contraries, resulting in the four natural compounds: for example, fire is the dry and hot. In the *Meteorology*, Aristotle argues that the fundamental constituents of the terrestrial universe are these fundamental bodies (*somata*) identified as the primary qualities of the hot, cold, moist and dry<sup>25</sup> (*Meteor* I.2 339a19-21; cf. GC II.2 330a24-5).

This apparently physical account of the constituents of the universe is the result of a thought experiment which has profound metaphysical consequences, apart from the setting the foundations of his equivalent to

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<sup>24</sup>In GC II.2, a different characterisation of these properties is given, the hot and cold (i.e. the active) being distinguished by their ability to aggregate (or not) things of the same kind, the wet and dry being distinguished by their inherent boundaries and ability to be bounded (329b24-32).

<sup>25</sup>This bears only slight similarity to Anaxagoras's view expressed in his fr.11 that there is a bit of everything in everything else.

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physical chemistry<sup>26</sup>. The argument I speak of is a recurrent theme in Aristotle's metaphysical works, and I shall argue that it forms the basis of the potentiality/actuality distinction, in conjunction with the set of elements we are given, above. The crux of the issue is to answer the monist/pluralist debate which we explored in the first chapter. An early mention of the problem is given in the *Physics*, and particularly in the setting out of first principles (I.1-3) and the definition of *kinêsis*, which we examined above (in chapter 1) concerning the possibility of movement, but the topic again arises in the *De Caelo*: in III.5 Aristotle argues that there must be a plurality of elements in order for there to be a plurality of natural movements. This conclusion arises from a battery of arguments, the details of which need not concern us here. The significance of the arguments lies in the fact that a monist theory of the constituents of the natural world would result in an impossibility: apart from the failures *within* the arguments of Aristotle's predecessors, Aristotle's most essential counter argument is that

The common error of all views which assume a single element is that they allow only one natural movement, which is the same for every body. For it is a matter of observation that a natural body possesses a principle of movement (*Caelo* III.5, 304b11-14).

But it is a matter of observation that not all bodies possess the same principle of movement. We noted above that Aristotle distinguishes between four elements because of the four movements they make, explained by the heaviness or lightness of the element. Yet a further distinction needs to be made between the operations of the elements. How is change possible at the elemental level? In *Meteorology* IV.1, Aristotle explains the distinction:

Two of the qualities, the hot and the cold, are active; two, the dry and the moist, passive. We can satisfy ourselves of this by looking at instances. In every case heat and cold determine, conjoin, and change things of the same kind and things of different kinds, moistening, drying, hardening, and softening them. Things dry and moist, on the other hand, both in isolation and when present together in the same body are the subjects of that determination and of the other affections enumerated.(378b12-20)

The way these function is the following: the natural changes we find in plants and animals is the work of these active powers by their combination with "the matter underlying a given thing when they are in a certain ratio

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<sup>26</sup>Owen (in Gotthelf, ed. 1985) examines the issue whether Aristotle's mechanics is to be identified with modern mechanics; I set aside the issue whether Aristotle's theory of the elements is to be identified with contemporary theories of elements. Seeming "pro" interpretations can be found in Bogaard, During, Edel, Owen and Sorabji; seeming "contra" (or at least noncommittal) theories can be found in Ackrill, and Gill.

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to that matter", the matter being the passive powers.(378b28-379a1) The ratio (*logon*) of the powers is extremely important, because three broad classes of ratios can be distinguished: first, a thing is generated if the active hot and cold elements are masters (*kratounta*)<sup>27</sup> of the matter (379a1): this can be expressed as the thesis that

1. the active elements dominate the passive;

second, if they fail to completely dominate the matter, the resulting object is "imperfectly boiled or otherwise unconcocted": this is the thesis that

2. the active elements incompletely dominate or balance the passive;

third, the proper opposite of becoming is putrefaction, which is the natural outcome of all life-processes. Aristotle explains that "things that putrefy begin by being moist and end by being dry. For the moist and the dry were their matter, and the operation of the active qualities caused the dry to be determined by the moist."(379a7-11) The moist and dry are matter for the concoction of tissues, organs and the like, at the most basic level, and these qualities become unified with the determinations made to them by the addition of hot or cold. Aristotle points out that all of earth (dry and cold), water (moist and cold) and air (moist and hot) are liable to putrefy, because they are all material relative to fire (hot and dry). Thus Aristotle is translated as saying putrefaction is "the destruction of the peculiar and natural heat in any moist subject by external heat, that is, by the heat of the environment"<sup>28</sup>(379a16-18). When the warmth of the object is extinguished by the warmth of the environment, putrefaction is the result: thus Aristotle says that the causes of putrefaction are both heat and cold, being respectively the source of change and the end state. The symbolisation of this thesis poses a problem, because it is not clear that the powers of the passive qualities are exerted more so than the active within the object, rather than that the active powers ceased to determine the matter because of other active powers in the environment. If we were to summarise the thesis as

3 a). the active elements balance the passive,

however, we would face a distinct objection that Aristotle is committed to the view that the active powers are equivalent to the passive powers as

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<sup>27</sup>Recall the earlier mention of Aristotle use of this term in *De Anima* III.4, examined in §1, above.

<sup>28</sup>For another interesting appeal to the environmental factor of heat, see Theophrastus *On Fainting* (345) in Sharples, ed.

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unified components of a substance. Thus for the moment, a plausible construction of the thesis is that

3 b). the active elements are dominated by the passive, at least for the object, because the end state defined by the change is one in which the passive powers dominate. Given that this is the explanation of the destruction of a substance (say, the effect on organic things of global warming) the problem of the overpowering of the active by the passive is not faced: it is not an overpowering but a ceasing to function of the active form.

Crucial to this account of the chemistry of natural things, then, is the fact that there are active and passive elements, the active being responsible for bringing change about in the passive. Given that there is a plurality of elements, a variety of combinations is possible, thus facilitating the plurality of movements which we find in the natural world. Herein lies the elements' potentiality, and Aristotle insists that if we are not going to allow these distinctions between elements, then our physics will not be explanatory. To repeat, this is accomplished by a simple argument -- *modus tollens*, to be precise -- as follows: "If then all bodies are one, [i.e. of one kind] all will have one movement" (*Caelo* III.5 304b14-15), but they do not have one movement (304b320; 269a35), so all bodies are not one. A plurality of natural bodies is required in order for change to occur, some functioning as active agents, others being passively affected. A similar point is made in *On Generation and Corruption*, I.9: Aristotle argues that "Anything which has grown together to make one thing is incapable of being affected." (327a2; Williams, trans.) In defending a thesis about the plurality of elements and the possibility of their transformation, Aristotle takes himself to have presented the material account of why something beyond a single element or a plurality of elements is needed for science: the elements cannot "account for the generation of flesh and bone or any other continuous body ... The elements alone cannot produce them because their collocation cannot produce a continuum" (*Caelo* III.8 306b22-25).

Contained within this account, as seen, we also find an account of the way in which passivity is associated with potentiality: Aristotle says that the moist and the dry "will exist either actually, or in the opposite [i.e. potential] <manner>: for instance, there is actual melting and on the other hand that which admits of being melted." (381b27-9; my trans.) It is not stated in the texts that the passive is to be identified with the potential -- it

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could not be, because the terms do not share the same reference, nor do they share the same use in all respects. However, the inclusion of all passive things within the set of things which are potentially otherwise is quite a plausible view, not the least because Aristotle often speaks of matter and the passive qualities as determinable. He says that:

Things that are active or passive imply an active or a passive potency and the actualizations of the potencies; e.g. that which is capable of heating is related to that which is capable of being heated, because it can heat it, and, again, that which heats is related to that which is heated and that which cuts to that which is cut, in the sense that they actually do these things(1021a14-19).

Thus we see that the implication from passivity to potentiality: this source comes from  $\Delta$ .15, Aristotle's discussion of relatives, which imply each other<sup>29</sup>. Evidence for the conceptual link can be found, for example, in *Meteorologica* IV.8, where Aristotle argues that all four primary qualities are found in mixed bodies, because of the changes they undergo or may undergo, the active hot and cold fashioning the passive moist and dry.

All these *substances*<sup>30</sup> are distinguished from one another partly owing to that they have special secondary qualities recognizable to our senses and because they are capable of some sort of activity [ $\tau\tilde{\omega}\tilde{\nu}$  ποιεῖν τι δύνασθαι] (for we are conscious of them as white, fragrant, sonant, sweet, hot, cold, all according to their activity on our senses), partly owing to other more characteristic passive qualities, as e. g. the aptitude to melt or congeal or bend or the like. All these qualities are called passive secondary qualities and are to be regarded as derivatives of the basal contrarieties of touch, the Moist and the Dry.(384b34-385a8; During, trans.; my italics)

The primary qualities are described here as having capacities. This is in a special sense, which is explained by principles we recall from chapters I - III: first, the passive qualities require an agent in order to become something, not being able to change as a result of an internal principle; if something has an internal principle or natural movement, it will actualise its potentiality if unimpeded. The passive qualities require the agency of another thing which has a particular form actually: at the level of the elements, the agent will cause a change because the passive qualities are heated or cooled. Second, we must recall the distinctions made by Aristotle between types of potentiality and actuality. Of the passive qualities, and matter generally, potentiality is used in the sense of the potential knower, who at an earlier time knows nothing, but at a later time knows something but isn't necessarily using it: Aristotle says that "the one ... being a potential knower, because his *kind or matter* is such

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<sup>29</sup>A similar point is made in *Physics* III.1, the chapter in which Aristotle provides his definition of change (200b28).

<sup>30</sup>"*Substances*" is inserted by the translator as assumed subject: Webster inserts the words "mixed bodies" in Barnes, ed.

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and such [τὸ γένος τοιοῦτον καὶ ἡ ὕλη]"(417a26-7; trans. Smith). This kind of potentiality is actualised by a change of quality brought about by the agent of change, and is contrasted to the potential thing which would realise its potential as long as no constraints prevent it. In the case of elemental matter, the *fundamental* constraints operant on it are those preventing it from seeking its natural place -- the heavy things seeking the earth, the light things seeking the sky, etc. This is quite distinct from the other types of actuality, such as occurs when a knowledgeable thing is doing mathematics: matter has no other goal than to seek rest, and does so only under constraint when it is not in its natural position. The most significant constraint, in Aristotelian metaphysics, is that the elements which are a substantial unity (with the form) -- combining into homoeomers, anhomoeomers, organs and ultimately flesh and blood -- no longer pursue their natural course, but exist as ontological parts of the substance as long as the substance exists. The elements are passive, but retain their nature in potentiality, and have fulfilled a higher potentiality, i.e. to be flesh and bone or *sperma* and *katamenia*. This interpretation is quite consistent with the primary sense of potentiality, which Aristotle gives in *Metaphysics* Θ.1:

Now then, that potentiality [*hê dynamis*] and being potential [*to dunasthai*] are said in many ways, as been determined by us elsewhere<sup>31</sup>; ... [the potentialities that are said] with reference to the same form are all origins [*arkhai*] of some kind, and are said with reference to one primary [potentiality], namely, *origin of change* [*arkê metabolês*] in another or [in itself] qua other. For one kind is a potentiality of being acted upon, the origin, in the thing itself that is acted upon, of being effectively changed by agency of another or of [itself] qua other (1046a4-13; Furth, 1985 trans.; translator's italics and insertions)

Aristotle continues with other ways in which "δύναμις" is used, but sufficient for our purposes is the fact that something with a potentiality<sup>32</sup> requires explanation through a distinction between an active agency and a passive *thing to be changed*, whether or not in other respects the thing has other powers. We saw above how this distinction follows from the fact that a single stuff is insufficient to allow for any change at all.

The view of matter as the potentiality underlying natural changes is the most theoretically fruitful account of matter in Aristotle's *Metaphysics*, allowing us to formulate a better characterisation of matter. We mentioned above the statement made in GC I.5 320a1 that matter is most

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<sup>31</sup>Furth refers us from here to *Metaphysics* Δ. 12.

<sup>32</sup>Aristotle is here taken to be talking about what we translate as the technical "potentiality" rather than simply "power", the plausible rendering of "δύναμις" in earlier meta/physical works.

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properly spoken of as the substratum underlying being and becoming. The "most properly" or "primarily" locutions are generally used by Aristotle when he is presenting his own view and the GC passage is an instance ("μάλιστα μὲν καὶ κυρίως ") of that use<sup>33</sup>. Yet we can in a sense analyse the technical term "substratum" into its analysans, which is the potentialities for change. In *Metaphysics* Z.7, Aristotle makes the following statement: "All things that come to be either by nature or by art have matter; for each of them is capable both of being and of not being, and this capacity is<sup>34</sup> the matter in each/ἅπαντα δὲ τὰ γιγνόμενα ἢ φύσει ἢ τέχνῃ ἔχει ὕλην· δυνατὸν γὰρ καὶ εἶναι καὶ μὴ εἶναι ἕκαστον αὐτῶν, τοῦτο δ' ἐστὶν ἢ ἐν ἑκάστῳ ὕλη" (1032a20-22). The result of this is the following characterisation of matter:

matter is the passive capacity in a thing to be *and* not to be<sup>35</sup>

This is a fruitful description of matter because as we saw, matter is a necessary component of the natural world if we are to grant the existence of the types of changes which we experience: that is, if we are to preserve the appearances. For such changes, particularly generation<sup>36</sup>, matter is required to be the entity to which change occurs. This is possible for matter because the substratum does not have its nature by necessity. For example, it is contingently the case that Socrates had red hair; it could have been brown, or it could have been changed by him to black. The capacity to change is the matter. It is the matter, rather than "material", because there is no necessary nature to material in itself<sup>37</sup>, similar to the indeterminacy of the bronze which becomes the brazen sphere. Second, it is not "material" because Aristotle allows descriptions in terms of the material

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<sup>33</sup>For other instances of "κυρίως ", see Bonitz 415b-416b.

<sup>34</sup>In his translation, Bostock adds "due to" at this point; I don't think the addition is justified by the Greek text.

<sup>35</sup>Corroborated at *Physics* 202a12, *De Anima* 412a9, 414a17, 429a16, *Metaphysics* 1050a15, 1050b4, 1070b13, 1071a7 cf. *Physics* 193a29, 201a10, *De Anima* 431b25, *Metaphysics* 1065b15,

<sup>36</sup>This qualification is necessary because Aristotle says that any nature, including form, can be potential or actual (*Physics* 201a10); however, the form of the organic substance is potential *in* the organic substance in a different way than the matter is potential, because the form is potentially the form of the progeny, (as examined in chapter III) but otherwise actual, whereas the matter is potentially no longer enformed by the substantial form. In the case of motions of the substance whose substantial form remains the same, the matter provides the potentiality of the motion. The contrast case would be the Prime Mover, whose immateriality does not allow it to change, but only to change other things.

<sup>37</sup>The view that matter is extension is not accurate for Aristotelian matter, although it is a property of the 'general substratum' as described in Z.3, because actual matter occurs in such a variety of forms: extension in space will be a feature of the matter of all composite, organic substances.

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"out of which" things of many different forms come to be, which are not physical, such as the matter of a syllable: the letters. Yet as in all cases of matter, the letters *qua* material have the potentiality to be syllables.

Thus we shall examine the various types of matter to explain Aristotle's notion further. Crucial to this issue is the respect in which things are said to have matter: I will show how for Aristotle this is a metaphysical, rather than a physical, notion.

### iv. The Elements: is Ontological Reduction Possible?

In the close of chapter V, we saw how Aristotle's method of science in the *Parts of Animals* was to explain animals by a variety of causes: he summarises these in the *Generation of Animals* I.1 as follows:

There are four causes underlying everything: first, the final cause, that for the sake of which a thing exists; secondly, the formal cause, the definition of its essence (and these two we may regard pretty much as one and the same); thirdly, the material; and fourthly, the moving principle or efficient cause.

We have then already discussed the other three causes, for the definition and the final cause are the same, and the material of animals is their parts, of the whole animal the non-homogeneous parts, of these again the homogeneous, and of these last the so-called elements of all matter (715a1-11).

Thus we find in Aristotle a willingness to understand animals in terms of the basic stuff, "τὰ καλούμενα στοιχεῖα τῶν σωμάτων"(715a11). But does Aristotle allow that the elemental bodies described in the previous section can provide a complete description? Does "the material of" a thing entail that the thing can be reduced to the material? This could occur in at least two ways: Aristotle's physics establishes the elements at the base of the system; but secondly it also recognises the essential role played by the parts of animals in determining the nature of the animal. That is, certain components are necessary in the hypothetical sense. To which of these types of matter, if either, is the animal reducible? Aristotle would deny a method of the ontological reduction of substances, for which I will offer four arguments.

First, the reductionist thesis is the view that a thing can be reduced to its components, whether these components are the things contained within its account, or its (more fundamental) material parts, or some other entity which the initial object is either ontologically or physically dependent upon. For example, if the Demiurge created the world, then an account of the world must include divine acts as its components, those being the ontological commitments of the divine thesis; unless there is some necessity to any particular creative acts, the resulting individuals found in the world will be dispensable to the theory. Now Aristotle would

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deny the possibility of a reduction of substance to the elements, on the models suggested, because of the focal meaning of the being of substance which he defends in the *Categories* and in *Metaphysics* Z.1. The being of particular things is the paradigmatic sense of 'being' in Aristotelian metaphysics; the meaning of 'being' used to describe how the qualities, quantities, or other predicables of substance occur is dependent on this focal sense. But disallowing the substantiality of the basic bodies according to Z.3, Aristotle cannot give ontological priority to them; as we saw above, their existence in relation to substance is one of potentiality, once the substance has come to be.<sup>38</sup>

Second, Aristotle rejects ontological reduction because in *Metaphysics* Z.16, he examines the possibility that the parts of animals, or the elements of earth and fire and air, are substances, but rejects this because they are potentialities (as we saw above) (1040b5-15). But why should this rule them out? The difficulty is that they are unities as heaps rather than organic unities. But, he continues, unity or being cannot be said to be the substance of things "*for the same reason as being for an element and being for a principle cannot be*" (1040b19-20; Bostock, trans.; my italics). The reason that they all fail is that they are common and must be treated elliptically: the substance of something must belong to the substance, rather than the many.<sup>39</sup> If the elements are principles of all terrestrial things, some other factor is needed to explain why substances differ.

This is given justification by a third problem arising for the reducibility of substance to the elements, which is the view that there cannot be an actual substance within a substance: in Z.13, this is expressed in the statement that "it is impossible for a substance to be composed of substances present in it in actuality." (1039a3-4 ; Bostock, trans.); in Z.16, the thesis is expressed as "a substance belongs to nothing but to itself and to that which has it, i.e. that of which it is the substance" (1040b23-5; Bostock, trans.). This is because the numerical unity of the unified substance would be impossible, the substance (singular) being substances (plural). This in itself is not apparently problematic, but if it leads the substance to follow

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<sup>38</sup>Indeed Aristotle was aware of attempts to reduce (ἀπάγειν) substance to the elements in such a manner: he argues against Empedocles's efforts to do so, at *Metaphysics* B.4.

<sup>39</sup>Note that this does not entail commitment to particular forms, but only that there is some criterion of distinction between things which are different substances, e.g. men or dogs.

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distinct ends, it would be impossible for it to attain its final cause. (*De Caelo* II.12, 292b10) This will be examined further in the next chapter.

Fourth, when Aristotle does (putatively) speak about the reducibility of substance to anything, he requires that we "may reduce the thing to something more knowable/"*ἵνα εἰς γνωριμώτερον ἀναγάγωμεν*". This is the original Ross translation of 1040b20, in which Aristotle explains the reduction undertaken with *principles*. Being a principle *simpliciter* -- whatever that might mean -- is of no explanatory value unless it is a principle *about* something. The reductions undertaken, implied by this statement, will be those which are explanatory because the entities reduced to are more knowable. It is not clear whether Aristotle would sanction such a procedure in the eliminative sense described above, particularly given that the Greek text of this sentence does not require 'reduction' for the translation of '*ἀναγάγωμεν*'<sup>40</sup>, nor are rules given for when such a procedure is applicable. However, the difficulties associated with the knowability of matter would then apply, according to which the matter of something is known by analogy, analysis, or after the destruction of the substance (H.4 1044a23-4): these imply that the reduction to elements would be disallowed.

Having established the types of matter Aristotle is not willing to sanction for the explanation of substance, we will now examine the type of matter which he is willing to sanction for the explanation of substance: the proximate matter.

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<sup>40</sup>In the Barnes edition (1984) it is translated 'refer', otherwise following the Ross translation; similarly Tredennick; Hope and Bostock render it 'reduce'. The OCT provides no alternative reading in the Apparatus.

**Chapter VIII**  
**On Matter: Proper Matter and Generation Revisited**

The matter of composite bodies can be posited at different levels of abstraction. In the previous chapter, the failure of the fundamental bodies to provide a complete account of all things was examined. Aristotle's view of the unity of a composite substance appeals instead to the proximate matter which is the unity with the form. This chapter is an explanation of other levels of matter, but particularly the proximate or proper matter of a material object.

**i. The Levels of Matter**

In *De Caelo* III.2 Aristotle lists his commitments to substance as follows:

As substance I class the simple bodies -- fire, earth, and the other terms of the series -- and all things composed of them; for example the heaven as a whole and its parts, animals, again, and plants and their parts (298a26 ).

The particular candidates he mentions here need not trouble us, for they differ in other texts. Of interest is that Aristotle is committed to the belief that his focal substances -- plants and animals -- are as a whole and in their parts composed of the simple bodies. Confirmation of this theory is given, e.g. in *Meteorology* IV.12: Aristotle describes the formation of flesh and bone, and the homoeomerous bodies in general:

The homogeneous bodies are made up of the elements, and all the works of nature in turn of the homogeneous bodies as matter. All the homogeneous bodies consist of the elements described, as matter, but their essential nature is determined by their definition.(389b26)

In other (regarded as later) works, Aristotle gives an account of how the essential nature of the elements is changed by the fact that they are constituents of organic substances. This issue comes to the forefront in the middle of *Metaphysics* Z.

Aristotle's positive doctrine about matter in *Metaphysics* Z starts at Z.7, in which he explores natural generation. As we saw in Chapter I, Aristotle argues that analyses into matter and form are required for the explanation of *natural things*, i. e. things which change according to internal principles. This is because they all have matter and they are generated or produced by the unification of the form with the matter into an organic whole. Aristotle argues, as mentioned, that

It is in fact common to all things that are generated, whether by nature or by skill, that they have (ἔχει) matter. For each of them is capable both of being and of not being, and this is due to the matter in them. (Z.7 1032a20-22; Bostock, trans.).

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This is the view we are familiar with from the theory of change given in the *Physics*.

Given that matter is not substance in the primary way, what is matter's relation to substance, i.e. the 'having'? An important statement in this regard occurs at Z.8. In the context of a discussion of the generation of substances, Aristotle argues against the view that the form or shape of a composite substance is generated. The generation of the form would create a problem for the Aristotelian and indeed any metaphysician because if the parts of an entity are further subdivisible into metaphysical parts, then it could be the case that there are no building blocks for the empirical world, and further, the explanation of anything must continue infinitely<sup>1</sup> because its nature always (of necessity, *ex hypothesi*) leads a step beyond. Aristotle uses the example of the bronzen sphere -- recall chapter one -- to argue that such things are produced from the components bronze and sphere, "by introducing the form into the bronze so that the result is a bronzen sphere"(1033b10-11; Bostock, trans.), on the model that a generated thing is always divisible into matter and form as its components. Thus if the form is generated, each (or as Aristotle says, "one") part of "shape equidistant from the centre" would have to be generated in something else.(1033b14; cf. *Met.* Δ.24 about 'comes from' (1023a26ff.)) Yet the generation of form, according to Aristotle, is assumed to be impossible, because it leads to a regress.

Here we face a problem. The posit of matter is not given solely at the level below substance, i.e. the proximate matter. Matter is appealed to at many levels in the hierarchy of things, and even at each stage of each thing's development. This includes the notions of prime or ultimate matter, intermediate matter, proximate matter, and even intelligible matter. If it possible to say that the proximate matter of a substance, say the flesh of a man, is itself subject to analysis into a more fundamental matter, then why cannot we say that this analysis can continue indefinitely? It is logically possible that the analysis can be continued infinitely, dividing quantitatively each successive layer into which we break things apart, and dividing qualitatively, too. Indeed, the possibility of this seems statistically likely, given the advances of science: from four elements, it was realised that each of them is made up of more fundamental elements which can recombine in various other ways, yet

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<sup>1</sup>Cf. Carr (1995).

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each of which was subsequently broken down into more fundamental particles.

When we speak about the matter and form into which a substance is analysed, we are talking about *proximate* matter. Aristotle defines this in his description of the substratum in *Physics* I.9 as "that primary [πρῶτον] underlying thing in each case, out of which as a constituent and not by virtue of concurrence something comes to be"(192a31; Charlton, trans.); primary taken to mean proximate [ἐσχάτη], that is, the perceptible matter of which a thing appears to be constituted. It occurs again GC I.4: "What is most properly matter is the substratum receptive of generation and corruption; but, in a way, so is that of other changes, since all substrata are receptive of contraries of one sort or another"(320a2-5). It follows from this statement that there are levels of substrata, whereas we were led to believe that the matter and form of a substance cannot be reduced further. Some explanation is given by Aristotle in *Metaphysics* Z.10, where he argues that "in the particular case Socrates is compounded immediately from the ultimate matter [ἐσχάτης], and similarly for the others"(1035b30-31; Bostock, trans.). This is still misleading, because the "ultimacy" of the matter can mean at either limit of the developmental chain<sup>2</sup>. For example, Aristotle argued in the *Generation of Animals* IV.1 that if we are seeking the causes of a biological phenomenon, the appeal to heat and cold, as features of male and female, (according to Empedocles) is insufficient. He argues that despite the plausibility of some variants of this view, "yet to put it in this way is to seek for the cause from too remote a starting point; we must draw near the primary causes in so far as it is possible for us"(745b4-6). He later argues that a significant difference in quantity is found between the initial and final matter (765b30 ). The text which makes plain Aristotle's intent by the use of the term "ἐσχάτος" is *Metaphysics* H.6, in which he argues that the components of a substance are its proximate matter and form: "the proximate matter and the form are one and the same thing, the one potentially, the other actually"(1045b18). The justification is that it is illegitimate to ask why things are a unity, except to say that the potential is actualised. Thus, "there is no other cause here unless there is something which caused the movement from

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<sup>2</sup>Ross's translation is similarly ambiguous, translating the Greek phrase into "ultimate individual matter". Other uses of "ἐσχάτη" and "ὑλη" in close proximity, as at GA I.22 730b, GA IV.1 766b, are similarly ambiguous because the matter discussed is the maternal contribution to procreation, which is also the initial matter of seminoid creatures.

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potentiality into actuality"(1045b21-2), cause here taken to mean the explanation of the occurrence of that substance. Aristotle says that he has remarked on this before but as Ross points out, the only available source seems to be 1045a23-33, in which Aristotle says that the other is form; that one is potential and the other is actual (1929, v.2, p. 239). We've seen that Aristotle is justified in characterising matter as potential, and he says often that the substance in actuality is the form of that substance. He was close to saying the same thing when in the *De Anima* he asserts that "Now matter is potentiality, form actuality"(412a10) in his characterisation of actuality. We shall return to this problem below.

The modern notion of matter as stuff seems to be evident in Aristotle's explanation of unified substances. To clarify what is meant by "stuff", Helen Cartwright has distinguished between what are called sortal and mass terms. In Aristotle's writings, these terms approximate the distinction between substance and matter. Of sortals, one can measure the quantity by counting the entities, e.g. the 35-40 authentic paintings by Vermeer. Of stuffs, quantities are determined by more and less, e.g. Arthur's Seat contains more rock than Castle Rock. Aristotle's investigation into the matter of sensible substances is like the notion of a mass term: Aristotelian matter is the stuff of which a thing is produced, which is identified by investigation of the thing arranging it, such as the marble (genitive) statue. The unified thing is denoted by a sortal. However, the sense of matter which has emerged so far in my study is the idea of matter as a principle of change, i.e. the stuff "out of which".

Making credible the theory of levels of matter poses difficulties, because an account needs to be given of how matter occurs in its various forms: we have read about the primary opposites hot-cold and wet-dry as the ultimate matter of every terrestrial thing, and about the proximate matter. What justifies this distinction? Earlier in *Metaphysics* H, Aristotle provided an analysis of what it is to be the proper matter of something, and argues that the matter is found either if we analyse the substance to find its constituent matter, or if the substance suffers decomposition. This entails that things which have the same basic constituents will differ in intermediate constituents. The examples given are "the sweet or the fat of phlegm, and the bitter, or something else, of bile; though perhaps these have the same constituent"(H.4 1044a18-20), i.e.

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at the elemental level they are dry or moist. But there are also intermediate levels of matter, Aristotle arguing that

And there come to be several matters for the same thing, when the one matter is matter for the other, e.g. phlegm comes from the fat and from the sweet, if the fat comes from the sweet; and it comes from bile by analysis [ἀναλύεσθαι] of the bile into its ultimate [πρώτην] matter. (H.4 1044a20-3)

There is a hierarchy of levels of matter -- as we saw earlier in the manner in which the simple qualities are yoked to form simple bodies, these combined form homoeomers and anhomoeomers, organs and ultimately the flesh and blood of organic creatures -- which Aristotle argues can actually be discovered and understood. The levels of matter can be discovered and understood because, he argues, there are two senses in which one thing comes from another: "either because it will be found at a later stage of development [πρὸ ὁδοῦ ἔσται], or because it is produced if the other is analysed into its original constituents [ἀρχήν]"(1044a23-5).

This type of analysis can be found in the corpus, from which I shall choose two examples. Using the "πρὸ ὁδοῦ" analysis, we find cases in which Aristotle appeals to things which take the role of the matter as *that from which* the result comes about. The case of artifacts is clearest on this model, because the perceptible matter remains the same: for example, the wood of my wooden desk is observably there. However, Aristotle is also willing to admit cases in which the development of something occurs out of perceptible, physical matter which is no longer observable. The first example is Aristotle's examination of the reason why the heart is the first organ to develop in an embryo after conception. Aristotle argues that

in the embryo all the parts exist potentially in a way at the same time, but the first principle is furthest on the road to realization. Therefore the heart is first differentiated in actuality. (GA II.4, 740a1-4)

οὕτω καὶ ἐν τῷ κυή-

ματι τρόπον τινὰ πάντων ἐνόητων τῶν μορίων δυνάμει ἢ ἀρχῇ πρὸ ὁδοῦ μάλιστα ἐνυπάρχει. διὸ ἀποκρίνεται πρῶτον ἢ καρδία ἐνεργεία.

He has just discussed how the *sperma* fixes the *katamenia* in conception, arguing that the earthy parts are solidified into organic matter, the full development of which is flesh and bones, and the first development of this is the formation of the heart as the first principle of living things. From the later stage of development which is the heart, ("πρὸ ὁδοῦ" here being translated "on the road") we can trace back the earlier stages of its development to what it came from as matter. We do we not find the *sperma* and *katamenia* at the later stage, i.e. as physical parts of an organic body (although some might add that on a more developed notion of

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conception, the sperm remains physically as the contribution which provides the spine of a cartilagenous creature), but we trace the development of these components into the substance which is the result.

A second case of "πρὸ ὁδοῦ" analysis is found in the *De Caelo*, in which Aristotle argues that actions ground whatever is the good or function of beings capable of action. He argues as follows:

The lower animals have less variety of action than man; and plants perhaps have little action and of one kind only. For either they have but one attainable good (as indeed man has), or, if several, each contributes directly [πρὸ ὁδοῦ] to their ultimate good. One thing then has and enjoys the ultimate good, other things attain to it, one immediately by few steps, another by many, while yet another does not even attempt to secure it but is satisfied to reach a point not far removed from that consummation. (*De Caelo* II.12, 292b10)

The argument arises out of an attempt to explain the behaviour of the lower stars, which have few movements. Man has contemplation or theoretical thought as the highest good, towards which any other goods are contributory. This sets him in distinction from plants and lower animals, because their actions are more simple, (if they are capable of many different actions). But if these other actions are *for the sake* of the function of the organic substance, as its highest actuality, then they serve as matter out of which yet on the way to the highest development of the thing. Action, in this sense, is the matter of the *ergon* or function of the thing.

The case of organic substances is the most metaphysically interesting because the matter-form distinction would be in vain if it did not serve to explain the most important class of things in Aristotle's ontology, i.e. substance, the primary things which are. The crucial feature of such substances is that they are unities of matter and form: in *Metaphysics* Z.17, Aristotle argues that some

things that are [are] compounded in such a way that the whole is a unity, not like a heap but like a syllable. And the syllable is not just its elements -- BA is not the same as B and A -- nor is flesh just fire and earth. For on dissolution the flesh and the syllable no longer exist, but the letters exist, and so do the fire and the earth. So the syllable, then, is not only its elements (vowel and consonant) but something else besides; and flesh is not only fire and earth, or the hot and the cold, but something else besides. (1041b11-19; Bostock, trans.)

If we break up the substance, the proximate matter which is to it as components no longer exists; rather, the remainder is the elements into which these components are divided, the fire and earth. The analysis earlier described, by which we get the matter, is not physical analysis, according to this claim: instead we have the physical elements by physical

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destruction. We read earlier Aristotle's description of the proximate matter and form as holding a relation of identity.

We must distinguish between various unities of parts which Aristotle considers, if we are to understand his appeal to mereological analysis. Dr. Scaltsas comments that "Aristotle distinguishes between three types of unity (regardless of whether the unified items are concrete or abstract entities): aggregates, related wholes, and substantial unities"(p.3). Aggregates are unities arising from the random grouping of parts into a whole<sup>3</sup>. In distinguishing between how different things are composed, Aristotle lists composition by mixture as in honey water, and composition by contact as in a book or in bundles of sticks (H.2 1042b15). The gold of Athena and Mount Olympus would fall into this class. These things are like "mere heaps": they have distinguishable matter which remains the same if the unity is dispersed (cf.Z.17 1041b11: unlike a syllable); the matter remains the same because the whole is not anything beyond the parts (H.6 1045a11), the parts being combined by some external cause such as contact (Z.16 1040b9, H.6 1045a11). Within the heap, the matter is the elements combined, and the form is the simple combination of the parts.

The case of the syllable is more interesting for students of Aristotle in particular, and metaphysicians in general, because its relation to the words composed of syllables is not a case of mereological composition, taking the sum as equal to the addition of its parts, nor is the relation of the syllable to its letters a case of mereological composition: Aristotle often uses this example as an analogy for the composition of substance (*Metaphysics* H.3, 1043b5). He defines syllable (συλλαβή) in the *Poetics* as "a non-significant composite sound, made up of a mute and a letter having a sound (a vowel or semivowel)"(1456b36). The lack of significance of a syllable is important for Aristotle's account, stressed in the example given in *De Interpretatione* "if we separate one syllable of the word 'human'[τοῦ ἀνθρώπου] from the other, it has no meaning"(16b31). The syllable is used as an example of how something *comes from* something else, i.e. it comes from the letters (*Metaphysics* Δ. 24 1023a36; cf. Plato's *Theaetetus* 206a8; 207c10). Indeed the account of the syllable must include mention of the letters, as its parts because they are prior and

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<sup>3</sup>I don't accept Dr.Scaltsas's definition of an aggregate a collection of entities which are unrelated to each other because I think Aristotle would allow some relations to hold between members of the collection, such as "similarity".

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more intelligible (*Topics* VI.4, 141b9; vs. Plato's *Theaetetus* 201e2, 203a4, 10; cf. Plato's *Theaetetus* 203b2, 206a5), even though the syllable as a whole is not synonymous with its parts (*Topics* VI.13, 150b21; vs. Plato's *Theaetetus* 203a10; cf. Plato's *Theaetetus* 203e4). The syllable also involves the position, indeed juxtaposition, of the letters: some take this to be a type of mixture (*Metaphysics* N.5, 1092a27; vs. Plato's *Theaetetus* 202b3). But the syllable is not the mixture or composite formed only of the letters plus the juxtaposition (*Metaphysics* H.3, 1043b5; vs. Plato's *Theaetetus* 202b4). Rather it is a unity, a measure indivisible to the senses (*Metaphysics* N.1, 1087b36; cf. Plato's *Theaetetus* 202b6, 204a7, 205c3).<sup>4</sup>

So what does the example of the syllable tell us about the matter of a substance? In Z.17, Aristotle is searching for the cause of the matter being enformed, to which the answer is the substance (*hê ousia*) (1041b6-8). Aristotle addresses what this means in the case of compound things which are unified wholes, using the example of the syllable: this is an effort to address the question what it would mean to say that the cause is something other than the matter, form or some other component of a compound unity. He argues that in the case of the syllable, when the syllable is broken up (*dialuthenton*), it no longer exists, so it must be something other than its elements. If it were not something other than its elements, then one could take the other candidate element(s), and ask of what they are composed i.e. do they themselves have elements? If so, the same question applies whenever they have components as causes, and there is an infinite regress as more fundamental causal components are putatively discovered. A regress being impossible, the principle or cause of the compound unified whole must be something other than an element, which is the substance of the thing<sup>5</sup>. As Scaltsas observes, this proves to be the substantial *form* of the particular substance (1992, p. 195), as shown by another aggregate-argument, from *Metaphysics* H.3 1043b4-14. In this argument, Aristotle uses the example of the threshold to show the

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<sup>4</sup>As I have listed the characteristics of the syllable which Aristotle provides, I have given the references to the account of Socrates' Dream in the *Theaetetus* of Plato; yet I don't believe that Aristotle uses the example for entirely the same purpose as Plato, which was to show how 'true belief plus an account' is insufficient for knowledge (because the syllable is more than the sum of the parts, even though one who is able to place the letters of Theaetetus's name in the correct order, believes this to be an account of the name, 208a7-b10). Rather, he uses the example in this way in the *Topics*, at least, and did so, I would propose, because it was a commonplace. Further on the comparison of Plato and Aristotle's theories of parts and wholes, and use of the syllable as an example, see Scaltsas (1991).

<sup>5</sup>On substance as cause, see Rorty (1973) and Harper (1985).

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analogous role of the substantial form: the timbers do not make a threshold unless they are placed in such a way at the bottom of the entrance, the threshold deriving from the position rather than the position deriving from the threshold (Scaltsas, p. 196).

Yet if the substance exemplified by the syllable is not physically divisible, in the same way that the threshold is not divisible, then the things which stand to it as parts must be something other than physical parts. This view is taken repeatedly by Aristotle in his claims that the parts of animals are not parts of animals in isolation from the animal: in Z.10, he argues that "It is not a finger in any and every state that is the finger of an animal; a dead finger is a finger only in name" (1035b23-25; Bostock, trans.). Similarly in *Meteorology* IV.12, he argues that

Everything exists partly in an objective sense as compounded out of these homogeneous substances and tissues as *matter*, partly to our thought as *notion* and *form*. This fact is especially clear in the case of the secondary products, of those, in fact, that are organs, as it were, and have an end; it is clearer, for instance, that a dead man is a man only in name. So too the hand of a dead man will in the same way be a hand in name only, just as stone flutes might still be called flutes; for even these appear to be instruments of a kind.(389b28-390a2; During trans., translator's italics)

What is missing from the severed hand is its capacity to fulfil its function, which is equivalent to having lost its essence. There is even a procedure which it must go through to regain the potentiality that is lost upon the severing: vinegar must become water again before it can become wine (1044b28)<sup>6</sup>. Thus for Aristotle, the parts of an organic whole are metaphysical parts, had by abstraction. For the elements would only be available upon the dissolution of something whose proximate matter is the elements. Otherwise, the matter is had by analysis, putting our attention onto the substratum as matter which gave rise to the substance whose essence is under examination.

Thus we can also understand Aristotle's point in *Metaphysics* H.6 that the "Proximate matter and the form are one and the same [ἡ ἐσχάτη ὕλη καὶ ἡ μορφή ταὐτὸ καὶ ἓν]": there must be something that makes the matter and form as abstract parts of a concrete substance into a unity, but what is this? The matter and form are a unity because the first stands to the latter as potential to actual, as we saw above. The matter is potential

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<sup>6</sup>Cf. the view that the "seed is not yet potentially a man; for it must further undergo a change in a foreign medium. But when through its own motive principle it has already got such and such attributes, in this state it is already potentially a man; while in the former state it needs another principle, just as earth is not yet potentially a statue, for it must change in order to become bronze"(Θ.7 1049a14-18, Ross, trans.; cf. GA I.18).

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because it underlies natural changes, *particularly the generation of organic substances*, and as we saw above, matter *qua* matter is not capable of bringing about these changes; rather, a form has to be brought to them (in the case of artifacts or the conception of living things) which is already in actuality. But becoming enformed entails that the matter is no longer of the same essence as it would theoretically be before being enformed: *katamenia* becomes embryonic, shaped dry clay becomes the bricks of a house, and the proto-fleshy stuff of an animal becomes (or functions as) bones and tissues.

This analysis of matter allows us to appreciate some statements made in the *Physics* and mentioned earlier in this dissertation: first, the view that "As for the underlying nature [matter], it must be grasped by analogy"(191a8; Charlton, trans.): the difficulty seems to be one of how we can know these things, given that the proximate matter and the form are one, because when we undertake a study of animals, say, we are aware of Lassie and Socrates, and must do our experiments on them. Recall the theories mentioned in Chapter V attributing to Aristotle a problematic use of analogy which does not serve to explain anything in science or philosophy. Yet dissections will not give us the matter of which our original subjects as individuals are made because it has lost its essence. However, we will be able to learn something about their causal history from such a process. More importantly, however, to know what is the dogginess of Lassie, we must observe living dogs if possible, because what they are is a compound of matter and form. This is because the proximate matter and form are unified in the substance as actuality, allowing the organic being to function according to its essence.

Second, the unity of matter and form provides an insight into the view that matter and form are relative: Aristotle mentions this topic in a discussion of nature, which we will examine in the following section.

### ii. The Indeterminacy vs. Nature Problem

Secondly, the interpretation of the proximate matter and substantial form as 'one and the same' also allows us a more comprehensive appreciation of what Aristotle means by the statement in *Physics* II.2 that "matter is something relative to something, for the matter varies with the form[ἔτι τῶν πρὸς τι ἢ ὑλῆ· ἄλλω γὰρ εἶδει ἄλλη ὑλῆ]" (194b8-9: Charlton, trans.). This is an exceedingly cryptic statement, and has generated surprisingly little comment. An initial ambiguity concerns whether the

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statement should be read to say that matter is *a* relative in the sense of the categories of being, which are things said *about* substances-proper. This would conflict with the many statements which Aristotle makes to the effect that matter is substance (which would make it fall within the category of substance), although it would be consistent with the reading of *Metaphysics* Z.3 which has been given above. However the statement in itself also implies that the same might be said about the form: in the Hope translation, the sentences are rendered as "Again, 'material' is one term of a relative distinction, since different forms require different materials"; in Ross's edition, "a different form requires a different matter", because to Ross, "matter and form are relative *to one another*" (1936, p.510). This is seriously problematic because the form is supposed to be identified with the essence and substance, some respects of which are supposed to be that substance is not said of anything else, from the *Categories*, and that it is what it is in itself, from *Metaphysics* Z.4-6 and as we saw in earlier chapters: how can these criteria be sustained when the form is at least partially what it is in relation to the matter, following Ross's analysis?

The context of the passage is a study into the subject matter of natural philosophy. Earlier (i.e. in II.1), Aristotle had argued that nature is "a cause of change and remaining unchanged in that to which it belongs primarily of itself, that is, not by virtue of concurrence"(192a21-2; Charlton, trans.). But a thing with an internal source of change is "an underlying thing, and nature is always in an underlying thing" (192b34-5; Charlton, trans.). Thus matter can be called a nature, even though it is not fully enformed: the example given is that the stuff which can become flesh or bone does not yet have its *proper* nature to function as flesh or bone (193b2). As in Z.3 of the *Metaphysics*, Aristotle says that form has a better claim than matter to be a nature, because it is in actuality. But matter is a nature (194a13), and as in the arts, the student of nature must know both the form and the matter (194a26-7)<sup>7</sup>.

When Aristotle speaks about matter as a nature, the scope must include different strata of matter in the thing. In *Metaphysics* Δ.4, his definition of 'nature', he argues that nature can be used of both the proximate matter and the simple bodies from which it originates:

That which comprises both of these exists *by* nature, e.g. the animals and their parts; and nature is both the first matter (and this in two senses, either first,

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<sup>7</sup>Cf. Martin, who argues that matter does not have *in itself* a definite nature, although *at any time* the matter is something definite (1996, p. 100).

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counting from the thing, or first in general, e.g. in the case of works in bronze, bronze is first with reference to them, but in general perhaps water is first, if all things that can be melted are water), and the form or substance, which is the end of the process of becoming.(1015a5)

But what is the sense according to which matter can be said to be a principle of change or staying the same? In this text as in the *Physics*, the analogy<sup>8</sup> is with the production of artefacts: in this case it is the bronze statue. In *Physics* II.2, the examples show both the production of an artefact, and the alteration of an organic substance: Aristotle observes that the doctor must know both health (the form) and the bile and phlegm (the matter in which the health will be produced), and the builder must know the house and its bricks and beams -- they are both trying to build the former in the latter<sup>9</sup>. These texts are evidence first that the sense of material nature intended is that *out of* which something becomes what it is (cf. *Metaphysics* Δ.4, 1014b26).

The texts are evidence second that when we have a composite substance, we have a unity of the matter and form, to which the potentiality of the matter and actuality of the form pose no obstacles (Cf. Gill, 1987). Thus we can conclude that matter and form are correlative notions because the essential properties which come with the form of compound wholes are unified with the matter; they are the same and one in the composite substance, as potentiality actualised. This is further advanced by Aristotle in his account of how the matter of a composite substance is to be referred to: appealing to what we might call the 'mass logic' of the stuff unified into the organic substance, he argues again on the analogy with the bronze statue:

Some things, when they have come into being from a certain matter, are said to be, not *that* from which they came, but rather *of that*, or *that-en*; for instance, a statue is not said to be [some] stone, but rather *of* stone. (1033a6; Bostock, trans.; translator's italics and insertion).

In these things the material substratum is changed, so the result must be said of it (using the dative case). The contrast case given is that of the healthy man: health being something accidental to a man, his health is more appropriately said to come from the privation, rather from his being a man (or of human stuff) (1033a8). The health will be health appropriate to a human body, but it is a change from an ill human body.

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<sup>8</sup>Recall the discussion of the substratum in Chapter 1, in which I observed that matter itself is not known directly but by analogy (191a8).

<sup>9</sup>In Z.8, Aristotle says a 'this' is made "out of the general substratum" (1033a30; cf. Z.10 1035b27-9) into a "such"(Z.8 1033b20).

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Of note in this regard is another example, which we find Aristotle using when arguing that the natural philosopher must understand both the material and formal natures of a thing: this is the snub (το σιμόν). It is a nose with a certain property, particularly curved inward in a way appropriate to noses (*SE* 31 182a4). We can appreciate how and why he identifies many natural objects with the snub: they are unities of matter and form, both of which natures are relative to each other when unified into a substance or its parts. To examine this, we must come to an understanding of Aristotle's comments about genus in relation to matter.

Ch. IX  
On Genus as Matter

In *Metaphysics* Δ.28, Aristotle says that one of the senses of "genus" is that "in which 'plane' is the genus of plane figures and 'solid' of solids; for each of the figures is in the one case a plane of such and such a kind, and in the other a solid of such and such a kind; and this is what underlies the differentiae"(1024b1-4). Yet also, "in definitions the first constituent element, which is included in the 'what', is the genus, whose differentiae the qualities are said to be"(1024b4-6). These accounts of genus express a common theme which Aristotle summarises with the statement that "'Genus' .. is used .. as matter; for that to which the differentia or quality belongs is the substratum, which we call matter [γένος .. λέγεται .. ὡς ὕλη· οὐ γὰρ ἡ διαφορὰ καὶ ἡ ποιότης ἐστί, τοῦτ' ἔστι τὸ ὑποκείμενον, ὃ λέγομεν ὕλην]."(1024b8-10). Now this text poses a big problem, because it contains a convergence of two separate sciences -- logic and ontology -- and this is perplexing: how can so bold an assertion be made that the parts of our definitions have corresponding *ontological* parts in the things defined? It is difficult enough to say why "redness" corresponds with the colour of the apple, to which we can ostensibly appeal; why is it that we can do the same, nay better, for our ontological and lexicographic terms?

The philosophical point of the genus is matter thesis is to explain the unity of substance: genus and differentia are the examples given of putatively discrete parts (on the Platonic "interweaving" thesis) which are in need of some metaphysical knot to tie them together. Aristotle connects them by showing that the matter and form are one, not qualitatively but numerically, this same identity holding of the genus and differentia of an essentialist definition. An examination of many of the passages will follow, which will reveal the many features by which genus and matter are identical: in potentiality, determinability, in being used hierarchically, as principles of natural things, focally as being identical at the proximate level with the differentiae, and because they are substrata for such differentiae. This last feature provides for us the middle term of the demonstration of identity.

To preclude the dismissing of "'Genus' .. is used .. as matter" as a minor or trivial comment by Aristotle, I register the caveat that genus as matter will be referred to neutrally as a *thesis*. Some commentators dispute whether Aristotle either believed (or defended) the actual

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statement that "'Genus' .. is used .. as matter" in a systematic or focal way: the defence of my conclusion that the genus as matter thesis is an important part of the Aristotelian *weltanschauung* is a central purpose of this chapter. Until explicitly stated otherwise, however, my references to the 'genus as matter' thesis will be to the statement quoted within this paragraph, as a possibly recurring feature of Aristotle's philosophy and referred to by some scholars as a 'thesis'. In the first section, I will examine texts which support the interpretation that Aristotle does not believe in an actual identification of the genus and the matter, but believes that they are analogous.

### i. The Analogy Interpretation: Aristotle's Mention of "Genus" as "Matter"

The genus as matter thesis seems to have been a regular component of the recent history of logic, e.g. in Whately's account of the parts of an essence, one is "the *material* part, which is called the *Genus*" (1801, p. 84). It is *stated* explicitly by Aristotle in a variety of places throughout the corpus.<sup>1</sup> In this section, I will review the cases in which it is given, and particularly those in which it is (putatively) simply asserted. The issue being addressed will be commented upon in terms of the distinction of uses of "genus" in  $\Delta$ .28. First, Aristotle states that

Of things which are active those whose form does not exist in matter are incapable of being affected; those whose form is in matter are capable of being affected. For we say that each of a pair of opposites has more or less the same matter, *which is like the genus* ( $\omega\sigma\pi\epsilon\rho\ \gamma\acute{\epsilon}\nu\omicron\varsigma\ \delta\upsilon\nu$ ); and that which is capable of being hot, given the presence and proximity of a heating agent<sup>2</sup>, necessarily gets heated.(GC I.7 324b4-9; Williams, trans.; my italics)

Aristotle here appeals to the fact that genus can mean the substratum of a class of varying individuals, underlying the differentiae (or contraries/opposites, as we will see below), as in his definition of change, which posits a substratum capable of taking on opposites. This is the interpretation of Verdenius and Waszink (p. 38), who comment that the matter referred to must be a determinate matter, presumably because the matter must be capable of being a unity with either of the opposites. Joachim takes the matter referred to in this passage, i.e. the food and the

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<sup>1</sup>Bonitz (787a19-22) refers his readers to the following passages as references for the genus as matter thesis: *Phys* II.9 200b7; *Met*  $\Delta$ .6 1016a28,  $\Delta$ .24 1023b2,  $\Delta$ .28 1024b9. Z.12 1038a6, H.6 1045a34, I.8 1058a23. Other scholars provide these references to genus as matter: *Metaphysics* Z.7 1033a1-6; H.2 1043a20; H.3 1043b29. I will give more references.

<sup>2</sup>Carteron notes that with things which are matterless forms, sublunary laws of reaction don't hold, so universality and necessity required of laws do not pertain: the problem is the prime mover moving without being moved, nor moving by contact.(p.167)

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patient's body, to have a loose similarity, (which is true) but compares this with the example of the similarity of a dog and a bird which are "ὁμοίως ζῶον"(p. 155), the same *qua* animals.

Similarly in *Metaphysics* Δ.6, Aristotle states that there is a similarity between genus and matter:

Things are also called one whose genus is one, being differentiated by opposite differentiae; and these are all called one because the genus which is the subject of the differentiae is one (as for instance a horse, a man, and a dog are one something because all animals) -- in much the same sense [παραπλήσιον], indeed, as the things whose matter is one.(1016a24-8; Kirwan, trans.)

This occurs within a discussion of the various sense of the word 'unity', Aristotle explaining that the various different forms of the genus makes them equally animals, none any more or less so than the others. In the case of things whose matter is one, he presumably refers to the fact that the material substratum of say, bronze things, makes them all 'brazen'. Furth sees 1016a17-24 as the account of the minimal amount of unity, which is typically available when one is using a mass term (1987, p.31-2): this is directly compared (τρόπον .. παραπλήσιον ) by Aristotle with the generic unity. Now there is a strand of commentary on the genus as matter thesis which holds that Aristotle's intention in his reference to the genus as matter is to show no more than an *analogy* between the genus of a definition and the matter of a composite thing. This is the stance of Marjorie Grene, whose exemplary rebuttal to Rorty's inaugural paper on the genus as matter thesis uses the reference just given to show that genus and matter cannot be identical, Aristotle saying also that they are similar (ὡσπερ<sup>3</sup>), implying that they couldn't be identical or he would have stated the stronger thesis (1974, p.59). Rorty, who initially took the stand that Aristotle intends the stronger thesis that the unity of proximate matter and form requires the mirror relation of the unity of genus and differentia in a definition (1973, p.394-5), comments on Grene that more than a simple analogy is implied, the genus and matter too frequently being identified with each other as substrata (1974, p.71). Ross, too, comments on 1016a24-8 that the comparison with matter is an appeal to analogy because "Both these kinds are unity of substratum; but in the one case it is the material substratum, in the other the genus as substratum of the differentiae, that is in question"(1929, v. ii, p.302). Lennox uses this passage

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<sup>3</sup>Note that this term is also translated "just as" in other contexts, which implies doubt about the comparison rather than the identity of genus and matter. Also, Aristotle does not explicitly say that the genus is *analogous* to the matter, which would have been expressible in his Attic Greek.

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as an example of the fact that in the *Metaphysics*, genus is not used extensionally but is typically "represented as a substratum (*hupokeimenon*) or material (*hulê*) for differentiation"(p.347)<sup>4</sup>: his interpretation is representative of a third view of the genus as matter thesis, according to which the thesis is presented to clarify the roles of kinds and their forms (referring to I.8, which we'll examine below) (1987, p. 349). A crucial question about this interpretation is how much emphasis is to be put on 'clarification' -- does it clarify in a pedagogic sense, or because it points to a real identity? Each of these interpretations is logically possible, given the various qualifying phrases or lack thereof which Aristotle uses: "παραπλήσιον" of the present passage implies similarity but non-identity, but the text doesn't say that genus and matter are the same only by analogy, which the Grene interpretation would require for absolute confirmation. Yet we must keep each of these interpretations in view as being the main contenders for truth about Aristotle's use of the genus as matter thesis.

In some contexts, "matter" and "genus" occur in enough proximity that the genus as matter thesis might appear to be stated, when actually an entirely different statement is being made and the genus as matter thesis isn't even implied. Take Aristotle's explanation of the respects in which things come from other things: one way is

to come from something as from matter, and this in two senses, either in respect of the highest genus or in respect of the lowest species; e.g. in a sense all things that can be melted come from water, but in a sense the statue comes from bronze.

Read the wrong way, this statement would mean that things come from matter as genus or *eidos*. This reading would be entirely misleading because although it is possible for things to be generated from forms as their matter, it is not *qua* form (*Physics* II.3, 195a35-195b5); rather, a generic form can serve as the matter for its differentiation into other forms as a material substratum for differentiation. In this passage, Aristotle is appealing to the fact that there are strata of matter as the elements get worked up into more complex structures, which can then serve as matter for more developed structures. The matter of the bronze statue is the bronze, although the matter of bronze is ultimately water, as it is for other meltable metals. Yet Aristotle's statement here implies that bronze is matter or form, depending on the analysis being undertaken. Christopher

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<sup>4</sup>Cf. Pellegrin, who takes genus to distinguish "logical space"(1987, p.347). However, Pellegrin notes that he and Lennox share the view that the same concepts and conceptual schemata are found in the biology and metaphysics (1985, p. 114n).

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Kirwan comments that some believe that Aristotle's account here means that bronze is entirely out of water, to which he contrasts passages at *Meteorology* IV (10 389a8, 8 385a25-33 etc.; cf. Furth, 1987, p. 32n); recall my chapter IV, §ii. Yet it is important to note that there are many passages which appear to appeal to a thesis we might call 'genus as matter', which do not in fact make such an appeal.

The *Metaphysics* contains many mentions of the genus as matter thesis. In *Metaphysics* H.2, Aristotle agrees with the Pythagorean Archytas of Tarentum<sup>5</sup> that definitions must include the matter and the form:

For the formula that gives the differentiae seems to be an account of the form and the actuality, while that which gives the components is rather an account of the matter (1034a19-21).

This is given as a response to a partial summary of views which are deficient at explaining the actuality of a thing: Aristotle argues that it is difficult to restrict the number of ways in which things are actual, listing differentiation "by more and less, .. dense and rare, .. and all these are cases of excess and defect; and things differentiated by shape or smoothness or roughness are all differentiated by straight and crooked; and for other things being is being mixed, and the opposite of this is not being" mixed, and other examples are given (1042b32; Bostock, trans.). Whatever this actuality is, for a composite substance it will be predicated of the matter, even though some say that it is only the matter: Democritus, whose theory was being criticised earlier in H.2, is presumably still under scrutiny. Yet the logos, expressible in a definition, should putatively consist of the genus *and* the differentia. LeBlond notes that this occurs in a context in which Aristotle claims that it is possible to define by form or by matter, but proper definitions include both (1979, p.67). Ross calls this Aristotle's "nominal definition", referring us to his method in *APo* 75b32; note my discussion of this in chapter VI. Similarly -- as far as seeing Aristotle as approving this type of definition -- White appeals to this text against Rorty by arguing that it shows precisely that matter doesn't always occur in a definition: he argues that if the definition is composed of the differentia, it is had by division (presumably as the ideal) and implies the genus,

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<sup>5</sup>None of the work of Archytas is extant, apart from quotations by others. He was a friend of Plato, and preceded him to the court of Dionysius at Syracuse (if Plato's IXth, XIIth, and XIIIth letters are accurate); Plato and he shared commentaries and Grayeff comments that Archytas secured Plato's freedom from captivity to Dion of Syracuse's bodyguards. See also Lloyd 1970, p. 30-35 and 1990; Plato's *Theaetetus* 201e-202c; and Ross 1929 p. 232-3 concerning Archytas's intellectual successes. Note that appeal to a precedent in this way can be taken as a hint that Aristotle is examining *endoxa*.

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whereas if it mentions matter ("the components") it is of something that is the embodiment of a form in matter which is accidental to it (p.49)<sup>6</sup>. Yet some scholars would deny that Aristotle gives sanction to material definition.<sup>7</sup> It seems to me that Aristotle would not sanction such accounts because of principles we examined in chapter VI: take, for example, the definition of thunder which we read from *APo* 94a7, that 'thunder is noise in the clouds caused by the extinguishing of fire': if we break this into segments, taking each named object as a material for combination, then the definition results that thunder is 'noise and clouds and extinguishing and air'. This would be a combination of components on the model, presumably, which is under Aristotle's scrutiny, but which he rejected in the Z.16/H.4 appeal to unity. If it would work at all, it would work for heaps, whose unity is minimal: as in the threshold argument (H.3 1043b4-14), Aristotle argues that the positions of the parts is all that gives the threshold a unity of account (H.2 1043a7).

Aristotle follows shortly after (in H.3) with a reaffirmation of the roles played by the matter and the form in definition by genus and difference of composite things: like LeBlond (p. 66), I argue that this is a focal Aristotelian statement about the definition of composite substances, and about definitions generally. Aristotle says

Therefore one kind of substance can be defined and formulated, i.e. the composite kind, whether it be the object of sense or of reason; but the primary parts of which this consists cannot be defined, since a defintory formula predicates something of something, and one part of the definition must play the part of matter and the other that of form.(1043b28-32; Bostock, trans.)

The indefinability of matter and form, as the primary parts of a composite substance, sounds a little odd, given that the substantial form is argued in *Metaphysics* Z (particularly 4-6) to be eminently intelligible<sup>8</sup>; even if the form of a composite is defined without mention of the matter, however, the genus will be implicit if it is the form of a composite natural

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<sup>6</sup>White makes much of a passage in Z.11 which he argues includes Aristotle's commitment to the possibility of man being a unity of his form and an entirely different kind of matter (1036a34-b7), which would seem to be threatened by the view he takes of the definition being the expression of the differentia, if, as it seems, the differentia and the genus *are* a unity in the way of the form and the matter. However, the reading of the Z.11 passage is at best ambiguous, much depending on the reference of τοὔτο in line 8: it could refer to the impossibility of our distinguishing the form from the matter. Note also that a difficulty would arise on the issue of the hypothetical necessity contained in the matter; sc. below on *Physics* II.9.

<sup>7</sup>e.g. Balme, 1987 p. 310n.

<sup>8</sup>See ch.2 §1, in which I examine the link between intelligibility and demonstration.

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substance<sup>9</sup>. Aristotle also refers back to his argument of Z.7-8 that the composite thing is generated, although its form is not (1043b16-17). He points out that he has some sympathy with the problem pointed out by Antisthenes the member of the Socratic circle, who argued that the account of something would be a long list of its parts<sup>10</sup>. Yet having heard Aristotle's claim in H.2 that proper definitions make reference to both the form and the matter of the composite substance, we can see the entailment of the account as it is given here: the parts cannot be defined, because the substance is a 'this in this', but such a thing is definable by matter and form playing the role of the genus differentiated. Crucially, Aristotle argues in this passage that definition must be done in this way. But what justified the implied necessity of defining by matter and form as parts? The reason is the regress of separating a thing and its essence: a thing must be identical with its essence (*Metaphysics* Z.6), and if the proximate matter and form are one, and either of these are separated from the composite substance, everything will be begging for an essence, and unknowable (by instantiation of "matter and form" into "essence").

Similarly, Aristotle implies the genus as matter thesis in H.6 with the claim that "There is intelligible matter as well as perceptible matter, and a formula always consists part of matter and part of actuality. (For instance, a circle is a plane figure)"(1045a33-5; Bostock, trans.)<sup>11</sup> H.6 was examined in the previous chapter, concerning the meaning which Aristotle gives to the notion of proximate matter in his explanation of the unity of a composite substance. The problem concerned the explanation of the unity of a composite thing, especially when the unity was to be explained by the sharing in a form, as Plato had argued. But, Aristotle argues, if the unity of a man, for example, is to be explained by saying that

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<sup>9</sup>I shall examine Aristotle's comments in Z.12 below, where he is translated as saying that the definition is of the differentia, rather than the genus and differentia.

<sup>10</sup>This would presumably be only its visible parts, Antisthenes believing in the existence of only what could be perceived, those things being of immediate practical value and being knowable. LeBlond (p. 64) quotes Ammonius on Porphyry's *Categories* (CIAG IV 3) that for Antisthenes, genus and species exist only in the imagination. Antisthenes is reported to have actively opposed Platonic forms. See also LeBlond's note 6 about Festugière's account of Antisthenes, and McDowell (p.237).

<sup>11</sup>The translations of this passage diverge: Ross (1929) treats sensible and intelligible matter as the objects of the sentence; but the Ross translation revised by Barnes (and included in Ackrill) has the passage translated as "Of matter some is the object of reason, some of sense, and part of the formula is always matter and part is actuality. For example, a circle is a plane figure". I'll not pursue the nuances of the use of these phrases as technical terms, in this context.

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individuals are unities because they share in "manness", which is a unity, then the problem isn't solved if "manness" itself is a composite of "animal" and "two-footed". To find the answer, Aristotle appeals to the notions of matter and form, that "if, as we say, there is on the one hand matter and on the other hand shape, and the one is potentially while the other is actually, the question will no longer seem a difficulty"(1045a23-25; Bostock, trans.). Relying on Z.12 (1038a5-9 see below), Gill comments that the "unity of genus and differentia is unproblematic because the genus is indefinite and general but not distinct in nature from its differentiated species"(p. 141, cf. 168). Now this doesn't provide us with a defense of the genus as matter thesis: we already know from chapter one that the principles of matter and of form are necessary for the natural scientist to provide the complete account of a natural thing. But what does it mean here to say that part of the formula is matter? The example of matter which is given is "plane figure", which is the genus of the definition of a circle, its differentia being "with circumference equidistant about the centre"(*Rhet.* III.6 1407b27 and *Metaphysics* Z.8 1033b14). This is a putative example of intelligible matter<sup>12</sup>, which would seem to imply that when the genus as matter thesis is being used, the matter referred to is an object of reason, consistent with the idea that matter is had by analogy. But we must pursue a defence of the genus as matter thesis, first, to decide

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<sup>12</sup>Mueller follows Alexander of Aphrodisias in interpreting the 'matter' of the last clause as a mention of intelligible matter, which for Alexander is extension: Mueller reports that "according to him, figure is an example of intelligible matter (*in Aristotelis metaphysica commentaria* 562.14-17)"(1979, p.104), the abstract matter 'out of which' we have our thoughts. Grene agrees that the matter under discussion is intelligible matter, but argues that this is because Aristotle is undertaking a logical rather than a physical analysis: within a context of arguing against a Platonic theory of unity, Aristotle argues that a separation of genus and differentia would make the unity of substance impossible (1974, p.65-6). Grayeff, too, takes the intelligible matter as the topic under discussion in the example of the figure, but appealing to Z.10 1036a9, argues that 'intelligible matter' "does not mean logical genera or 'the generic element in species'"(p. 133 fn 1). Rorty points out that Aristotle has just been speaking about the animal and biped nature of man, too, which provides us with an example of *sensible* matter (p. 76). Yet David Charles comments that the genera "can be seen to *like* matter (cf. 1038a6) because it is this particular matter (e.g. the matter of Socrates) seen in abstraction (universally) as the matter of an animal to which the predicate 'biped' applies."(1994a, p. 91, my italics) Ross comments that a substance could be analysed into either sensible or intelligible matter, depending on the type of substance being defined: 'man' will require the sensible matter taken *as universal*, (Z.10 1035b29) (or 'intelligible matter' in a different sense (1045a34(?)) than 'line' taking the intelligible matter 'length' (Z.10 1035b29) (1929, p.233). Whether concerning sensible or intelligible matter, White takes this passage to fail at establishing an identity between the genus/differentia and matter form because we would still only have a definition by components (because of 1035b27) (p.52); he does note that *Physics* 190b26 suggests that matter is "almost an individual concrete thing"(p. 54).

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whether it must be intelligible matter, an appeal to analogy, or otherwise.

Finally, the genus as matter thesis is mentioned in the *Physics*: in II.9, Aristotle closes the book with a discussion of the features of an object which enable it to fulfil its function, arguing that the necessity is in the matter<sup>13</sup>

Perhaps the necessary [ἀναγκαῖον] enters even into the account. Suppose the work of sawing is defined as a certain sort of division: that will not be, unless the saw has teeth of a certain sort, and there will not be teeth like that, if it is not made of iron. For even in the account there are parts which stand to it as matter [ἔστι γὰρ καὶ ἐν τῷ λόγῳ ἕνια μόρια ὡς ὕλη τοῦ λόγου.]. (200b4-8; Charlton, trans.; my italics)

By appealing to the necessary, in this context, Aristotle is attempting to answer an *aporia* which he had mentioned earlier in the *Physics*, namely how is necessity involved in natural things? Knowing that natural things are (by definition) things which come to be and pass away according to internal principles of change, and that in this sense our primary alternatives are the principles of the matter and form, Aristotle opts for the former as the source of necessity: if anything is to achieve its function, then the material out of which it is made must have its own natural principles which can be preserved in order to be put to use in a new shape, i.e. when it becomes a unity with a new form<sup>14</sup>. Aristotle repeats that the "that for which" will be given in the account of what our composite thing is (200a13-14; Charlton, trans.). The texts differ in priority in two main ways: some concern foremost the nature of definition; others concern foremost the theory of change and relation of form and matter (*Metaphysics* I.8 and *PA*). The interpretation of these passages can be divided into three types. First, the genus as matter thesis can be taken literally: "the genus is a name for the sort of thing that an exemplar of a species of that genus can be made out of" (Rorty, p.411.), in the sense of providing the material cause. Second, the genus as matter thesis can be taken metaphorically: "*genos* here is intelligible matter, and surely this is only analogical to what gets worked up through all four kinds of change into Socrates" (Grene, p.55). Finally, the genus as matter thesis can refer to the potentialities of matter: "The *genos* is that which can be determined in various different ways" (Lennox, p.348). In Bostock's commentary on Aristotle's *Metaphysics* Z and H, he comments about passage H.6 1045a33-5, mentioned earlier, that the genus is matter thesis

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<sup>13</sup>Cf. Charles (1980) and others on Hypothetical Necessity. See also Aristotle's *Rhetoric* 1412a.

<sup>14</sup>Furth (1987, p. 39) claims that this passage is the confirmation of an *endoxon*.

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is by no means a standing feature of Aristotle's thought (cf. Z12, 38a5-9n.), one would certainly expect him to *state* the thesis somewhere in his discussion if he is in fact relying on it. But he never does. The interpretation must, then, depend upon the point that one of the very few occurrences of this thesis is in Z12, where again the topic is the unity of a definition. (1994, p.281)

I shall take Bostock's claim as a challenge: having given other passages -- other than Z.12 1038a5-9, which I will examine at the end -- in which Aristotle states the genus as matter thesis, I will examine a text in which the theory of the genus as matter thesis is justified, and then examine other instances of the genus as matter thesis in which Aristotle gives some explanation of its merits. In doing this I will present a defence of the literal interpretation.

### ii. The Literal Interpretation: Aristotle's Use of "Genus" as "Matter"

In *Metaphysics* I.7-8, Aristotle sets out to solve an *aporia*<sup>15</sup> about how the intermediates of the contraries are related to the forms which make up substances. (*Metaphysics* I as a book opens with a discussion of unity, followed by discussions of why unity and being are not substances *but predicates*, leading up to a discussion of the relation between the opposites/contraries which by being opposed are many rather than one; all of these seem to foreshadow a discussion of the relation of the forms/*eidê* to contrariety.) In I.7, Aristotle argues that the intermediate qualities, i.e. qualities intermediate between the contrary qualities which a thing might have, must be composed from those contraries. Take as examples 'carnivore' and 'herbivore'. His argument takes the following form: Intermediates must be in the same genus as the extremes (because a changing thing changes through them to the extremes), i.e. it changes from being carnivorous to herbivorous; but the intermediates are between opposites as contraries (because there are no intermediates of contradictories, nor of relatives). Aristotle addresses the objection that they don't have to be of the same genus by arguing that if they are of the same genus, the genus (e.g. eaters) is prior and becomes differentiated into *eidê*.<sup>16</sup> In this case the previous account fits. However, if the

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<sup>15</sup>Ross notes that the answer to one of the *aporia* given in *Metaphysics* B is further elaborated here, namely, "Does the science that investigates substances investigate their properties as well?" (Ross 1929, v.1 p. xvi-xxiii). The main attributes of substance are given as being, unity etc. in book I (1053b9ff.).

<sup>16</sup>Ross's translation of this is misleading or worse, here, because he renders it "species", particularly when Aristotle claims that "the species consist of the genus+differentiae [ἐκ γὰρ τοῦ γένους καὶ τῶν διαφορῶν τὰ εἶδη]" (1057b4). Now Aristotle is discussing attributes (neutrally) which are intermediate between extremes. Admittedly, such attributes can be grouped together into species, but when Ross has Aristotle continue that

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intermediates do not have to be of the same genus as the contraries (1057b19), then they must be of something other than the genus: the differentiae are either incomposites or not<sup>17</sup>, such as 'carnivorous' said of itself or something other than the carnivorous things. Yet the former alternative is impossible because intermediates are between contraries which belong to something, out of which the contraries will change to the intermediates. For example, a carnivorous man (consuming only milk) becomes omnivorous before declining to eat meat and becoming vegetarian. The intermediates must then nevertheless be composites out of the contraries, because they will be variations on the extremes, and as such variations of the genus, i.e. 'eaters' in this example.<sup>18</sup>

*Metaphysics* I.8 is about the clarification of what it means to be "Τὸ .. ἕτερον τῷ εἶδει"(1057b35): other in *eidōs*. For the moment, I'll leave that term untranslated because I intend to challenge the accepted rendering as "species"<sup>19</sup>. Having established in I.7 that all contraries belong to a genus, this chapter is the explanation of distinguishing *within* a genus. Aristotle argues that the explanation of the difference between *eidē* is in the possession of a contrary differentia, and he offers arguments for this conclusion. First, taking genus as "that one identical thing which is predicated of both <things which are other in *eidōs* > and is differentiated in no merely accidental way<sup>20</sup>, whether conceived as matter or otherwise"(1057b37-1058a2), Aristotle says that a common nature must attach to each of the differentiae, differing *in* each differentia, as animality is different in horse and in man (1057b35-7<sup>21</sup>; cf. 1038b19, 1039a20). The

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"The intermediates will be composed of the genus + certain differentiae" what Aristotle is saying is ambiguous: he could mean that any particular or individual attribute will be an instance of the species of a genus which is under discussion, or he could be saying that intermediates are species, both being 'genus + differentiae'. (Apart from the hazards of using '+' to denote the relation of genus to difference -- see Z.12 1038a29-30, PA 643a24) I object that the rendering of *eidē* as species is particularly unwarranted here. Aristotle is discussing things like qualities of warmth and coldness, which are particularly forms which a substance gains and loses, and 'form' would be an entirely appropriate translation.

<sup>17</sup>Here I follow the translation of Furth (1985), *contra* Ross and Tredennick, whose translations of "ἀνάγκη γὰρ τὰ ἐν τῷ αὐτῷ γένει ἐκ τῶν ἀσυνθέτων τῷ γένει συγκεῖσθαι ἢ ἀσύνθετα εἶναι"(1057b20-2) imply that the *genos* is never a component in the formation of a contrary, which is inconsistent with Aristotle's conclusions that follow.

<sup>18</sup>Pellegrin gives particular attention to the theory of I which holds that "The *eidē* issue from the *genos* and from its differences" (I.7 1057b7; Pellegrin, trans., p.58).

<sup>19</sup>Even Pellegrin (1986, p. 183n but trans. Preus) refers to this as 'specific difference'.

<sup>20</sup>Note that substance is accidental to the matter (if Aristotle speaks in *propria persona* in Z.3), suggesting a disanalogy between the genus and matter.

<sup>21</sup>Lennox (1987, p.349) translates 'εἶδος' in this passage as 'form' rather than species, as would.

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genus as matter thesis is stated here again, referring us to the genus as the substratum underlying the differentiae: as Lennox comments, the "notion of kind as matter is introduced to clarify the role played by the kind which is common to its different forms, yet differentiated in each"(concerning 1058a1-5). The foregoing provides the opportunity for the definition of 'difference *in* the genus': "an otherness which makes the genus itself other" (1058a7-8).<sup>22</sup> That is, a difference in the genus is the being different of a common thing by being common to other distinct things, which are distinguishable in form.

Second, the difference between *eidê* of a genus is in the possession of contrary differentiae because "all things are divided by opposites, and it has been proved that contraries are in the same genus"(1058a8), i.e. in I.4-7, and taking opposites [*antikeimenos*] as equivalent to contraries [*enantia*]. Yet contrariety as difference in *eidos* is a difference from something *in* something, as a composite. Thus the situation is suggestive of classification: Aristotle continues

Hence also all contraries which are different in species and not in genus are in the same *line of predication*, and other than one another in the highest degree -- for the difference is complete -- and *cannot be present along with one another*. (1058a13-16; my italics)<sup>23</sup>

διὸ καὶ ἐν τῇ αὐτῇ συστοιχίᾳ πάντα  
τὰ ἐναντία τῆς κατηγορίας ὅσα εἶδει διάφορα καὶ μὴ γένει.  
ἕτερα τέ ἀλλήλων μάλιστά τελεῖα γὰρ ἢ διαφορά καὶ  
ἅμα ἀλλήλοις οὐ γίνεταί

15

By being in the same line of predication, the genus divides into contraries at an equal level of qualification; they are different in the highest degree because, *pace* Ross, contraries could only be the opposites within the same genus, as substratum (reading "of something/τίνος"(1058a12)). As we saw in the biological works, if there is classificatory work being undertaken with genus and *eidê*, it is the genus which is the classifier, being broken into *eidê* as forms. Apart from the difference between the views of

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<sup>22</sup>Furth translates the definiens as difference 'of' the genus; Tredennick leaves out the article; a nice alternative rendering of the definition itself is Hope's (1952) "a difference which marks the γένος itself with variety", although this is less warranted by the Greek. Grene comments that this text exemplifies a "diffuse, or analogical" sense of matter which is nothing beyond the *eidê* (p. 63); cf. Alexander of Aphrodisias similar comment, based on his adherence to prime-matter (*Quaestiones* 2.28 77,32). Pellegrin defends the view that in these parts of I.8, there is an ambiguity in the notion of otherness of *eidos*: in the earlier section, the examples are 'man' and 'horse', whereas in the later they are 'footed' and 'winged'(1985, p. 114).

<sup>23</sup>Ross glosses the italicised phrases in his commentary replacing them with 'category' and 'are incompatible'. Hope, Furth and Tredennick do not translate this phrase in any remarkably different way.

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Lennox and Pellegrin noted above (n3), Pellegrin's comment that we find in this passage a taxonomy of contraries (p. 59-61) is appropriate: the genus is a unity of the contraries by being the identical thing which is differentiated in each<sup>24</sup>.

But what, then, about the translation of "εἶδος" and the supposed classification? The conclusion of the chapter provides crucial evidence about both issues: Aristotle here summarises what he has found so far, that being 'other in *eidōs*' is "to have a contrariety, being in the same genus and being indivisible (and those things are the same in species [τῷ εἶδει] which have no contrariety, being indivisible)"(1058a17-19). Crucial to the issue about the classification of things as *species* of a genus is the fact that "a species is the sort of thing that have members: something akin to a class or a set"(Woods, 1993, p. 404). But being indivisible implies that an *eidōs* is not divisible in the way required for member-possessing. Now this is possibly a difficulty of the ambiguity of the *atomon eidōs* mentioned elsewhere. Yet here we are led to believe that an *eidōs* must be indivisible. Does he give us any reason to suppose that this must be so? Indeed, for he continues with a justification for the summary which he has just provided: the contrariety arises when we distinguish the members of a genus, even *among the intermediates* [ἐν τοῖς μεταξύ]. But the intermediate what's? The intermediates lie between the genus and the indivisibles, about which Aristotle says that "ὥστε φανερόν ὅτι πρὸς τὸ καλούμενον<sup>25</sup> γένος οὔτε ταῦτόν οὔτε ἕτερον τῷ εἶδει οὐθέν ἐστι τῶν ὡς γένους εἰδῶν"(1058a21-2), which I translate as "Therefore, it is apparent that in relation to what is named a genus, the forms of the genus <both intermediate and indivisible> are neither the same nor other than it in form". If we translate *eidōs* in this passage as species, (as have Ross, Tredennick, Hope and Furth) then a paradox arises: the species (as a class) is and is not the same as the genus (as a class). If we treat the notions of genus and species as taxonomic in both cases, then a genus must contain all and only the same members as the species! Presumably Aristotle would want to say that the genus would include all of the members of

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<sup>24</sup>See Pellegrin p. 61ff about why a genus implies contraries, but not conversely: appealing to the *Categories* and *Physics*, he notes that "every *genos* is divisible into contraries, but not every pair of contraries is a pair of *eidê* that can be included in a *genos*" (p. 63).

<sup>25</sup>Ross (*ad loc*) comments that this term's 'technical meaning .. is not quite familiar' and is used modestly; yet he argues that Bonitz's emendation to κατεγορευμενον is unnecessary; in what follows I shall defend an interpretation which treats it somewhat baptismally: things are a genus when they fulfil Aristotle's criteria.

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each of its species, and no members which are not from one of its species, and all of the members of each species constitute a sub-group (by what we might call the principle of significant contrast). To make this reading fit, however, requires us to treat the identity criteria differently in each of 'same' and 'other/different', in relation to different subsets, and to treat the (stated rather than assumed) 'τῶ εἶδει' of the second clause as 'form', because it will be in form that the genus and species differ, the latter being a variation on the former. However, this would be to equivocate<sup>26</sup>. Given the topic we have already examined from these chapters, i.e. how things can differ in *eidos*, we are not required to charge Aristotle with equivocation if the term is translated 'form' throughout, because the forms of the genus will be neither completely the same nor completely different than the genus: they will be qualitatively similar in nature, possessing a common core, but different in that the *eidos* is a differentiation of that core. As we saw in chapter three, (and we will find concerning Δ.6 1016b31, below), they will be different either by the more and the less, or by analogy.

Testing this further, Aristotle continues that the sameness and difference of a genus and its forms is appropriate,

(for the matter is indicated by negation, and the genus is the matter of that of which it is called the genus [τὸ δὲ γένος ὅλη οὐ λέγεται γένος], not in the sense in which we speak of the genus or family of the Heraclidae, but in that in which the genus is an element in a thing's nature), nor is it so with reference to things which are not in the same genus, but it will differ in genus from them, and in species [εἶδει] from things in the same genus. For a thing's difference from that from which it differs in species [εἶδει] must be a contrariety; and this belongs only to things in the same genus.(1058a23-8)

Two things are crucial to this passage: first, Aristotle sees the genus as an element in a thing's nature [*tâ phusei*], whose purpose is not solely classificatory -- here again I would translate as 'form' rather than 'species': the nature referred to is the notion of matter as an enformed nature (chapter VIII), and emphasises the qualitative features of the genus, in relation to the forms which are its members with a more determinate nature. Hence I reject Marjorie Grene's (p. 63) claim that this is a "very general sense of matter" as substrate, following on I.4 1055a6, and a35. It follows that the things which are not in the same genus as another will not have the same nature as them. And continuing the theme of nature, the forms of a genus will have opposed contraries on the basis of which

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<sup>26</sup>Similar comments can be found in passages addressed by Loux (1993) and a parallel response by Woods (1993).

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they are called different forms of the genus. Second, matter (and presumably genus, if the two are to be identified) is said to be "indicated by negation [ἀποφάσει δηλοῦται]": being limited according to the type of nature the genus is, it sets constraints on the actualities which can be differentiated within it. But what can this passage tell us about the genus as matter thesis? Both being elements in a thing's nature, under different names, the genus and matter are to be identified as substrata *because* they are able to take on contrary forms as differentia of the definition capturing the essence of such things. In his *Quaestiones* 2.28, Alexander of Aphrodisias<sup>27</sup> claims that matter is not genus because

matter is a [real] thing and underlies [by] contributing to each of [the things it underlies] being a definite something; but genus taken as genus is not a [real] thing that underlies, but only a name, and it possesses the [property of] being common in its being thought of, not in some reality.(78,16; Sharples, trans. 1994)

On my interpretation of the genus as matter thesis, Alexander's claim is inaccurate as an interpretation of Aristotle<sup>28</sup>, because the claim made in 1058a23-8 is that genus is "an element in a thing's nature": whether abstract 'intelligible' matter or more concrete biological matter, the view expressed is that there is something called 'genus' to be found in things. Following upon the views expressed in chapter VIII, what Aristotle is identifying as the genus/matter of a thing is its enformed proximate matter, which is lost on the destruction of the substance (1041b12): this will be the loss of the contrary which makes the essence of the substance complete.

Now Grene is willing to allow that (in the "categorical context") individuating within a genus requires a substratum "open for distinctions of more or less"(p. 63), yet she argues that this cannot allow identification of the substratum with the enformed matter from which a substantial thing is generated: it is too metaphorical; Alexander calls it 'common' in a way which matter cannot be called 'common' to the many individual things (*Quaestiones* 2.28 78,6). Yet this response is itself vague. As Lennox has claimed,

I can't see why the first meaning of 'matter' is very metaphorical or how 'bronze', as the name for what can become many different sorts of (bronze) thing and which is common to them all, is matter in any sense radically different from 'bird' as the name for what can become many different sorts of bird and which is common to them all. (1987, p. 348n)

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<sup>27</sup>I thank Professor Sharples for bringing passages on the genus as matter thesis from Alexander to my attention.

<sup>28</sup>Alexander's commentary on the *Metaphysics* in the *CIAG* survives as comments on books A-Z, so his comments on *Met.* I might be different.

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That is, why is the universal (i.e. genus) "metaphorical" if it is nothing beyond the instances, as the advocates of the *para ta eidê* interpretation (Balme, Rorty and A. C. Lloyd) believe? With Lennox, I claim that it isn't "metaphorical": being an element of the essence of a thing but not exhaustive of the essence entails that the genus/matter of that thing is an incomplete part of the primary substance, but even if the matter is grasped by analogy (as said in the *Physics*), the genus/matter as the substratum is not unintelligible in context. This is confirmed by at least two things: first, it is possible to say that the genus exists concretely because of the existence of its instances; second, Aristotle believed that the existence of the mule shows the possibility of the concrete genus, because mules do not form a differentiated species but have the form of the horse family (i.e. *equidae*). Yet we can also establish the identity which Aristotle appeals to in the various texts by constructing the syllogism

Any substratum for differentiation is matter. (*PA* 1.3 643a21)

Any genus is the substratum for differentiation. (*Met.* D.28 1024b9, *Met.* I.8 1058a28)

Therefore, genus is matter.

Although we will take occasion to examine the *PA* passage shortly, enough has been said in this and the previous chapter on matter to warrant the justifiability of the first premiss, literally interpreted as the proximate stuff.

The view is confirmed in the subsequent chapter of *Metaphysics* I, chapter 9: Aristotle is examining what types of generic contraries make a difference in substantial form [κατ' εἶδος], and argues that matter will not suffice.

Hence pallor of a man does not make [a difference of species], or darkness, nor is there a differentia with respect to species between the pale man and the dark man, not even if a single word is assigned [to each]. b5 For the man [is here taken] as material, and matter does not make a differentia; for this reason the [individual] men are not species of man, even though the flesh and the bones 'out of which' this and this man are, are other; but the composite is other, but not other in species, because in the formula there is no contrariety. b9 This [=species] is the ultimate indivisible (1058b3-10; Furth trans.; inserted text is that of the translator)

This text has been appealed to as a putative source for a material principle of individuation,<sup>29</sup> but for present purposes it is sufficient to note that matter is insufficient to account for substantial forms because the *logos* does not entail a particular contrary: by this, we can appeal to the context and understand the argument as presupposing the *logos* of the substantial

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<sup>29</sup>Cf. Charlton (1972, pp.244-5) and (1994, p.45-6), who challenges its credibility.

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form as a differentiated genus. According to my analysis of I.8, the matter will be contained within the *logos*, so appealing here to matter as a way of generating new species must fail, because only the matter of the particular men will be different, not generically but qualitatively (so Charlton, 1994 p. 45), in details. As matter of the composite, the matter of Socrates and Callias will not be different (b9) except numerically. Similarly, Aristotle continues *Metaphysics*  $\Delta$ .28 on genus, quoted at the beginning of this chapter, with an explanation of otherness in genus:

Those things are said to be 'other in genus' whose proximate substratum is different, and which are not analysed the one into the other nor both into the same thing (e.g. form and matter are different in genus); and things which belong to different categories of being (for some of the things that are said to 'be' signify essence, others a quality, others the other categories we have before distinguished); these also are not analysed either into one another or into some one thing. (1024b9-16; Ross, trans.).

Lennox (347n24) observes that in  $\Delta$ .28, Aristotle does not distinguish the different cases (metaphorical, categorial, etc.) of genus which Grene (1974) claims to find. Instead, while not talking in  $\Delta$ .28 about sameness in genus, he argues that difference in genus is difference in substratum, with the qualifications mentioned. Grene argues that in this passage, the identification of genus and matter is pulled apart because *eidos* and *hylê* differ in genus (p. 56). However, Grene's comment is inaccurate because Aristotle is talking about the identification of the genus and the proximate substratum, whereas she focusses on the concrete matter: Rorty comments in response to Grene that the genus of form and the genus of the matter refer to the genus of the composite .. and the genus of the stuff out of which the composite was formed, which will be different (1974, p. 75). Aristotle appeals to a variety of levels of matter in the deconstruction of things, and form and matter being relative, he would find levels of form, too. Taking Rorty's point, one must describe the form of the composite, as expressed in its definition, to be of a different level than the proximate stuff out of which the composite is made, because the form is a determination of the material substratum. A parallel to this account is to be found in the comments of David Balme on Grene's paper, as follows:

If I define a genus in my way of thinking, I have to state a group of possibilities; e.g. Bird is Animal having two long/short thick/thin legs, long/short feathers, etc. These are the differences possible within the generic similarity. Therefore the definition of a genus cannot be a list of determinations (as the species is) but a list of alternative possibilities which can be more or less vague and far-reaching according to the taxonomic level at which you put the genus (and this is only a matter of convenience, again unlike the species). The proximate matter of a bird is stuff capable of these differences; it may be merely stuff capable of developing wings rather than forelegs, or it may be worked up to the point where it is capable

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of long or short wings but not this that or the other - i.e. it is nearer the specific determination.(fn.10 in Grene, 1974, )

The substratum is in need of determination by possessing a range of possibilities, which a substantial form gives to it either by the procreation by the parents or by the skill of the craftsman. But in the varying degrees by which the form can dominate (*kratei*) the matter, different possibilities arise for the composite thing. Grene argues that this notion of genus (as "the unity of categorial context open for distinctions of more and less"(1974 p. 120)) is metaphorical, rather than concrete. But once again, it is difficult to see why this must be metaphorical, given that we can ostensibly notice the quantitative, or qualitative, differences between forms of a kind. The unity of a genus is by analogy, in some cases, or by the more and the less: these stances were defended in chapter V on the biology. Yet the identity of genus and matter does not fit that metaphorical model of identity and difference; like Lennox, I conclude that Aristotle's identification of the genus and matter is to be taken as a commitment on Aristotle's part to the identification of the two as substrata. "Animal stuff" is physical matter capable of sustaining conscious life. The same sentiment is expressed by Aristotle in the biological works. In the *Parts of Animals* I.3 Aristotle is discussing division, and particularly the problems of division by dichotomy: splitting a group according to whether its members/subsets have or do not have a certain property. As we saw in chapter three, Aristotle thinks that dichotomy must fail because it would involve grouping animals together which belong in different groups: this is the same problem Aristotle discussed in *Metaphysics* I that taking contradictories as the grounds for differentiation will involve everything in the universe. For example, everything in the universe either is or is not a cod and is or is not a raven; but the members of the class of non-cods will be partially contained within the class of non-ravens, overlapping groups. Again, we find that the *eidos* is the differentiation of the matter or genus. Aristotle argues that

It is the differentia in the matter that is the species. For just as there is no part of an animal without matter, so there is none that is only the matter; for it is not body irrespective of state that can be an animal or any part of one, as we have often said.(643a24-27; trans. Balme 1972<sup>30</sup>)

By 'parts', in this context, Aristotle refers to the proper parts of a thing (e.g. web-footed), which are not simply the "so-called elements of all bodies" but are rather the proximate materials into which a thing can be analysed.

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<sup>30</sup>In his (1987), Balme translates 'εἶδος' as 'form'.s

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The animal kind being analysed will have some qualitative difference which sets it out as a kind, because the material parts will not be sufficient for the being of an animal kind: this could be defended in a variety of ways, such as the appeal to the unity of matter and form as correlatives, and because like the matter of an artefact, we could have the material stuff without the form. For example, the bronze is not yet a statue, nor is an unfertilised egg in a specimen dish a man (Θ. 1049). At the level of proximate matter, too, it would be impossible to say that the matter of the thing is *what it is* independently of the fact that it has been enformed in such and such a way, as noticed by Theophrastus. However, the material parts will be necessary, in the sense that if the form is to occur, it must occur to the type of stuff which allows for/does not prohibit the appropriate structural properties: recall the discussion from the *Physics* of the necessity being contained within the matter. As he had said, in order for something to achieve its proper function, the material out of which it is made must be able to sustain that functioning. A recurrent example in Aristotle's philosophy is the snub (nose), a commonplace reference to the nose of Socrates<sup>31</sup>, which is a translation of a *single* Greek term 'τὸ σιμόν'. Yet Aristotle appeals to the snub in another appeal to the "genus as matter"<sup>32</sup>. The example also shows that Aristotle does intend to treat the genus as matter thesis literally, even to the point of specifying to which class of things the thesis pertains: composite things which are a *this in this*. In *Metaphysics* K.7, Aristotle is providing an answer to the question whether one or more than one science must study the first principles of demonstration (asked in K.1 1059a26). Aristotle argues that each science has its own particular domain, but that the sciences which are prior have principles which apply in the subordinate sciences. In K.7, he writes:

And since each of the sciences must somehow know the 'what' and use this as a principle, we must not fail to observe how the natural philosopher should define things and how he should state the definition of the essence—whether as akin to 'snub' or rather to 'concave'. For of these the definition of 'snub' includes the matter of the thing, but that of 'concave' is independent of the matter; (1064a19-24)

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<sup>31</sup>Socrates defends his features in Xenophon's *Symposium* 5.6: the snub is better able to fulfil its smelling function by having nostrils turned out to catch the scents from all around; the recessed bridge of the nose allows the eyes to see better whatever one wants, without the barricade between them.

<sup>32</sup>Cf. *Metaphysics* E.1, of which this is a parallel passage according to Ross (1929 v.2 p.305, 320), and *De anima* III.4 "for flesh necessarily involves matter and is like what is snub-nosed, a this in a this"(429b14); *De anima* III.7 431b13; also *Physics* II.2 194a6, *Metaphysics* Z.10 1035a26, and others we will examine below; they all instantiate a similar point.

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Thus we are given the class of noses, which is to be differentiated, and the concavity as that *diaphora*, the particular form that the snub has. But try explaining the snub without mention of the nose: it is defined as particular kind of concavity, i.e. that in a nose. The genus seems to be the matter in the proximate physical or organic sense. However, Aristotle repeatedly takes the snub to be representative of organic substance. He says in this chapter that the model of the snub shows how the natural philosopher should define things; in E.1, he says that "in the snub matter is implicit"(Kirwan, 1025b33). In *Metaphysics* K this is explained by the fact that snubness is an attribute of (some and only) noses, requiring us to include the nose as part of the definition, and similarly with the other parts of animals and the animals themselves; the contrast is with concave, the aspect of things "with outline or surface curved like the interior of a circle or sphere"(Fowler and Fowler, p.249) which does not require mention of the concrete or intelligible matter.

In Z.5, the problem of the snub led Aristotle to argue that a dilemma arises if we try to define it, which would be seriously problematic if many natural things are like the snub: on the first horn, if we take 'snub' as having a meaning apart from its matter, then 'snub nose' is the same as 'concave nose' and 'snub' and 'concave' are the same, which is false because things other than noses can be concave. On the second horn, if we maintain the reference to the nose, either 'snub nose' is unspeakable or repetitive ('said twice') because we'd be obliged to say snub nose nose. The solution to the dilemma, which we should expect to find by now, is that the dilemma is not vicious: we can challenge the second paradox, thereby denying the redundant repetitiveness of 'nose'. Aristotle does this by appealing to the general principle that in "the case of terms that are predicated of the terms through which they are defined", (say, concavity is predicated of snub,) you should say that 'concavity' used in the definition "is not the same in abstraction as it is in the whole phrase" (181b35). For of course concavity can be said of other things -- bandy legs is his example, or one could use it to describe lenses, roulette wheels, etc., and in each of these cases its meaning could change: thus, 'snubness' is the affection of concavity belonging to a nose (ῥινὸς τοδί, οἷον πάθος; 182a4).

Aristotle also argues that indeed, if things such as the snub have a τί ἐστίν, (the same phrase as used in K.7) an infinite regress would arise: in what I call the 'Second Nose Argument', Aristotle argues that the snub (τὸ σιμὸν) being of the nose, if we talk about the snub nose (ῥὶς σιμή: two

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words) we would instantiate into 'snub' the definition to get 'snub nose', replace 'snub' with the definition to get 'snub nose nose', replace again to get 'snub nose nose nose', et cetera<sup>33</sup>. Aristotle says in *SE* 13, "if snubness is a concavity of the nose, and there are snub noses, there are concave noses noses/εἰ τὸ σιμὸν κοιλότης ῥινός ἐστιν, ἔστι δὲ ῥις σιμή, ἔστιν ἄρα ῥις ῥις κοίλη"(173b9-11); I am taking his 'SNA' to be one drawn from the phrase 'snub nose' itself as the condition of the snub (cf. Hare, p. 174). Its being what it is (τί ἐστι) is being something in something else, and so to state its being is to include mention of that something else in the *logos* of what it is. But if that essence is always in something outside of it, then the regress begins: snub nose becomes snub of a nose, in a nose, etc., independent of the definition provide for it, and we cannot start our investigations into the essence. But if we find, *contra* the pallor of a pale man, that the object under scrutiny is in something else, and that it is only in such a something else that it can occur, the two are not simply a sum, but a natural unity like "rational"<sup>34</sup>.

Thus the regress can be avoided without losing the meaning of 'snub' by ensuring that the material subject of the snub is mentioned in the definition, or at least that the account "must always be stated without eliminating the matter". The *Metaphysics* K.7 passage is thus an instance of the genus as matter thesis because it fulfils the criteria given in the

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<sup>33</sup>Approaching the generation of the regress in this way requires taking on board an apparent inconsistency on Aristotle's part. To get the regress of 'snub nose=concavity of a nose' requires that 'snub' be taken to mean not only 'snub = concavity in the nose' but also, at alternating steps 'snub = concavity', which is the view that we take the meaning of 'snub' without its matter, which (Aristotle says) is false, as mentioned. However, he could be taking a holistic view of things as generated in such a way that the instantiation of 'snub = concave' is grounded in the fact that in the definiendum, there is mention of the material nose, which becomes the object of regress. In this reconstruction, snub is taken to be 'snub of a nose', getting the regress by repeatedly instantiating 'snub of a nose' into 'snub', which is equivalent to taking 'snub' to be equivalent to 'concave'. The generation of the regress depends on this equivocation -- I thank Dr. Scaltsas for helping me to see this issue -- but Aristotle can use it by treating snub as a proprium of noses which are concave in aspect. In *Met* a.2 Aristotle explains his rejection of the infinite regress in various forms in which it is found; relevant to the Z.5 regress are the arguments that a) epistemically, one cannot know the essence of something if one does not reach an unexplained term which can serve as a first principle: the first definition is always more informative than its (putative) entailments; b) metaphysically, a material explanation must appeal to something which is changeable, but anything changeable is changeable in some relevant respect -- an infinite number of respects is impossible. The problem in the Z.5 regress is found in taking the snub to be both something in its own right (καθ' αὐτὸ) and had by addition (the topic of Z.5); as he made clear in Z.6, Aristotle believed that it is impossible to have it both ways.

<sup>34</sup>Aristotle also objects that 'snub' should not be used as a noun but only as an adjective (182a3).

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converged definition of genus as matter, "the what which underlies the differentiae." This will be the manner of definition of composite things by the natural scientist, because of the dependence of composite things on the matter which they qualify. The example of the snub is of an accidental unity, because noses do not have to be concave, but when the nose is a snub, the material nose must be mentioned. And if the genus and matter are part of the being of such things, then what could be said of the dispute between literalists, analogists, and heuristicists? It seems that an identity can be found.

A source popularly believed to support the genus as matter thesis can be found in *Metaphysics* Z.7. There, Aristotle is considering the nature of matter and the components that make up a substance; having established that in the case of a substance or one of its accidents coming to be, the material is present before the maturing of the form in the matter, he asks the following:

But must there also be present a part that occurs in the formula? Well, in fact we speak in both ways when we say what a bronzen circle is, saying that the matter is bronze and the form is such-and-such a shape (that being the genus under which it first falls). So the bronzen circle has its matter in its formula. (Bostock, trans.)

ἀλλ' ἄρα καὶ τῶν ἐν τῷ

1033a.1

λόγῳ; ἀμφοτέρως δὴ λέγομεν τοὺς χαλκοῦς κύκλους τί εἰσι, καὶ τὴν ὕλην λέγοντες ὅτι χαλκός, καὶ τὸ εἶδος ὅτι σχῆμα τοιόνδε. [καὶ τοῦτό ἐστι τὸ γένος εἰς ὃ πρῶτον τίθεται]. ὁ δὲ χαλκοῦς κύκλος ἔχει ἐν τῷ λόγῳ τὴν ὕλην. (My brackets)

As mentioned before, the case of the bronze sphere poses interesting difficulties, because there is no proper matter for a sphere: it could be of bronze or wood, etc., and the bronze will persist in a way I have denied to the matter of organic wholes in the previous chapter. The bronze circle is a related whole rather than a substance. If bronze is to become a circle, then the bronze is arranged in such a way that the only determination of it by form is according to location. That is, the position of any bit of the bronze must be within the circumference of the circle. But Aristotle has also been discussing the production of plants and animals, which are unified substances with proper matter. The suggestion (implied in Aristotle's statement, above) that the bronze circle has an essence leads us to believe that there is an essence or definition of such things in the same way as there is a definition of unified wholes -- note that the term used here is "λόγος" rather than "ὄρισμος" of the "τί ἦν εἶναι". The definition would be "figure whose circumference is equidistant at any point from its midpoint, which is made of bronze". The formula to construct it would be "bits of bronze laid out in a way that the contiguous extremes of its shape

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are equidistant from its midpoint". But even accepting Ross's suggestion (1929, v.ii, p.186) that the bracketed phrase is a gloss, how does the matter occur in the formula, and can it then be identified with the genus? As we noted from the I.9 passage (1058b3-10), above, the matter does not make a differentia, entailing that individuals do not make species/forms (*eidê*) of a genus.

Comments on this passage fall into the divisions we are familiar with between the literalists like Rorty, analogists like Grene and the non-committal<sup>35</sup>. To interpret this passage, we must settle the question of the emendation of the text. On Ross's view, the phrase translated "that being the genus under which it first falls" is "perhaps" a gloss by someone interpreting the passage according to the genus as matter thesis. First, we must note that shape *is* the genus in which sphere first falls, and given that matter does not provide a differentia i.e. create a distinct substantial form (*Metaphysics* I.7-9), *brazen* (1033a17-19) will not create a genus. (This fact also prevents us from saying that there are two genus as matter theses, one each for organic wholes and accidental unities.) For these reasons, I accept that the text might be an addition, but if so, it is Aristotelian in spirit. Second, Ross is correct to point out that Aristotle is here using the example of a "λόγος ἔνυλος", but particularly a "λόγος ἔνυλος" which takes as matter bronze, although its *eidos* could be part of a nickel circle: the bronze is not essential to the circle, but is part of the formula of the bronze circle. So if the genus as matter thesis occurs making use of the stated

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<sup>35</sup>Gill comments that Aristotle is here asserting the conclusion that the account of a composite must not explain the form of the composite in isolation from the matter (1989, p.135). However, Irwin argues that the matter is not 'a this' (1988, §12n31). Likewise, Granger argues that the matter of the definition seems to be the potentiality made actual by the differentia (1984, p.28). Rorty argues that form is not substance but part of it (the question answered at 1033a2) because matter is part of the formula - of brazen sphere at 1033a6. He mentions that "[a] bit later, in chapter 8, he decides that "'man' and 'animal'" correspond to "brazen sphere in general" (1033b24-6)"(p. 405): this and the previous passage suggest that matter and form are not to be seen as concrete parts, but parts of the unified whole, but the example is a misleading counterfactual because the circle does not take bronze as its proper matter. Rather, the form (taken to be essence) must include the matter in some way(p. 406). But Grene is correct to emphasise the apparent inconsistency of this passage with the identity interpretation of the genus as matter thesis: if the genus of the bronze circle is "figure" and the matter of the bronze circle is "bronze", then unless these two are to be identified, which is implausible, the genus is not the matter (p.58). She follows Ross, who argues that Aristotle's point in this section is to explain that things like the bronze circle are a *λόγος ἔνυλος*, but that the genus as matter thesis does not occur (contra Alexander and Bonitz) (Ross, *ibid.*).

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genus, Grene is right that there could be simply an analogy between genus and matter elsewhere<sup>36</sup>.

Yet the genus as matter thesis could be read into the quoted passage as a whole, in a meaningful way. Taking figure to be the genus of circles, as the proximate genus of which "with points equidistant from the centre" is the differentia,<sup>37</sup> bronze circle can be explained by the genus as matter thesis. Using the example, we would first be given a heap of bronze -- whether as ingots, or some amorphous mass. It will have a shape, call it  $f_1$ , but if the shape is expressible in terms appropriate to plane figures, it is so only accidentally. Yet the smith can stamp or otherwise shape the lump of bronze into a geometrical circle -- say, an obol for a day's jury duty -- using the appropriate ratio. The pre-existing bronze  $f_1$  comes to be a bronze circle, by the rearrangement of its parts. Yet shape is the proximate matter and genus of the bronze sphere because it provided the source from which the bronze sphere was generated. The concrete matter of the bronze sphere is incidental, because the sphere does not have any proper matter, in the concrete sense -- only the bronze sphere does. Thus Ross is correct but misleading to say that Alexander and Bonitz are wrong in finding a reference to the doctrine that genus is matter: 1033a1-5 does not make explicit reference to the thesis, but does make implicit appeal to it.

The point that the genus as matter thesis is required for the explanation of organic wholes is more clearly made in *Metaphysics* Z.12, which Grene has named the πτε (παρὰ τὰ ... εἶδη) passage, and sees as proving proof that the 'genus as matter' thesis must be taken analogically: Aristotle argues that the differentia is all that is needed for a definition, a view which apparently adds great credence to the claim that the genus is

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<sup>36</sup>Ross offers three objections to the hypothesis that the genus as matter thesis is being referred to in this passage, none of which I find convincing -- even though I'll come to the same conclusion below. First, he believes that Aristotle should have mentioned the form as a pre-existing part, but then second, points out that Aristotle takes up this question in the *next* chapter as a *new* question, where, third, he sets aside the "notion that part of the form pre-exists while the rest supervenes (b11-16)"(p.185). None of these seems to deny the genus as matter hypothesis to this text, however, because the fact that Aristotle resumes the question in a later chapter may have nothing to do with Aristotle's editing but may presuppose an arbitrary distinction by Andronicus or some later editor. The role of matter in generation is a focal topic of Z.7, so it is not surprising that Aristotle examines its place in the λόγος first. Finally, Aristotle probably qualified his examination in Z.8 because the topic is dealt with at great length elsewhere, notably in the *Physics* and other physical texts concerning the contraries through which a changing thing passes.

<sup>37</sup>The example is still liable to mislead, because circles do not have the final cause as such which is the highest expression of essence; yet Aristotle repeatedly claims that in the case of many things the formal and final causes are the same.(1044b1; see Introduction n14)

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not to be identified with the matter. This is an answer to the question how it is that the components of a definition are a unity.

If the genus absolutely does not exist apart from the species which it as genus includes, or if it exists but exists as matter (for the voice is genus and matter, but its differentiae make the species, i.e. the letters, out of it), clearly the definition is the formula which comprises the differentiae. (1038a5)

The genus as matter thesis occurs in this passage as a disjunct<sup>38</sup> provided to account for the unity of one type of definition. The lack of prominence accorded to genus is used to justify the theory that this type of definition needs only to mention the last differentia: with it, the definition had by division will be a unity. The division continues because "we always want to go on so till we come to the species that contain no differences", i.e. the atomic forms (1038a16). The outcome of this effort will be the last differentia, which "will be the form and the substance"(1038a26). Recall that in H.6, one conclusion is that the actualised form is the explanation of the unity of the thing. As I argued in chapter VI, the genus will be entailed by the last difference because division by definition is the method for finding the essence of things, excluding the accidental properties which may seem to be part of the definition, if we could pick from any attributes belonging to members of a class.

Interpretations of this passage differ between attributing to Aristotle anything from the ridiculous to the sublime. In "sublime-mode", Aristotle is taken to be describing the substratum of change, the realm of possibility which is instantiated in the plethora of natural kinds in the natural and human worlds<sup>39</sup>. A neutral view has it that Aristotle intends in this passage to show how it is that genus is unnecessary for definition, taking this text to mean that the genus drops out of the theory of definition.<sup>40</sup> In "ridiculous-mode", Aristotle is taken to be explaining

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<sup>38</sup>I agree with Rorty (p. 74) *pace* Ross that it is not an exclusive disjunction. See ch. VI §iii. Bostock describes the disjunction as 'casual'(p. 281).

<sup>39</sup>Gill interprets this passage to mean that the genus "can be divided into definite species"(p.141). Pellegrin calls this the "canonical formulation" of "generic enclosure" of the *eidê* (p.57), the topic we examined above using *Metaphysics* I.

<sup>40</sup>Ross explains that the last difference "will presuppose all the previous differentiae and finally the genus" and interprets the passage as groundwork for the elimination of the genus, which "offers no obstacle to the unity of the definition"(1929, v.II, p.207). According to Granger, "the genus as that which does not exist apart from the differentiae is simply nothing apart from or nothing in its own right above and beyond the differentiae or species"(p.19): this chapter contains the third of Aristotle's positions on the genus-difference relation, according to which the differentia is more important (Granger p.14). Halper takes issue with the validity of the conclusion offered in this passage, arguing that Aristotle isn't using the genus as matter thesis in this text because that "[the] genus has not been eliminated from the definition at this point is evident because the subsequent

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things in a way heavily dependent on the analogy by which matter is defined in the *Physics*, but overstepping the apparently well-defined boundaries between language and the world<sup>41</sup>.

Yet is it necessary that the genus drops out? First, this is not a problem according to the genus as matter hypothesis, because the genus becomes more determinate as it is realised in its instances. From the last difference(s), we would be able to trace other differences and *genê*.<sup>42</sup> As

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discussion continues to refer to differentiating the genus animal"(p.111). Similarly Bostock (p.182 and see below).

<sup>41</sup>The London seminar (hesitatingly) explain that "If we select one last differentia and understand it as implying the rest, it will be single in expression only", sharing some properties with the genus, which must be instantiated -- and they find the comparison to the voice "ludicrous" or a case of actualising "vocal possibilities".(Burnyeat, 1979, p.104-6). LeBlond calls this an instance of definition by genus and difference, rather than definition by matter and form: he argues that "analysis by genus and difference is constantly confused with analysis into matter and form; but the genus is not really matter at all, neither concrete nor abstract -- it is not the matter of the *object*, but at best the 'matter' of the *definition*"(1979, p. 71) i.e. intelligible matter. Michael White's view is quite similar: like LeBlond, he distinguishes between different types of definitions to be found in Aristotle's work, and argues that definitions by matter and form are those referred to in H.2 1043a19-22, involving an addition of the parts, since "a *logos* constructed in terms of <<parts>>, <<components>>, or <<elements>> (ένυπαρχόντων) involves the matter of a thing"; in contrast, definitions had by division with genus and difference are those for which the genus need not be mentioned (p.48). According to Grene, Wieland calls this passage a *Reflexionsbegriffe* - a concept or principle to help one understand - guiding the pursuit of the basic *eidê* (1974, p.65)

<sup>42</sup> To make this thesis consistent with Aristotle's view in the biological texts that multiple differentiae are required in order to explain the *eidê*, I have pluralized this aspect, noting that I have diverged from Aristotle's text in Z.12. Yet Aristotle does go on to say in Z.12 1038a1ff that multiple differentiae will be reducible to one as the last difference. The interpretation that seemingly 'parallel' differentiae will be reducible to one deviates from the text just noted, because there Aristotle argues that whether many or two differentiae are provided, one will be the final difference, the other of two, at least, being the genus. Yet I believe for other reasons that putatively final differentiae will reduce to one final difference, because of Aristotle's theory that the last difference will be the substance of the thing: if this is taken to be the function of the substance, its "highest actuality", then his arguments against multiple goods, (*De Caelo* II.12, 292b10) will be contravened: if the essential actuality of a substance is defined by two activities, from different genera, then the substance will be divided against itself. That is, its behaving *qua* F, when F is its substantial actuality, will prevent its behaving *qua* G, when G is its other substantial actuality. This parallels the difficulty of having a substance within a substance. Yet if either F-ing or G-ing is supervenient, then this isn't a problem: the other will be entailed by it. For example, the essence of many artefacts is to serve dual functions, but these are reducible to (vaguely) serving human needs, in the way that a coffee dispenser's function is to react to the presence of a certain amount of coinage by pouring hot water into a cup full of powder, although this is for the sake of quenching the caffeine addiction of the recipient of the coffee. Note that even in *PA*, Aristotle doesn't say that dividing by many differentia will prove that any chosen differentiae are essential, and he does use the singular "διὰφορὰ" for differentia in *PA* I.3, examined above. Cf. Balme 1972, p.117; Bostock p.183. Yet an interesting parallel might be found in the need for multiple differentiae for certain classes of (non-primary substance) things: for example, Thucydides's description of the 430 BC plague of Athens is difficult to diagnose in terms of modern disease categories, because

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Balme puts it "in a true division, as Aristotle points out, the final differentia implies its predecessors and should be sufficient by itself (*Meta.* VII 12, 1038a9; 25)"(1975, p. 184) This interpretation is entirely consistent with the determinate/determinable hypothesis regarding the differentia/genus relation, because both the genus and the matter are potentialities which are actualised by composite substances.

Yet Bostock comments that the example of sound to which Aristotle appeals can be interpreted as matter, but that the genus as matter thesis is dubious anyway: whether sound is taken as genus or matter, nothing Aristotle says, he believes, licenses the conclusion that the genus can be eliminated (p. 182)<sup>43</sup>. He seems to be pointing to the particular problem that in things such as the snub the definition could (in some sense) be stated without appeal to its genus: can we derive the necessity for the genus by which, in all possible worlds, the snub will entail its genus, such that in no possible world is it necessary to mention the genus? According to Bostock, the necessity of the entailed genus seems to be assumed by Aristotle, yet doesn't follow from the arguments given in Z.12. Of course we must distinguish between the definition of the syllable -- recall chapter VIII, in which I've discussed the syllable's relation to its letters as non-mereological unities, and the definition of qualities like redness, which do not require us to mention the particular matter of the post-box which is red, nor the substratum of other *accidental unities*.<sup>44</sup> A parallel problem is that which surrounds the issue of the analogy of substantial unities to artefacts: artefacts do not contain their matter in their essence as unities with the form, because the materials used in their construction are variable (at least in many cases). But they can still be defined according to their essential function, and using the genus as matter thesis: they could be machines, binary machine-code functions or the familiar vessels, ornaments and tools. In these cases, the definition will be like the form of Socrates, i.e. man (possibly plus other features), not mentioning the matter that makes Socrates the individual substance that he is. The difficulty of

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the various symptoms he describes overlap those familiar to modern biologists; I speculate that Aristotle's own medical background might have inspired his respect for things like this. On the plague, see Poole, J. C. F. and Holladay, A. J. 1979.

On the putative lack of parallel in the tracing back of the matter, if it is identical to genus, one answer is by analysis (*Metaphysics* H.4 1044a24)

<sup>43</sup>This will be only apparently inconsistent with the I.7 view that a common nature attaches to each differentia (1058a1-5).

<sup>44</sup>Bostock acknowledges the relevance of the distinction between accidental and essential unities (p. 282); and the problem which occurs with artefacts such as bronze (*ibid.*).

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unifying the parts again resides with Platonic predication, as examined in chapter IV. That is, if we ask why animal plus biped is a unity, we'll not be able to find an answer, apart from the fact that the substance as ousia/being of the thing has it so (or the form of the male progenitor made it so, plus other cases *mutatis mutandis*). In the Platonic case, the account of the generic or formal features of a thing is by appeal to the co-presence of a number of participant forms, which provide what is for Aristotle an accidental unity: the problem is how to account for organic unity. *Contra* Bostock, I'd argue that Aristotle could be charged in Z.12 with giving a bad example of the bronze circle, which is an accidental unity, instead of the syllable, which is a formal unity: Aristotle would have been slightly wiser to pick as examples things which are machines, such as a hydraulic pump, because they do exemplify the kind of unity which is more analogous to substantial unity: some have parts, at least, which could serve no other function. Or for another example, to provide a definition of the Prime Mover would be to account for both the form of the Prime Mover and for the genus of the Prime Mover, the Prime Mover being the only instance of its kind, i.e. god which moves without moving and thinks all things.

What can be concluded, then, about the claim that "the definition is the formula which comprises the differentiae"? First, no Greek term is the equivalent of "comprises", but the last clause is translated so by Bostock as a derivation from the use of the genitive case of "differentiae" and "out of/": the verb has been added. Furth renders the last clause as follows, "it's plain that the definition is the formula [constructed] 'out of' the differentiae", using square brackets to denote the added phrase; most literally, the clause is translated "clearly the definition is the out of the differentiae formula", i.e. it is the formula from the differentiae. Aristotle is appealing to the fact that in providing a definition of something, we are not giving an account of the genus -- the definition is not predicated of the genus, nor vice versa -- but an account of the differentia. Yet this would apparently allow the conclusion that the genus can be eliminated, at least in the sense that it *need not be mentioned*. Recall the problem of repetition which Aristotle often appeals to and which was discussed concerning the snub, above: the definition of concavity need not mention the flesh of the snub, but the definition of the snub must mention the nose because the snub is a nose with concavity appropriate to noses. A parallel would be to claim the huge gunship used in *The Empire Strikes Back* to fire on the rebel troops can be described as a featherless biped: it

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certainly is a featherless biped, but it is so only homonymously, because in the possible world of Spielberg, the gunship is of metal, and could not have feathers: it wouldn't be of the same genus as man.

Z.12 contains the most difficult counterexample which one might use to oppose the literal interpretation of the genus as matter thesis, because of the apparent claim that genus is not needed in definitions. Yet I have argued that the claim not only cannot be used as a counterexample, but also it supports the genus as matter thesis, taken literally. Yet there are other counterexamples to which philosophers and historians of philosophy might appeal.<sup>45</sup> The one which the analogy interpreter Grene takes to be the *coup de grâce* is *Metaphysics* Δ.6 1016b31-1017a2, in which Aristotle explains the different senses of unity. Aristotle comments that

Again, some things are one in respect of number, some in respect of form, some in respect of genus, some in respect of analogy: in number things whose matter is one, in form things whose formula [λόγος] is one, in genus things whose figure of predication [σχῆμα τῆς κατηγορίας] is the same, in respect of analogy any things related as are two further things. In every case the earlier imply the later, as for instance what is one in number is also one in form but what is one in form is not all in number, and whatever is one in form is all one in genus but what is in genus is not all in form; it is, however, in analogy, but what is in analogy is not all in genus.(106b31-1017a2; Kirwan, trans.)

Grene comments on the fact that things one in number, (or "numerically identical"), are those which are one in matter, whereas things which are one in genus are those given the same description: if the genus and the matter are identical<sup>46</sup>, then they should presumably be judged according to the same identity criteria (p. 59-60)<sup>47</sup>. However, Rorty points out that even so, this points to the fact that the genus embraces differences in concrete matter: the genus remains the "unmastered matter of accidents"(1974, p.75). The distinction between proximate matter, concrete matter and

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<sup>45</sup>Drawing of a distinction between matter and form *within* a genus (*De caelo* 312a12-14) does not pose a problem because the identification of the genera of the things within the genus could be identified with the material: Aristotle is using genus and matter to refer to different levels in the hierarchy of things. *Meteorologica* IV.12 389b27 and other references to dead hands and other body parts do not pose a problem for the genus as matter thesis, because as I have argued, as did Rorty, the dead hand is not proximate matter for the living hand. Aristotle's statements in *Physics* IV..3 210a18ff that there are senses of being 'in' something which place both the species 'in' the genus and the genus 'in' the species is consistent with and supportive of the account I have given of I.8 of the *Metaphysics*. Aristotle's claim in *De generatione et corruptione* 335b3 that the shape or form of something is its essence and definition, but the matter is not, is to be interpreted in the same way as Z.12 of the *Metaphysics*.

<sup>46</sup>Charlton argues that this text does not provide criteria of identity because identity is a two place relation, whereas unity is one-place (1994, p. 42-3); Gill disagrees (1994, p. 60-64).

<sup>47</sup>Predicates common to genus and to matter will be examined in the next section.

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generic matter must be kept: in the case of the matter which unifies things in number, we speak about the concrete matter of the individual like Bucephalus; but in the case of things which are one in genus, they will have the same term applicable to them, and will all be of such stuff as flesh, bones, scales, or feathers, which is all *animal* matter, but isn't the numerically identical concrete stuff for each.

### iii. The Principal Unity of Aristotle's Thought

We have seen in this chapter how the genus as matter thesis is stated, defended and put to theoretical use by Aristotle. We have seen in this dissertation how the philosophy of Aristotle is given as an essential tool for the student of nature eager to come to understanding of natural things. Thus, we should expect to find other instances of the genus as matter thesis being used as an explanatory tool throughout the corpus, in efforts to understanding the essential nature of natural things. Yet not only that, we should also find cases of its implicit use in philosophical questions.

One example is that used by White (1975) to prove the identity theory incorrect: this is Aristotle's examination about the possibility of coming to be out of substance. In *Physics* I.8, he argues as follows:

ώσαύτως δέ

οὐδ' ἐξ ὄντος οὐδέ τὸ ὄν γίνεσθαι, πλὴν κατὰ συμβεβηκός· οὕτω  
δὲ καὶ τοῦτο γίνεσθαι, τὸν αὐτὸν τρόπον οἷον εἰ ἐκ ζώου ζῶον  
γίγνοιτο καὶ ἐκ τινός ζώου τι ζῶον· οἷον εἰ κύων ἐκ κυνός ἢ  
ἵππος ἐξ ἵππου γίγνοιτο. γίγνοιτο μὲν γὰρ ἂν οὐ μόνον ἐκ τι- 20  
νός ζώου ὁ κύων, ἀλλὰ καὶ ἐκ ζώου, ἀλλ' οὐχ ἢ ζῶον· ὑπ-  
άρχει γὰρ ἤδη τοῦτο· εἰ δέ τι μέλλει γίνεσθαι ζῶον μὴ  
κατὰ συμβεβηκός, οὐκ ἐκ ζώου ἔσται, καὶ εἴ τι ὄν, οὐκ ἐξ  
ὄντος· οὐδ' ἐκ μὴ ὄντος· τὸ γὰρ ἐκ μὴ ὄντος εἴρηται ἡμῖν 25  
τί σημαίνει, ὅτι ἢ μὴ ὄν. ἔτι δὲ καὶ τὸ εἶναι ἅπαν ἢ  
μὴ εἶναι οὐκ ἀναιροῦμεν.

Similarly there can be no coming to be out of what is or of what is, except by virtue of concurrence. In that way, however, this too can come about, just as if animal came to be out of animal and animal of a particular sort out of animal of a particular sort, for instance dog <out of dog or horse> out of horse. The dog would come to be, not only out of a particular sort of animal, but out of animal; not, however, as animal, for that belongs already. If a particular sort of animal is to come to be, not by virtue of concurrence, it will not be out of animal, and if a particular sort of thing which is, it will not be out of thing which is; nor out of thing which is not. We have already said what it means to say that some thing comes to be out of what is not: it means out of what is not, as something which is not. Further, there is no violation here of the principle that everything either is or is not.(191b17-27; Charlton, trans.)

Taking 'animal' / ζῶον to represent a genus, White argues (I believe) that this text shows an account of one (particular) animal's coming to be *only accidentally* out of animal, in a way which a generated thing does not

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come to be accidentally out of its matter (because 191b26-7). White's text of preference, Wicksteed and Cornford's Loeb edition, does not include the emendation of Ross (within '<>' above; Ross (1936, p. 495) (and Charlton following him (p.80-1)). Ross argues that the emendation is necessary to prevent Aristotle from saying something "fantastic"(so Ross) or "too weird to be correct"(so Charlton). Although Aristotle would presumably say that a foetal dog arose out of some "unspecific animalness", White says, still the embryo is animal (adjective, in the role of 'brazen'); but, according to White, it "seems unlikely that even within the Aristotelian framework we would ordinarily speak of a genus term as <<potentially>> some specific τὸδε τι"(ibid.).

Ross comments that even on the unrevised reading, this passage presents no greater problem than "the ordinary generation of animals"(ibid.): I'd add that it presents no greater problem than any generation from an actual thing. The problem is the variability of matter which we examined in the previous chapter. *Contra* White, it is indeed possible for a genus term to be spoken of as potentially some specific thing: first, in the way that the matter has a nature. "Animal stuff", (if there were such a thing) for example, would allow for the generation of different types of animals according to the different opposite qualities which it could come to possess. This is the sense in which Aristotle says that the members of the genus, and the things made of a type of matter, are accidental to that matter: the genus and matter have the potential to be many things, or nothing, and will become different things according to the presence of an agent of change who can dominate the matter (or stuff of that generic type) by imposing onto it or generating in it a structure or form. What Aristotle does not allow is the existence of a substance within a substance, but he never argues that genera are substances *qua* substances; rather, substances belong to γέννη whose members have properties such as their own. Second, taking the Z.17 question and H.6 answer seriously, according to which the components of a definition are a unity because the genus and differentiae stand to each other as potentiality to actuality, the genus will be the potentiality to be a Socrates, for example.<sup>48</sup> *Contra* White, this text cannot be used to refute the identification of genus and matter; rather, Aristotle here presupposes that the thesis is true.

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<sup>48</sup>See also Granger 1984, p. 20.

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The most salient disanalogy to the genus as matter thesis is that a thing of a genus, say, an animal, can be referred to as an animal, by its generic name. This point is emphasised by Granger, who argues that in one part of his career, Aristotle regarded the genus to be the more important part of a definition, a point which is reversed by the time Aristotle got to writing Z.12. For example, in *Topics* I.5 Aristotle argues that "A genus is what is predicated in what a thing is of a number of things exhibiting differences in kind", which he amplifies by saying that they are things which can be given in answer to the question "what is it?"(102a31-4) such as Socrates being called an animal. However, a material thing cannot be referred to by the name of its material except *qua* matter. For example, that bronze will still be a statue/sphere, requiring reference as a heap rather than a unity. If it is a brazen bust, it is brazen (properly speaking) rather than bronze. The problem, as hinted, is that matter is referred to by stuff language rather than sortal language. How is Aristotle able to breach the stuff/sortal divide? The difficulty arises because of the nature of the material substrate: it is a stuff *lacking in the qualities which it will become or come to have*. The genus will still be a reference to the proximate matter as stuff which can resist or take on the new qualities: it is capable of taking on opposite forms, as we saw concerning I.8. When the matter is a unity with the form, however, it is different, and naming composite by the matter does not identify its essence, which is given according to the form. Yet once we have the form, then the genus, and hence the matter "of reason" or generic matter will be implied, according to the statements made in Z.12<sup>49</sup>. In itself, the matter is a heap, but as the potentiality made into an actuality by union with the form, the matter has structure.

A second putative problem with the identification of genus and matter concerns predication: if the substance is predicated of the matter, yet the form is not predicated of the matter, how is the differentia predicated of the genus, if the form and the differentia are to be identified? This is apparently a problem because of the many respects in which the differentiae cannot be predicated of the genus: being the more inclusive term (*Topics* IV.1 121b13; cf. *Categories* 3b3-4), the genus must embrace the differentia and its contrary, so a single differentia cannot be said of all

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<sup>49</sup>And there is a sense in which things are named by their matter, e.g. a man called 'skin and bones'. Further, the awareness of the matter of the proximate genus will also be implied: the doctor only accidentally knows how to cure my back-pain, because he knows human backs in general.

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members of the genus. For example, in *Topics* IV.2 Aristotle says that the genus "should not partake of its differentia [μὴ μετέχειν τῆς διαφορᾶς]"(123a7). Yet as we read in *Metaphysics* Δ.28, for example, the differentiae are qualities of the genus (1024b4): they belong to the genus as samples. Similarly, in both the *Topics* and *Metaphysics*, as the examination of Z.12 made plain, the generic qualities are entailed by the last difference, so Aristotle is committed to generic<sup>50</sup> content. The problem is partially resolved by noting the relevance of the levels of matter which Aristotle is committed to: the substance is predicated of the enformed proximate matter out of which it is made, as a potentiality which is actualised in the substance. The differentia is identified with the substantial form, the genus with the matter, and they stand in the relation of a actualisation of a potentiality. The differentia is an identical actualisation of its proximate genus, as one of its determinations by the possession of a contrary contained within the proximate genus. This is substantiated by Aristotle's account of genus in *Metaphysics* I.3, in which he states that genus is "that identical thing which is essentially predicated of both the different things [ὁ ἄμφω τὸ αὐτὸ λέγονται κατὰ τὴν οὐσίαν τὰ διάφορα]"(1054b30-1), i.e. the things which differ in form. They will differ in genus from other things, he states, because they differ in matter and source of generation (1054b27-30). Thus, taken as the proximate genus of which the substance is a member, the differentiae can be said of the genus as its potentialities.

Thus we have seen cause for the positive identification of genus and matter as it pertains to substantial wholes. First, they are both potential. The H.6 explanation of the matter/form and genus/differentia unity as the unity of potentiality and actuality establishes this. Second, neither the genus nor the matter are fully determinate because they each need something to make them an actuality: in the case of the matter the form gives it shape (minimally) or substantiality<sup>51</sup>. Third, each occurs at various levels in the analysis of things: in this chapter we have heard mention of the matter of sense and of reason, and in the previous chapter we studied the matter of elemental bodies of which all things are composed, and the intermediate and proximate matters of concrete things;

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<sup>50</sup>Recent developments in the linguistic theory of generics lead too far afield from the present issues to establish their relevance to this dissertation. See Moravcsik (1994).

<sup>51</sup>The one possible exception to this is the mule, although only a few females can mate. These usually show more inheritance from the father, who cannot be a mule.

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yet in the biological works, particularly, we find the genus being used to group things at a variety of levels -- although not for classificatory functions. Fourth, each is a principle of nature: as Aristotle says in  $\Delta.28$ , a genus is referred to when things possessing the same form generate continuously (1024a29-30), yet nature is a principle of change; and matter is one of the four primary principles of change (*Physics* I.7). Fifth, the proximate level of each is a unity with the differentia to produce individuals of the  $\acute{\alpha}\tau\omicron\mu\omicron\nu$   $\epsilon\acute{\iota}\delta\omicron\varsigma$ , (the " $\acute{\alpha}\tau\omicron\mu\omicron\nu$ " referring to its indivisibility into more determinate forms). Sixth, both are at some stages in Aristotle's career eliminable from the definition of primary substance, the matter because it requires form in order to be actualised, genus because it requires the differentia to be real. Finally, both are 'substrata' of organic substances, this providing the crucial middle term to establish substantial identity: they are substrata for differentiation, their unity with a generated form being the differentia<sup>52</sup>. Yet as substrata, traces of both the generic qualities and the matter are still present in the concrete substance, because the genus is a set of potentialities, i.e. to be  $A \vee \neg A$ ,  $B \vee \neg B$ , and the matter is what has been transformed. Yet both have been overpowered, so some of their potentialities are not actualities.

Thus, I take myself to have explained the various meanings given for genus, and shown that Aristotle can identify of the subject of differentiae and the component of the definition which takes the qualities. In identifying them in this way, Aristotle is able to explain the unity which is particular to organic wholes, the primary substances which the natural philosopher wants to understand: the genus as matter thesis provides the crucial link. Yet if the genus and the matter can be identified in this way, then what grounds exist for claiming that any of the meanings in  $\Delta.28$  is the focal sense of genus? I have argued that the sense of genus used when "the coming to be of the things possessing the same form is continuous" is derivative from the theory of change: there must be a common form being transmitted from the agent of change to the recipient of the change, which makes the two belong to the same genus if it is a case of the reproduction of a living thing; I have argued that the sense of genus which is used of those "with a common ancestor" is a sense derivative from the previous one, with qualifications; I have argued that the sense of genus which is

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<sup>52</sup>Aquinas agrees with the substratum analysis of the genus as matter thesis, although sees genus as a predicable, which points to a lack of identity (*Commentary on the Metaphysics of Aristotle*. v. 1, bk. 5, Lesson 22, §1123).

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used of "the subject of its differentiae" is tied to the notion of a subject which can take different properties, as a class of potentialities which are grouped in kinds; I have argued that the sense of genus which is used of "the first constituent in formulae which is stated in [answer to the question] what a thing is" is the same sense of genus as subject, which takes on qualities as given in the definition of a thing. All of these presuppose the idea of genus as subject of change, the thing out of which things are generated according to kinds. This provides grounds for locating the focal sense of genus in the subject of change, out of which as matter the members of kinds are generated.

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The list of texts, with abbreviations and translators names, is the following:

Text	Abbreviation	Translator
Categories	Cat.	E. M. Edghill
On Interpretation	Int.	E. M. Edghill
Prior Analytics	APr.	A. J. Jenkinson
Posterior Analytics	APo.	G. R. G. Mure
Topics	Top.	W. A. Pickard-Cambridge
Sophistical Refutations	SE	W. A. Pickard-Cambridge
On Generation and Corruption	GC	H. H. Joachim
Physics	Ph.	R. P. Hardie and R. K. Gaye
On the Heavens	Caelo	J. L. Stocks
Meteorology	Meteor.	E. W. Webster
On the Soul	de An.	J. A. Smith
On Sense and the Sensible		J. I. Beare
On Memory and Reminiscence	Mem.	J. I. Beare
On Sleep (and Wakefulness)	Somn.Vig.	J. I. Beare
On Dreams	Insomn.	J. I. Beare
On Divination in Sleep	Div.Somn.	J. I. Beare
Youth and Old Age, Life and Death, and Respiration and Breathing,	Juv., ., Resp	G. R. T. Ross
On Longevity and Shortness of Life		
On Breath	Spir.	G. R. T. Ross
The History of Animals	HA	D'Arcy Wentworth Thompson
The Parts of Animals	PA	William Ogle
The Movement of Animals	MA	A. S. L. Farquharson
The Progression of Animals	IA	A. S. L. Farquharson
The Generation of Animals	GA	A. Platt
Metaphysics	Met.	W. D. Ross
Magna Moralia	MM	St. G. Stocks
Nicomachean Ethics	EN	W. D. Ross
The Constitution of Athens	Ath.	Sir Frederic G. Kenyon
On Virtue and Vice	VV	Anonymous
Politics	Pol.	Benjamin Jowett
Rhetoric	Rh.	W. Rhys Roberts
Poetics	Po.	S. H. Butcher

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