

FINAL CAUSE AS THE UNITY OF SENSIBLE *OUSIA*: THE COMPATIBILITY OF
ARISTOTLE'S METAPHYSICAL AND PHYSICAL DEFINITIONS OF A LIVING BEING

by

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(Under the Direction of Edward Halper)

ABSTRACT

My project aims to show how metaphysical assumptions can be present in natural science without hindering the empirical aspect of natural science. Aristotle's conception of zoology lends well to this project being empirical and assuming that animals are *ousiai* or primary substances. For Aristotle, science depends on grasping a definition of a thing and demonstrating what attributes belong to that thing. But Aristotle is not consistent in how he defines an animal. In the *Metaphysics* Aristotle claims that an animal, a sensible *ousia*, is defined by one, final differentia. In *Parts of Animals* he claims that an animal is defined by many differentiae. Many contemporary scholars prioritize the latter answer. I argue that the two are compatible. First, Aristotle distinguishes between the way metaphysics studies a thing and the way physics studies the same thing. Metaphysics studies primary *ousia*, which Aristotle concludes is essence. Essence is one in the same ways sensible *ousia* is one. Physics studies how a thing comes to be, which presupposes the essence is one. Zoology, a branch of physics for Aristotle, studies how all the parts belong to any kind of animal. Second, I show that the metaphysical definition is of the form by itself; the physical definition is of the composite, form and material. This is not yet sufficient to show compatibility, for the form could still be defined by many differentiae. Third,

science for Aristotle is primarily inquiry that seeks a definition and zoology seeks the definition of the form through the many differentiae. The many differentiae are the various material parts which we can grasp through empirical inquiry. Whatever unites these differentiae in one thing is the form and essence of the animal. This interpretation of Aristotle's zoology conforms to the way *Posterior Analytics* II argues how a scientist can seek the middle term of a demonstration through established facts. The middle term is also the essence. I conclude by showing how various explanations found in Aristotle's practice of zoology conform to my interpretation of Aristotle's conception of definition and science as inquiry.

INDEX WORDS: Metaphysics, Zoology, Definition, Differentia, Animal, Ousia, Empirical, Science, Inquiry

Final Cause as the Unity of Sensible *Ousia*: The Compatibility of Aristotle's Metaphysical and
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DEDICATION

TO MY PARENTS, TOM AND SHIRLEE WIENER,
FOR RAISING ME WITH THE MORAL CHARACTER TO FINISH SUCH A PROJECT.

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CHAPTER I: THE PROBLEM OF ONE OR MANY DIFFERENTIAE

1.1 Introduction

Studying Aristotle's zoology in an era where evolution has made all other conceptions of biology obsolete may seem like a fruitless endeavor or an exercise in intellectual history. Even worse, Aristotle argues that knowledge or scientific understanding is best expressed in a syllogism—a mode of inference that, on the one hand, has been replaced by a more powerful predicate logic and, on the other hand, seems out of place in an empirical investigation. Finally, at the heart of Aristotle's zoology is his conception of *ousia*.¹ Animal is Aristotle's paradigm example of sensible *ousia*.² But *ousia* is also primary being and a key concept in Aristotle's metaphysics. This connection raises a red flag for science: we generally suppose that science should be empirical, falsifiable, and devoid of metaphysical commitments. The history of science has shown that Aristotle's conception of physics was detrimental to the development of modern physics.³ The same argument has been made for Aristotle's zoology, which has

¹ There is disagreement on how to translate this word "*ousia*" into English. The standard translation of this word into English has been "substance." The problem with this translation is that it best matches one meaning of *ousia*, that which underlies (ὑποκείμενον) (Z.3 1028b36). Other suggestions such as "Entity" (Joseph Owens), "Being" (David Balme), "substantial being" (James Lennox), and "independent thing/thinghood" (Joe Sachs) suffer similar problems: each is not broad enough to cover the different senses of *ousia* but focuses on certain aspects of its meaning. I avoid the controversy by transliterating the word in this work. For Aristotle's claim that *ousia* is a primary in his biological science, see *PA* I.1 642a25.

² See *Metaphysics* Z.2 1028b10.

³ The classical articulation of this is found in Galileo. See his *Dialogues Concerning Two New Sciences*, Buffalo, NY: Prometheus Books, 1991, pp. 61-70. This is the famous passage where Galileo refutes Aristotle's claim that bodies free fall at different rates due to weight. Galileo, although here claiming that Aristotle was unlikely to test his claim through an experiment, was careful not to confuse Aristotle the philosopher with the Peripatetics of his day that dogmatically accepted Aristotle's views has correct. Numerous examples can be found where he claims that Aristotle himself may revoke his claim, and

been interpreted as hindering the development of evolutionary biology.⁴ But there is a difference. Numerous evolutionary biologists have stated that Aristotle was one of the greatest biologists who ever lived, most significantly, Charles Darwin.⁵ Allan Gotthelf argues that Darwin recognized the sophistication of Aristotle's principles of zoology, but it is possible that Darwin believed that Aristotle arrived at these principles through his detailed observations of zoological facts rather than being intimately connected to his metaphysical theses developed in his *Metaphysics*.

But this is precisely the problem: are the principles that Aristotle employs in zoology derived from or based on his metaphysical theses? A principle (ἀρχή) for Aristotle is an assumption that cannot be proved and is necessary to assume to prove anything else in that science (*APo.* I.10 76a31-36). A metaphysical thesis, at least in the way I will use it, is a claim about the being of a thing, i.e., determining what is most real about a thing. Aristotle calls what is most real about a thing “ousia” (*Met.* Δ.8 1017b14-6). It is possible that a metaphysical thesis can be a principle, but it need not be the case that a principle is a metaphysical thesis. Now, there is evidence in the *Parts of Animals* that suggests a positive answer to the above question. At *PA* I.1 642a24-25, right after

Stillman Drake supports this view. The point still holds, for Galileo prioritized experiment and experiential evidence over theory and metaphysics. For some of the passages where Galileo claimed Aristotle might revoke his claim, see Stillman Drake, *Discoveries and Opinions of Galileo*, New York: Doubleday Anchor Books, 1957, p. 118, p. 141, and p. 142. For Drake's claim that this was Galileo's view, see *Essays on Galileo and the History of Philosophy and Philosophy of Science*, Vol. I, Toronto: University of Toronto Press, 1999, p. 23.

⁴ For example, Elliot Sober argues that Aristotle's essentialism coupled with his natural state model demand that all differences from the natural state are to be viewed as monstrosities or unnatural. Assuming this kind of essentialism, there can be no natural process where a population over time could gain or lose a property. Population thinking, one of the cornerstones of evolutionary biology, is not possible. See his “Evolution, Population Thinking, and Essentialism,” in *Conceptual Issues in Evolutionary Biology*, Second Edition, Cambridge, MA: The MIT Press, 1994, pp. 161-89.

⁵ Charles Darwin stated this in a letter to William Ogle in 1882 by stating that “Linnaeus and Curvier have been my two gods, though in very different ways, but they were mere school-boys to old Aristotle”. See Allan Gotthelf, “Darwin on Aristotle”, *Journal of the History of Biology*, 32, 1999, p. 3. Gotthelf, in this article, defends the fact that Darwin serious meant that Linnaeus and Curvier were mere schoolboys to Aristotle, which has been doubted by numerous scholars, especially Simon Byl.

determining the relevant causes of the science, Aristotle announces the following: “One reason our predecessors did not arrive at this way is that there was no ‘what it is to be’ and ‘defining *ousia*.’”⁶ Aristotle claims at *Metaphysics* H.1 that the what it is to be or essence just is *ousia* (1042a17). Both passages are controversial, but the fact is that there is textual evidence for a strong connection between metaphysics and zoology in Aristotle’s writings. Scholars such as D. M. Balme and Allan Gotthelf argue that Aristotle uses the term “*ousia*” differently in the biological writings than in his *Metaphysics*. I will argue instead that not only does Aristotle use the term “*ousia*” in the same way, but the science of zoology is not possible apart from assuming the conclusions reached in *Metaphysics* ZH concerning *ousia*. But this raises the fundamental problem I want to explore in this dissertation. Can a science assume metaphysical theses and still remain thoroughly empirical?

Early 20th century philosophy called into question the legitimacy of a connection between empirical science and metaphysics. As Rudolf Carnap argued, not only does it make little difference to a practicing scientist in relation to his empirical studies whether he is an idealist or a realist or believes all is water, it is not clear that metaphysical terms have any meaning.⁷ But Quine recognized that this argument need not apply to ontology, traditionally considered a branch of metaphysics. Empirical science has ontological commitments, just like one who believes in the Homeric gods to describe natural phenomena, empirical science may be committed to the existence of atoms or material

⁶ Translation by James G. Lennox, except I replace his “substantial being” with “*ousia*.” All translations of *Parts of Animals* will be by Lennox, and I will always replace his “substantial being” with “*ousia*” simply to be consistent and avoid confusion. Lennox, *On the Parts of Animals I-IV*, Oxford: Clarendon Press, 2001, p. 7

⁷ See Rudolf Carnap, *Philosophy and Logical Syntax*, London: Paul Kegan, Trench, Trubner & Co. Ltd., 1935, pp. 18-22.

particles. Quine shows that there is a way to determine what these commitments are in his article “On What There Is.” Quine claims that to be is to be a value of a variable. A person is committed to those beings which make the bound variables of their claims true. But this formula cannot decide between competing ontologies, rather, as Quine states, “We look to bound variables in connection with ontology not in order to know what there is, but in order to know what a given remark or doctrine, ours or someone else’s, says there is.”⁸ Ontological issues only arise within the context of empirical science and cannot be decided apart from these sciences. Carnap accepts this view in a later work entitled “Empiricism, Semantics, and Ontology.”⁹ Both of these works make clear the consequence of this view: there is no first philosophy to decide what there is. This is the job of empirical science. All philosophy can do is clarify semantics within the debate, i.e., when one is committed to a certain ontology through their use of language.

Some of Quine’s views are challenged by philosophers in the second half of the 20th century that may at first appear to revive metaphysics as an independent science. Quine argues that there is no need to hold onto any essentialism, but philosophers like Kripke and Putnam argue that this dismissal of essentialism will raise problems for a theory of reference. Ever since Quine’s “Two Dogmas of Empiricism”, many philosophers have followed Quine in the claim that the meaning of a term that enables us to pick out the extension of that term can no longer be considered an analytic truth. Under the assumption that necessity is only found in language, not in the thing, Quine’s

⁸ Quine, “On What There Is”, in *From a Logical Point of View*, second edition, revised, 1980, p. 15.

⁹ Carnap accepts Quine’s claim that to be is to be a value of a variable, but, like Quine, acknowledges that this formula cannot be used to decide between competing ontologies. See “Empiricism, Semantics, and Ontology”, in *The Linguistic Turn*, ed. by Richard M. Rorty, Chicago: University of Chicago Press, 1967, esp. p. 78.

argument contributes to his claim that modal logic is superfluous. But this raises a problem with reference. Since there are no descriptions that are necessarily true of either individuals or natural kinds, there is no way to know whether the same thing is referred to in counterfactual situations. Identity over counterfactual situations demands that an individual or natural kind have something which identifies it as the same thing in each situation. For Kripke, the name that refers to the same thing in any possible situation is a rigid designator, but what enables the rigid designator to refer to the same thing each time is that there must be essential properties of that thing. Using a term as a rigid designator does not entail that we know what these properties are. Thus, Kripke and other philosophers such as Putnam revive a version of essentialism, coined by Quine as “Aristotelian essentialism”.¹⁰ But this new brand of essentialism does not claim that metaphysics is an independent science but remains only a logical claim about how names refer. In this sense, those involved in the revival of Aristotelian essentialism still follow the fundamental thesis of Carnap that philosophy is merely concerned with logical matters and there is no first philosophy.

Aristotle appears to take a different approach to metaphysics. He treats it as an independent science that arrives at or can arrive at positive claims about the nature of being. Since an animal is an *ousia* for Aristotle, these positive claims would appear significant for zoology. It is widely accepted today in the literature that Aristotle holds this position.¹¹ I will argue a more substantial claim here; namely, that empirical science,

¹⁰ See Quine, “Reference and Modality”, in *From a Logical Point of View*, Second edition, Cambridge: Harvard University Press, 1980, p. 155.

¹¹ David Balme is the first major figure to put forth such a view. His claim is that the biological writings can clarify the often obscure claims in the *Metaphysics* about *ousia*. See his “Aristotle’s biology was not essentialist”, in *Philosophical Issues in Aristotle’s Biology*, Cambridge: Cambridge University Press, 1987. For other scholars, see James Lennox, “Kinds, Forms of Kinds, and the More and the Less in Aristotle’s Biology”, in *Aristotle’s Philosophy of Biology*, Allan Gotthelf, “Notes towards a study of Substance and

at least the science of zoology for Aristotle, is only meaningful and coherent when grounded upon metaphysical theses. What I mean by “Y is grounded upon X” is that “X” is both ontologically prior and is what makes Y intelligible as a science is X. Although it may seem at first that many scholars of Aristotle’s zoology hold this view, this is not the case. Many scholars follow Balme in holding that Aristotle’s empirical research in zoology forced him to change and/or revise some of the conclusions reached in the *Metaphysics* concerning *ousia*. An empirical scientific inquiry that revises its own principles about the nature of its object is not grounded upon metaphysical theses arrived at independently of that empirical inquiry. Balme, on this view, seems to attribute to Aristotle a Quinian approach to natural science—there is no separate study of being apart from natural science. My claim is that Aristotle maintains the independence of both sciences, yet metaphysical theses will serve as methodological principles that govern zoology. But, since each science is independent, the inquiry into the parts of animals and their nature will remain thoroughly empirical. Thus, Aristotle’s zoology is both empirical and falsifiable even though metaphysical theses govern the science. Finally, in response to Carnap’s claim about the meaningless of metaphysical claims, I will argue how Aristotle’s metaphysical theses are meaningful both within the science of metaphysics but more importantly within zoology. The metaphysical theses are meaningful in zoology insofar as they allow for the possibility of explanation. Thus, a successful defense of Aristotle’s conception of the intersection of metaphysics with empirical

Essence in Aristotle’s *Parts of Animals* ii-iv”, in *Aristotle on Nature and Living Things*, Pittsburgh: Mathesis Press, 1985, Pierre Pellegrin, “Logical Difference and Biological Difference: the unity of Aristotle’s thought”, in *Philosophical Issues in Aristotle’s Biology*, David Charles, *Aristotle on Meaning and Essence*, Oxford: Clarendon Press, 2000, and Edward Halper, *One and Many in Aristotle’s Metaphysics*, Columbus, OH: Ohio State University Press, 1989, esp. pp. 114-18. For a critique of this interpretation in general, see G. E. R. Lloyd, “Aristotle’s zoology and his metaphysics. The *status quaestionis*. A critical review of some recent theories”, in *Biologie, Logique, et Metaphysique chez Aristote*, Paris: Editions du CNRS, 1990.

science shows that 20th century philosophy's dismissal of metaphysics is too hasty.¹² Its dismissal did not cover all conceptions of metaphysics.

My interpretation of Aristotle's conception of the intersection of metaphysics and empirical science adds to the scholarship on Aristotle as well. The interpretation I argue here is new. In the first half of the 20th century scholars of Aristotle commonly treated his zoology as a distinct enterprise from his metaphysics. Zoology is empirical and metaphysics is a priori. Although these two sciences study the same objects, they admit to two different methodologies and in no way relate to each other. Werner Jaeger posits a developmental view of Aristotle's thought in *Aristotle: Fundamentals of the History of His Development* to account for why he holds different methodologies to study the same objects. Jaeger resolves some apparent inconsistencies in Aristotle's writing by ascribing different texts or even parts of a text to different periods of Aristotle's philosophical career. These different periods relate to Aristotle's development of his philosophical thought. W. D. Ross, following Jaeger, articulated this same position in his work entitled *Aristotle*. But developmentalism suffers from at least two problems. First, any developmental story of Aristotle depends upon the chronology of the texts, but the chronology of texts is often determined by the scholar's claims about Aristotle's development. So, the defense of the development turns out to be circular. Further, even if a scholar attempts to avoid this circularity, there end up being many stories that can be told of Aristotle's development, each equally plausible and confirmed by one's reading of

¹² David Charles presents the same claim, though he argues it differently in his *Aristotle on Meaning and Essence*, Oxford, Clarendon Press, 2000, pp. 4-19. His two main points are that the essentialism of philosophers like Putnam, Kripke and others assumes the existence of the kind in the meaning of the term, and they make this assumption based on the fact that an every day person assumes that a natural kind term must refer to something real, namely, the underlying structure of a thing, e.g., that water is H₂O. How Aristotle's essentialism differs from the modern revival will be examined in the second and fifth chapters of this dissertation.

the texts. But the deeper problem is that, in respect to the relation between Aristotle's metaphysics and his zoology, developmentalism tends to ignore the significant amount of overlap of the claims made in each science. But under the Jaeger view, there is no relation between the two sciences.

In the 1960s, David Balme turned the tide against the Jaeger-Ross interpretation that the two sciences have little to no overlap. Balme pioneered the position that these two sciences have a more intimate relation. Balme begins from the problem that the doctrines put forth in Aristotle's *Metaphysics* can support numerous interpretations, especially the central books. His view is to turn to the biological texts first. Since they study the same thing as the central books of the *Metaphysics*, they are a good place to turn to see what doctrines Aristotle really accepted in his *Metaphysics*. The assumption is that biological texts give answers to the same questions more concretely, and they are a later and more refined articulation of Aristotle's views on the nature of living beings. This motivated numerous scholars to turn to the question of how these two sciences are related and whether Aristotle's claims in one science are consistent with the claims in the other science. Various inconsistencies are found between Aristotle's *Metaphysics* and his biological writings, but Balme now tries to smooth over these inconsistencies. For example, Aristotle makes apparently opposing claims about the definition of a sensible *ousia*. *Metaphysics* Z.12 concludes that an animal is defined by one, final differentia, whereas *Parts of Animals* I.3 claims that an animal must be defined by many differentiae. Balme claims that Z.12 cannot be read as stating the above conclusion for the definition of an animal must include its material. Balme reads *Metaphysics* H.6 to resolve this

problem insofar as Aristotle concludes that form and material are one.¹³ The conception of definition in the biological writings confirms this view. But Balme also acknowledges that the biological writings advance their own theoretical claims beyond those developed in the *Metaphysics*. “But teleology nevertheless is the primary subject of *PA*, and the other treatises likewise have primarily theoretical purposes. They are not just empirical studies in which some philosophical concepts are put to use.”¹⁴ But if zoology derives its own principles independent of any metaphysical theses, then this would return to the view that the two sciences are distinct from each other. It also becomes unclear how the biological writings could resolve thorny issues of interpretation in Aristotle’s *Metaphysics*. But even if his view is plausible, he fails to explain why Aristotle studies the same thing in the same way in two distinct sciences. But his new approach to interpreting the *Metaphysics* seems to require to address this issue. Balme does not leave us with a clear view of the relation between these two sciences or even if one is possible.

James Lennox accepts Balme’s approach but with one exception. The biological writings, since they were written later, can show us when certain claims in the *Metaphysics* have been refined or given up by Aristotle. Lennox picks out *Metaphysics* Z.12 and its conclusion that an animal is defined by one, final differentia as a primary example where the biological writings show that Aristotle has given up this claim. As stated above, *Parts of Animals* I.3 claims that an animal is defined by many differentiae. According to Lennox, this latter passage presents a more rigorous and elaborate

¹³ This view is stated in his article “Aristotle’s biology was not essentialist,” which is supported by two appendices, “Note on the *aporia* in *Metaphysics Z*” and “The snub.” These articles are found in *Philosophical Issues in Aristotle’s Biology*.

¹⁴ Balme, “The place of biology in Aristotle’s philosophy”, in *Philosophical Issues in Aristotle’s Biology*, p. 11.

methodology on how to define an animal than the one at Z.12.¹⁵ Lennox explains that the change in mind on definition arises out of Aristotle's empirical investigation of zoology. The inquiry just does not support that an animal can be defined by one, final differentia. In light of this, it would appear as if Lennox's tactic is similar to that of the Jaeger-Ross view: theory and practice of science are developed separately. The *Metaphysics* presents a theoretical attempt at how an animal should be defined whereas the zoology presents an answer in respect to actual empirical inquiry. On the other hand, Lennox's view may be the same as Balme's Quinian approach: there is no real separation between investigating the theory of a science and investigating empirical evidence. On either view, we are left with the same problem. Either the two sciences are disparate and have no relation to each other or they collapse into one science.

David Charles has one of the more promising approaches to the question of the relation between metaphysics and zoology. Charles sees the *Metaphysics* as determining whether the logic of the *Posterior Analytics* can be applied to an animal insofar as there is a single unified feature of an animal that is explanatory of all its *per se* attributes. The zoology, in turn, attempts to explain the various parts of an animal by finding this unified feature, the essence of an animal, and constructing demonstrations, i.e., scientific syllogisms, in accordance with the theoretical principles developed in the *Metaphysics*. But Charles recognizes a deep problem in Aristotle's practice of definition and explanation: although the *Metaphysics* succeeds in showing that each sensible *ousia* admits of a unified definition and explanation through one middle term, the zoology fails

¹⁵ See Lennox, "Kinds, Forms of Kinds, and the More and the Less in Aristotle's Biology", in *Aristotle's Philosophy of Biology*, Cambridge: Cambridge University Press, 2001, pp. 167-73.

to carry this out in practice.¹⁶ But if the zoology fails to uphold the theoretical principles in its empirical inquiry, the relation between metaphysics and zoology is severed. The zoological inquiry does not discover a unified cause for all the *per se* attributes. Theory and practice become disparate again as under the Jaeger view.

Montgomery Furth proposes yet another way to conceive of the relation between metaphysics and zoology in Aristotle's philosophy. He begins from the claim in Aristotle's zoology that an animal is defined by many differentiae, but he claims that this raises a metaphysical problem. Biological entities are best understood through form as opposed to merely being made up of Empedoclean compounds, such as bone which just is a ratio of the elements. Aristotle sees a deep connection between being formed and being unified. How, then, is an animal one thing if it is defined by many differentiae? Furth's claim is that metaphysics is required to solve a problem that empirical science is not able to solve. In other words, since empirical science studies *ousiai* and each is assumed to be one by this science, zoology has theoretical commitments it cannot ground. As opposed to Charles, who argues that the theoretical structure must be grounded before a zoologist can practice her science, Furth claims that empirical science leads to metaphysics when it relies on assumptions it cannot prove. Empirical science cannot show why an animal is one being. Thus, for Furth, the relation between empirical science and metaphysics is one of answering how a plurality can be one. Furth calls Aristotle's approach to metaphysics a Tarski methodology. This kind of methodology provides a deep theoretical foundation for doing a science.¹⁷ In other words, the metaphysics works out the logical problems to show what kinds of inferences can be

¹⁶ Ibid., p. 337.

¹⁷ See Furth, *Substance, Form and Psyche: An Aristotelean Metaphysics*, Cambridge: Cambridge University Press, 1988, p. 5 and p. 68.

made and how these inferences are possible. The methodology is not a separate science but one that clarifies and defends the theoretical commitments of a science, such as why and how a form is one. But it is unclear if the problems raised by Aristotle in the *Metaphysics* are merely logical in character. If Furth holds this above view of the *Metaphysics*, then the relation between the two sciences collapses into one science with an appendage for clarification, consistent with Carnap-Quine view of metaphysics. This contradicts Aristotle's own view that metaphysics is its own separate science.¹⁸

Finally, the last distinct approach to the relation between metaphysics and the zoology is to hold that the two sciences are distinct insofar as they study the same thing in different ways. Pierre Pellegrin and Edward Halper both discuss the relation of these two sciences in such terms. Both actually hold that zoology, falling under the science of physics, demands less unity of *ousiai* than the science of metaphysics. Pellegrin provides little motivation for accepting this thesis.¹⁹ Halper, on the other hand, stresses that the way in which an animal is studied in zoology is different than the way it is studied in metaphysics: the former studies all the essential attributes individually and seeks to show how they are connected to the genus whereas the latter studies the being of the object by itself, i.e., as one thing. This matches the distinction made of these two sciences at *Metaphysics* K.4 1061b25-33. This distinction also helps answer why plurality is stressed in the biological works for Halper—the animal has many attributes and motion

¹⁸ Aristotle makes this claim in numerous passages in the *Metaphysics*. See A.1 981b10-12, A.2 982a4-6, B.1 995b5-10, Γ.1 1003a21, E.1 1025b3-4, K.1 1059a18-22, and Λ.1 1069a18-19. This is not a claim that the *Metaphysics* is a coherent whole but only that it claims to be its own distinct science. Whether these passages are referring to the same conception of metaphysics as a science or not is irrelevant to my point.

¹⁹ See Pellegrin, *Aristotle's Classification of Animals*, translated by Anthony Preus, Berkeley: University of California Press, 1986, p. 32. Pellegrin claims that Aristotle is satisfied at *PA* I.3 with merely coordinating several lines of differentiae, and the critique is one aimed at the Platonist. This critique does not demand it also answer what is the unity of these multiple lines of differentiation. This still fails to address why physics demands less unity than the science of metaphysics.

requires multiple principles. Metaphysics, on the other hand, studies how the animal can be one and so be an *ousia*. Halper also claims that the science of zoology is not possible without a unified essence from which one can prove which essential attributes belong.²⁰ Thus, Halper sees an ontological and logical priority of the metaphysics over the zoology. But since Halper's main focus is on the *Metaphysics*, he does not work out the details for the zoology. This dissertation will work out such an approach.

The scholarly literature, as shown above, has had little success characterizing the relation between metaphysics and empirical science in Aristotle's thought. But there is a common thread running through all of the above approaches, including the Jaeger-Ross approach. Metaphysics demands a unity. Empirical science claims that an animal is a plurality. If there is to be a relation between the two sciences, one answer is that the unity explains the plurality in some way. But this is precisely the problem. Empirical science is insufficient on its own grounds to provide such an explanation. Metaphysics, on the other hand, attempts to reduce all plurality into a unity.²¹ But it is at least possible to rid ourselves of this tension. Aristotle's conception of scientific explanation, as argued in the *Posterior Analytics*, is that the explanation for why certain attributes belong *per se* to a genus is through its unified nature, i.e., its essence. These scientific explanations for Aristotle are best couched in scientific syllogisms or demonstrations, where the middle term is an essence, the nature of a genus, and this essence provides a connection of an attribute to a subject *per se*, necessarily, and universally. The essence as the middle term insures the fact that the premises used to prove the conclusion is true, primitive, immediate (i.e., without a middle itself), more familiar, prior to, and explanatory of the

²⁰ See Halper, *One and Many in the Central Books of Aristotle's Metaphysics*, pp. 110-18.

²¹ Any way one reads *Metaphysics* Z.12 and H.6, this appears to be the conclusion in each chapter.

conclusion. These are all requirements for a syllogism to be scientific so that we recognize that we have knowledge (ἐπιστήμη) (*APo.* I.2 71b17-26). Further, if the essence is a unity, and the attributes that belong *per se* to an animal are discovered empirically, then the possibility of resolving how the two sciences relate becomes possible. The essence or unity is what explains the plurality of attributes discovered empirically as belonging to the same thing. What an essence is, how it can be articulated as a unity, and that it belongs to things like animals properly are issues determined by the science of metaphysics. Zoology, on the other hand, takes these theses about essence and *ousia*, which are proved through the science of metaphysics, and assumes them to find both the specific definition of each animal's essence and show why certain attributes belong to each animal *per se*.

But this solution points to two bigger problems. First, Aristotle appears to be either inconsistent in defining the essence of an animal in the *Metaphysics* and the biological writings or he changes his mind in that the approach in the *Metaphysics* is not applicable in practice. Second, Aristotle's zoology does not seem to put this simple connection into practice and does not seem to use demonstrative syllogisms. Since demonstration assumes an essence as the middle term, the first problem has priority over the second. I will turn to this problem first. Thinking through this problem helps us think through the core issue of this dissertation: what relation is possible between metaphysics and empirical science? As shown above, the inconsistency in defining an animal has implications for Aristotle's theory of science—the middle term is an essence and an essence is what admits of definition. Not surprisingly, the *Metaphysics* assumes that a definition, since it is of one thing, must be a strict unity, and Aristotle shows that

this requirement is satisfied insofar as an *ousia* can be defined by one, final differentia. But the biological writings claim that the definition must contain a plurality of differentiae. In *Parts of Animals* I.2-3, Aristotle advocates multiple differentiation—dividing a genus by many differentiae to grasp the nature of the particular species. I will call this discrepancy between ways of defining an *ousia* the problem of one or many differentiae. This discrepancy seems to sever any relation between metaphysics and zoology. The real question here, then, is twofold. I will ask both whether these two views are actually inconsistent with each other and also whether or not there is a way to understand multiple differentiation as itself grounded upon the metaphysical thesis that a definition of an *ousia* must be one, since an *ousia* is one. I will argue that there is no inconsistency between the kind of definition reached in the *Metaphysics* and the definition as conceived in the biological writings: the latter is dependent upon the former. I will show that both definitions are acceptable within their respective sciences, but Aristotle's zoology presupposes the unity of the definition while empirically searching for the many differentiae in the definition of an animal. But this solution must be coupled with a defense that Aristotle maintains the unity of the essence in his empirical inquiry into the nature of animals. I will argue that Aristotle both puts into practice the kinds of scientific explanations consistent with the *Posterior Analytics* and seeks to explain all *per se* attributes via a unified essence. This argument will help show how Aristotle's conception of metaphysics does not hinder empirical science and give us reason to believe that Aristotle's metaphysical theses have meaning within such sciences. So, solving the problem of one or many differentiae turns out to be the central project of this dissertation.

1.2 The Problem of One or Many Differentiae

The problem of one or many differentiae involves a conflict on how to define an animal, Aristotle's paradigm example of an *ousia*. The conflict arises, as stated above, because Aristotle gives one answer in the *Metaphysics* and another apparently incompatible one in *Parts of Animals*. I will argue that this problem cannot merely be solved by a developmental hypothesis or explained away by some change of mind of Aristotle. The problem of one or many differentiae strikes at the very heart of the possibility of the science of zoology for Aristotle. Science is possible for Aristotle when one grasps the essence of a thing and uses this essence to demonstrate why certain predicates belong to a subject. This essence, insofar as it is a unity, insures the unity of the composite thing insofar as all of its essential features belong through one cause. But if Aristotle is inconsistent about the nature of this essence, whether it is one or many, we are left with either the problem that the kind of scientific explanation developed in the *Posterior Analytics* will fail to apply in zoology or Aristotle has given up the unity of the object being studied, here, an *ousia*. If the problem cannot be explained away as a mere change of mind and the two passages can be shown to be consistent, then the exploration of the problem will provide a path into deciding what the relation between metaphysics and zoology in Aristotle's philosophy is. I will begin by formulating the problem below, and then I will propose a rough solution to this problem.

It is best to begin by looking at the two texts where Aristotle proposes different methods of defining an animal. Aristotle concludes in *Metaphysics* Z.12 that an animal is defined by one, final differentia (1038a19-20), which I will call the "metaphysical definition". One reading of this text is that it solves the problem raised in Z.10-11

concerning the fact that any definition has parts, but an *ousia* is one thing and must be defined by something that is one.²² Aristotle assumes that the parts of a definition are the genus and the differentia.²³ Aristotle argues in Z.12 that this plurality can be conceived as one if the definer follows the method of proper differentiation. Why this is called proper differentiation is that the divider always takes what is proper of a difference, the difference of a difference, e.g., two-footed of footed. This method insures that the final difference actually entails all previous differences, and, assuming that the genus is either material for the differentia or nothing apart from the forms that fall under it, the final difference also includes the genus. But in *Parts of Animals* I.3 Aristotle argues that an animal cannot be defined by one differentia alone; the definer must pursue many lines of differentiation simultaneously (644a1-9). I will call this kind of definition the “physical definition”. This conclusion follows from what the literature standardly calls “Aristotle’s rejection of dichotomy.” Following Balme, “dichotomy” here is short for a single line of dichotomous division of a genus. To reject dichotomy is to deny that the genus together with the ultimate differentia of a single line of division will adequately define an animal. Given the claim in *PA* I.3, an adequate definition of animal requires more than one line of division under a genus. But Aristotle still maintains that multiple differentiation requires each line of division must be formed properly by taking the difference of a difference.

²² See Edward Halper, *One and Many in Aristotle’s Metaphysics*, pp. 110-18. This is by no means the standard reading of this passage. Z.12 is often read as an insert, following W. Jaeger, since it does not begin with a connecting particle and it is not clear how it relates to the previous chapters. See his *Studien zur Entstehungsgeschichte der Metaphysik der Aristoteles*, Berlin, 1912, pp.53-62. Along this same line of interpretation, Z.12 is also read as a doublet with H.6, which appears to deal with the same problem: how is the definition of a sensible *ousia* one? This interpretation was also made popular by Jaeger. But Z.12 also clearly states that the definition of an *ousia* must be one since it is one thing (1037b25-7).

²³ This claim is not universally agreed upon. Balme objects to this reading because the passage that introduces this problem in Z.10 states that the part of the statement of a definition is related to the part of the object (1034b20-1). Furth also objects, for he reads the parts as implying many differentiae that do not fall under one line of division. But the parts of the definition as presented in Z.12 are the genus and the differentia. See 1038a3-4.

Under Balme's view, each line of differentiation will arrive at only one, final differentia, but the definition will have many lines of differentiation, each of which belongs to the initial genus. *Metaphysics* Z.12 appears to endorse the method of dichotomy; thus, its conclusion is at odds with the conclusion of *PA* I.2-3. Even though *PA* I.3 endorses taking the difference of a difference when dividing any given line of differentiation (*PA* I.3 643b17-22), Aristotle says nothing about the nature of the genus in relation to any given line. Thus, it appears as if Aristotle has abandoned his claim in Z.12 that one, final differentia can express the definition of an animal and an *ousia*, assuming that the biological writings represent Aristotle's most mature thoughts on this matter. But as noted above, science is contingent upon finding a unified essence that serves as a middle term to explain why certain predicates belong to a certain genus universally, necessarily, and *per se*. The literature commonly argues that even though an animal lacks a unified essence, this by itself does not rule out demonstrative science in Aristotle's zoology.²⁴ Aristotle could just appeal to different middle terms to prove what attributes belong to a certain animal. In practice this seems to be the case more often than not.²⁵ But this appeal to different middle terms would violate the unity of the *ousia* assumed both in the *Metaphysics* and in *Parts of Animals* (Z.12 1037b25-7, Z.16 1040b16-20, *PA* I.3 643a1).²⁶ There would be no unifying cause for why all the *per se* attributes belong to one thing.²⁷

²⁴ James Lennox presents the clearest articulation of this view. See his "Kinds, Forms of Kinds, and the More and the Less in Aristotle's Biology."

²⁵ See Allan Gotthelf, "Notes towards a Study of Substance and Essence in Aristotle's *Parts of Animals* ii-iv", in *Aristotle on Nature and Living Things*, pp. 27-54.

²⁶ I am not assuming that Aristotle must or even does hold onto both assumptions, that *ousia* is one and that any science must employ the same middle term, but rather I am raising the question whether it is possible for Aristotle to hold onto both assumptions given the apparently conflicting ways he defines an animal in the *Metaphysics* and the biological writings.

²⁷ See David Charles on this issue, *Aristotle on Meaning and Essence*, pp. 191-95 and pp. 198-204.

On the other hand, multiple differentiation is necessary in zoology to grasp all the different parts that belong to an animal. It is clear that many parts contribute directly to the being of the animal. The method proposed by *Metaphysics* Z.12 assumes that the different parts of an animal can be traced back and explained by this unified essence. These two methods, though, would not be in conflict if the aim of multiple differentiation was to grasp the different parts that ought to be demonstrated to belong to that animal *per se*. This solution is the one that I will advocate, but it is questionable whether Aristotle ever accomplishes such a degree of demonstrative completeness of any given animal in his practice of zoology in *Parts of Animals* or any other biological treatise. Rather, he appears to employ different middle terms at different times to prove what attributes belong *per se*.²⁸ Even worse, it is not clear that Aristotle ever employs the methodology developed in *PA* I.2-3 that seeks out multiple differentiae of any genus or species of animal.²⁹ Some scholars such as James Lennox and David Charles have concluded from these problems that there is no solution to the problem of one or many differentiae.³⁰ But even if I can prove a way to conceive of both definitions as consistent with each other, there is another problem related to this issue and Aristotle's demonstrative science. Many scholars, most prominently Jonathan Barnes and G. E. R. Lloyd, would argue that we cannot construct a solution in relation to Aristotle's practice of zoology on the grounds that Aristotle does not employ demonstrations on a regular basis in his scientific writings and the biological treatises do not ever present its knowledge claims in

²⁸ Some of these middle terms are things like heat to prove why brains belong to certain animals (*PA* II.7 652b6-25), or protection and strength to prove why horns belong (*PA* III.2 662b27-34), or having or not having a complete set of teeth as the reason why one has one or many stomachs (*PA* III.14 674a24-34).

²⁹ Balme made this claim in 1976. See Allan Gotthelf, "Division and Explanation in Aristotle's *Parts of Animals*", in *Beiträge zur antiken Philosophie*, edited by Hans-Christian Günther and Antonios Rengakos, Stuttgart: Franz Steiner Verlag, 1997, p. 216.

³⁰ Lennox argues this in "Kinds, Forms of Kinds, and the More and the Less in Aristotle's Biology". Charles argues this in *Aristotle on Meaning and Essence*, especially Ch. 12.

axiomatic form.³¹ Aristotle, then, may not even employ definitions in his explanations, so any solution to the problem of one or many differentiae would be irrelevant, for it would not help clarify any issues in Aristotle's practice of science. On the other hand, those scholars who do argue that they can construct demonstrations from Aristotle's biological writings, e.g., Balme, Lennox, Charles, Gotthelf, etc., all agree that there is no unified middle term demonstrating why all the *per se* attributes belong to any given animal but there are numerous middle terms that Aristotle employs in explanations.³²

The above reasoning would lead us to conclude that the unity of an animal is not preserved in the practice of Aristotle's zoology. Such a conclusion seriously undermines Aristotle's philosophical project as well as his zoology. To understand why the unity of each *ousia* must be preserved for these aspects of Aristotle's philosophy, we need to grasp the role of definition both in Aristotle's metaphysics as well as its role in the biological sciences. Why is Aristotle concerned about whether an *ousia* has a definition and whether this definition itself is one? Aristotle claims in *Metaphysics* Z.1 that *ousia* is primary in knowledge and in formula (λόγος) (1028a32-3). A definition (ὁρισμὸς) is both a formula of what a thing is and allows someone to have knowledge of that thing. Further, the definition of *ousia* is primary in that all the other categories of being must have in their formula that they belong to an *ousia* (Z.1 1028a33-6). Thus, no formulae or definitions are possible independent of there being *ousiai* and definitions of these *ousiai*.

³¹ See Barnes, "Aristotle's Theory of Demonstration", in *Articles on Aristotle: 1. Science*, edited by Jonathan Barnes, Malcolm Schofield, and Richard Sorabji, London: Gerald Duckworth & Company Limited, 1975 pp. 65-87. See G. E. R. Lloyd, "The theories and practices of demonstration", in *Aristotelian Explorations*, Cambridge: Cambridge University Press, 1996, pp. 7-37.

³² Gotthelf's article "Notes Towards a Study of Substance and Essence in Aristotle's *Parts of Animals* ii-iv" argues this point clearly.

But Aristotle also assumes that an *ousia* is one (Z.12 1037b27).³³ If the *ousia* is one, and an essence is just what makes an *ousia* be the thing it is, and a definition is the formula of an essence (Z.4 1030a6-8), then the definition must also itself be one (Z.12 1037b25-6). Thus, if Z.12 is rejected for the claim in *Parts of Animals* I.3, then Aristotle either must be giving up his unity assumption of an *ousia* or he has another way to conceive of this unity. But Aristotle still seems to assume the unity of an animal and the unity of the form even within his rejection of dichotomy (*PA* I.3 643a1-3, cf. 643a8). It is not clear that in any of his texts Aristotle explains how an *ousia* defined by many differentiae can be one.³⁴ The definition of an *ousia* cannot be one by conjunction, i.e., simply adding the various predicates together as a sum. Unity by conjunction is rejected both in the *Metaphysics* (Z.4 1030b9, H.6 1045a13) and in *Parts of Animals* (I.3 643b18). Another suggestion is that these many differentiae are made one by the one common nature they share as a genus of animal, e.g., the one common nature of bird or fish. But Aristotle denies that a genus is an *ousia* in *Metaphysics* Z.13-16.

This dissertation will argue that it is possible for Aristotle to accept multiple differentiation and preserve the unity of the definition of an animal. The problems stated above have prevented any previous solution to this problem from gaining a significant amount of support in the scholarly community. I will suggest two further reasons why other scholars have not been able to present a clear solution. First, we need to get clear on the aim of the argument in *Metaphysics* Z.12. I will argue that *Metaphysics* Z.12 does not argue for a methodology for discovering an essence when it is unknown but rather just argues in what way a definition via genus plus differentia can be one. The science of

³³ This assumption is also explicitly stated in Z.16 1040b16.

³⁴ See James Lennox, *On the Parts of Animals I-IV*, Oxford: Clarendon Press, 2001, p. 166.

metaphysics does not actually find the definition of any particular essence of a sensible *ousia* and nor does it claim how one should come across the content within a line of division that articulates the essence.³⁵ The rejection of dichotomy in *Parts of Animals* I.2-3, on the other hand, does present a methodology for seeking a middle term when it is unknown. Aristotle's method of inquiry as laid out in the *Posterior Analytics* will show how to grasp the content of this definition, and I will show that multiple differentiation conforms to a significant amount of this method of inquiry. Second, we need to get clear on the role of multiple differentiation in zoology. What kind of definition does it seek? If this method seeks out the definition of the composite *ousia* of an animal, which contains the various attributes that belong *per se*, it may not be in direct conflict with the claim in *Metaphysics* Z.12 that an animal is defined by one, final differentia. This latter definition is of the form by itself (1038a26). But it is also the case that the definition of the composite *ousia* presupposes a unified definition of the form. The definition of the composite *ousia* includes the parts but the parts are not independent entities; they only have being in respect of the form (Z.16 1040b5-8). At the end of first book of *Parts of Animals*, Aristotle maintains that he is looking for the attributes of specific animals (645b1-2) and that the parts are subordinate to the whole and the end of the animal (645b15-20). Thus, there is textual evidence that Aristotle is not seeking the many differentiae of an animal as the essence, for an essence is not subordinate to the whole. But a common view in the literature is that the many attributes of an animal just is the

³⁵ Although most scholars accept the former point, they are not clear on the latter point. They often take the example in Z.12 at face value. Proper differentiation will begin from a genus, e.g., animal or bird, and then find one essential feature, being footed or being winged, and then divide this term properly—taking the difference of a difference. But it is hard to see that this is how Aristotle proceeds in *Parts of Animals*. He mentions several features that are in the *ousia* of a thing: blood (693b5-6), lung (669b12), capacity of flying of a bird (693b12), and capacity of swimming of a fish (695b20). For the problems that these passages create and the lack of clear solution in the literature, see Lennox, *On the Parts of Animals I-IV*, pp. 267-68 and 331-32.

essence.³⁶ This seems to be ruled out not only by the fact that such a unity would only be a conjunction but also by the above passage at *PA* I.5. To unify the many attributes of an animal, they must be subordinated to a whole and the best candidate is the essence.

My proposed solution to the problem of one or many differentiae, simply put, is that the many differentiae express the nature of the composite, i.e., the various parts of an animal, but seeking out these parts will help find the unified middle term that explains why all these parts belong *per se*. The middle term can be found through multiple differentiation for this term will be the one term that explains why all these differentiae belong to one thing. But as we have seen above, the problem of one or many differentiae is a complex problem with many adjacent issues that need to be addressed before a proper solution can even be mapped out let alone defended. Fortunately, there is a large amount of scholarly literature on or surrounding this problem. There have been two substantial attempts at solving this problem—the first by Balme and the second by Furth. There is a minor attempt by Pierre Pellegrin that is worth noting for his work on Aristotle’s conception of division, definition, and classification. There are two major figures that have argued against any possible solution. James Lennox has presented this view through several articles, and David Charles reaches this conclusion in his book *Aristotle on Meaning and Essence*. Finally, Edward Halper has hinted at a solution that I will follow and expand. A review of this literature will help us understand the scope and significance of this problem, but, more importantly, it will help to situate the problem so a thorough solution can be mapped out.

³⁶ This was first defended by David Balme, but others also hold this view, including Furth, Lennox, and Gotthelf. See Balme, “Aristotle’s biology was not essentialist.” See Furth, *Substance, Form, and Psyche: An Aristotelean Metaphysics*, p. 241-47. See Lennox, “Kinds, Forms of Kinds and the More and the Less in Aristotle’s Biology”, pp. 176-77. See Gotthelf, “Notes Towards a Study of Substance and Essence in Aristotle’s *Parts of Animals* ii-iv”, p. 46.

1.3 David Balme

David Balme pioneered the approach of understanding Aristotle's zoology within the context of his metaphysics as well as his logic. His work propelled numerous scholars to look closely at the biological writings to see how these studies apply in practice Aristotle's theoretical notions developed in other texts as well as add to these theoretical discussions in themselves. It is appropriate to begin a survey of the literature with him. But it is also the case that Balme was one of the first in the 20th century to posit a solution to the problem of one or many differentiae. Balme's method of interpreting Aristotle's *Metaphysics* differs from previous scholars such as Jaeger and Ross. He looks at the biological writings of Aristotle to understand the metaphysical theses and principles Aristotle accepts on the supposition that they are more intelligible when seen in practice. This is plausible on the assumption that metaphysics and zoology study the same thing, sensible *ousia*, in the same way. This method also helps avoid beginning with the *Metaphysics* itself. The *Metaphysics*, especially the central books ZHΘ, has lent itself to numerous interpretations over the years, which is largely due to its labyrinthine character.³⁷ It is just this move that enabled him to posit a solution to the problem of one or many differentiae.

The problem is that the *Metaphysics* and the biological writings seem to propose two different ways of defining an *ousia*. Balme resolves this apparent discrepancy of defining an animal by focusing on the claim Aristotle makes that the definition of a natural being is like the definition of the snub – it must include its material in its definition (*Met.* E.1 1025b30-4). But if a definition must include the material in its

³⁷ *Metaphysics* Z is often called the Mount Everest of ancient philosophy just by itself. See Myles Burnyeat, *A Map of Metaphysics Zeta*, Pittsburgh: Mathesis Publications, Inc., 2001, p. 1.

articulation, this would either violate the unity of the definition or threaten its intelligibility, since Aristotle's assumes the material is indefinite. Balme argues that Aristotle does not resolve this problem in *Metaphysics Z* but rather in *Metaphysics H.6*. This will allow Balme to deny that *Metaphysics Z.12* has a role in solving the unity of a definition. Balme reads Z.12 as an argument how a single line of differentiation can be one with the genus, not necessarily that the final differentia is the definition of the form and the *ousia*.³⁸ So, for Balme, it is possible that the conflict between the kind of definition of an animal supported by the *Metaphysics* and the kind of definition supported by the biological writings is only apparent. I will present Balme's argument here only in outline before presenting in detail to alert the reader of the steps Balme takes to arrive at his solution. The first step in Balme's solution is to claim that Aristotle's zoology implies individual form insofar as Aristotle's account of generation of the individual is towards the general likeness of the species (*GA IV.3* 768b10-14). Individual form is where the form of an *ousia* is unique for that particular in that, although it may have attributes in common with other particulars of the same species, all of its attributes as a whole are particular to it and are not due to some universal cause. The universal would be abstracted from the many particulars and so derivative. The second step is to show that this interpretation of Aristotle's biology is compatible with the assumption that nature is defined like the snub—it must include its material, and, as such, form cannot be defined by itself. But Aristotle assumes that no definition can include the material of a thing, for material is indeterminate and capable of being other. Balme claims that this raises an *aporia* for Aristotle, namely, that definition is of an essence apart from its material, but no animal has a definition that does not include its material. Yet, Aristotle

³⁸ See Balme, "Note on the *Aporia* of *Metaphysics Z*", p. 304.

assumes that an animal is an *ousia* and has an essence. Now, an aporia is where two equal set of reasonings raise an antinomy for a thinker. Picking up on the literal meaning of aporia, lack of passage, Aristotle uses this term when the thinker cannot move forward in his investigation. Balme shows in the final step how Aristotle solves this aporia: material can be included in the definition of an animal in a certain way. According to Balme, Aristotle overcomes this aporia by arguing that form and material are one at the moment of actualization in *Metaphysics* H.6 so that all material attributes when actualized can now be conceived as formal attributes. Since there is a plurality of material attributes and these are now formal when actualized, what follows is that no one differentia can define the composite *ousia* that also just is the individual. Thus, there is no conflict between one or many differentiae because the first side of the disjunction is not possible for Aristotle in Balme's interpretation. *Metaphysics* Z.12 does not, for Balme, solve the problem of the unity of the definition, since it does not argue how material can be included in the definition. For Balme, this chapter only shows how one line of differentiation can be one with the genus to which it belongs. Let us turn to the detail of Balme's arguments to see how well this captures Aristotle's thought on this issue.

The argument for Balme's solution to the problem of one or many differentiae is found primarily in his article entitled "Aristotle's biology was not essentialist" as well as his two supplementary articles that appear with this piece in *Philosophical Issues in Aristotle's Biology*.³⁹ These latter articles show how the central books of the *Metaphysics* can be interpreted as hostile to essentialism and argue for individual form as the biological writings demand. Balme is arguing against the kind of essentialism normally

³⁹ For these three articles, see *Philosophical Issues in Aristotle's Biology*, pp. 291-312.

attributed to Aristotle's biology where the essentialism "either identifies form and species, or recognizes individual forms merely as variations from a basic specific form."⁴⁰ Balme begins his solution from theories supported by the biological writings, and in "Aristotle's biology was not essentialist" he begins from Aristotle's discussion of genetics in *Generation of Animals*. In this latter work, Aristotle argues that the growth and inherited resemblances of an individual animal is governed primarily by the father and the mother and only remotely by the universal or the kind of animal it is. Thus, it is the individual form of the father or the material of the mother that exerts its influence on the growth towards its own form and the inherited resemblance of the offspring.⁴¹ Balme points out that Aristotle makes no mention of form (εἶδος) in this discussion. What follows according to Balme is that species membership is consequential upon the individual forms of the parents, thus, species is not the primary cause of animal growth and reproduction but the parents.

Balme's next move is to show that the essence of an animal, although it can predict the general morphology of an animal, cannot predict all the formal characteristics of an individual animal.⁴² In other words, the essence of an animal can tell us that human beings will have hair or will have eyes, but the essence cannot tell us that this particular human being will have blonde hair or blue eyes. The problem is that the

⁴⁰ See Balme, "Aristotle's biology was not essentialist", p. 291.

⁴¹ Since form and material are two distinct principles, Aristotle argues that it is better for nature to keep them separated in distinct sexes. Thus, the male supplies the form in the semen and the female supplies the material in the menstrual fluid. See GA II.1 731b24-732a11 for the first argument.

⁴² Balme accepts that any formal difference is part of the form of the animal. This is best supported by his interpretation of the main argument in *Metaphysics* H.6 that form and material are one. Balme states, from the argument of H.6, "It follows that a definition of Socrates includes a complete account of all his matter at a given moment. Aristotle makes no distinction here between substantial and accidental properties." "Aristotle's biology was not essentialist", p. 295. Cf. "This solution permits every material characteristic to be formalized as a differentia, so that our question is whether the human form should now be differentiated into forms of Socrates and Callias. In favor of this is the clear statement of H.6 that the proximate matter is one with its form, making definition possible" "Note on the *aporia* of *Metaphysics Z*", p. 304.

definition of any animal does not include the process of coming to be. Some formal characteristics of an animal come about due to movement and the material. But there is also a deeper problem in relation to defining the essence. Essence for Aristotle must be capable of being defined apart from its material to which it belongs. Material cannot be included in a definition because it is indeterminate and capable of being other.⁴³ But this is not possible for the essence of an animal, since it is defined like the snub. An animal cannot be thought apart from its material since it must be defined in terms of its motion. A thing in motion necessarily has material for Aristotle. Thus, Aristotle cannot define the essence of any animal. But an animal, as an *ousia*, must be knowable, and it is knowable through a definition. These two claims together, according to Balme, lead Aristotle into aporia in *Metaphysics* Z. There must be a definition of the essence, but there is no clear way to define the essence of an animal. The question now is how does Aristotle resolve this aporia?

The final step of Balme's solution is to show that Aristotle's *Metaphysics* demands individual form because the material must somehow be included in the definition to overcome the aporia. Balme claims that this solution follows from the argument of *Metaphysics* H.6, which concludes that form and the material of an *ousia* are one at the moment of actualization, since the potency of the material just is also the actuality of the form in a way. But if form and material are one in the moment of actualization, then material can be included in the definition of an *ousia*. This implies that form and material here are of the particular composite, e.g., Socrates or Coriscus. Since each composite *ousia* is a particular, so are its definition and its form. Finally, there need not be any conflict between *Metaphysics* Z.12 and *Parts of Animals* I.3, as

⁴³ See *Metaphysics* Z 1036a5, 1037a27, and 1039b28 for this claim.

mentioned above, because many differentiae are necessary to define an *ousia* but further Z.12 is merely a skeleton for how each line of differentiation is one.⁴⁴ Each line of the multiple differentiation of a particular *ousia* demands this unity as *PA* I.3 also argues (643b17-26), but the definition is one because the animal is one at the moment of actualization, which is the proper object of definition. But is this solution plausible?

There are two major problems with Balme's solution. First, his reading of *Metaphysics* Z.12 is not consistent with the text. Aristotle explicitly states in Z.12 that the final differentia is the definition (ὁ ὁρισμός) and the *ousia* of the thing (ἡ οὐσία τοῦ πράγματος) (1038a19-20). There is no mention of the possibility of multiple lines of differentiation and no textual reason to read this into this passage. But Balme could simply respond by saying that Z.12 is an insert. The second problem raises a deeper issue with his solution. Balme leaves Aristotle with no account of what unifies form and material other than this appeal to actualization. But Aristotle claims that form is actuality and material is the potential. If form is essence, as the passage implies (1045a30-33), and the essence is the cause of form and material being one in the thing, then the essence itself must be one to be the cause of the form and the material being one. So, Aristotle must already have an account of why the essence of a sensible *ousia* is a unity prior to this argument. The most natural place to look for this account is in *Metaphysics* Z.4-12. I will defend this interpretation of *Metaphysics* H.6 in the next chapter and show that *Metaphysics* Z.12 answers how a definition of a form is one. But Balme's argument also

⁴⁴ Balme claims that *Metaphysics* Z.12 was never intended to state that an *ousia* is defined by one, final differentia. This is not what the texts of this chapter states (see 1038a19-20), but since it is often considered an insert or superfluous to the flow of the argument, Balme gives it this interpretation to fit with his conception of how the aporia is resolved in relation to defining a sensible *ousia*. See Balme, "Note on the aporia in *Metaphysics* Z", in *Philosophical Issues of Aristotle's Biology*, p. 304. This is not textually supported by Z.12 (see 1038a19-20), as I will argue in section 2.2.3.

has problems on its own terms. If Balme just assumes that this essence is the plurality of parts of an animal, and these parts just are one in actuality, there is no account of their unity apart from this assertion. If this is Aristotle's position, then there is no reason to accept this argument that form and material is one. Balme's solution then comes at a high price.

But even if Balme's solution is problematic, it points to the deeper issue of this dissertation: how is an *ousia* one? One of the main questions of the central books of the *Metaphysics* is asking what accounts for this unity. In respect to the problem of one or many differentiae, there is also the further question of whether or how this unity is present at all in the biological writings. Balme's solution and other views on the biological writings seem to suggest that this unity is not a concern in the science of zoology. But this is to be expected given the fact that Balme's solution rules out that no animal has one defining feature that makes it be what it is. In Balme's favor though is the fact that the biological writings themselves do not appear to refer to one defining feature to demonstrate that certain parts of animal belong. Balme's approach helps us see that to resolve the discrepancy between the two texts of Aristotle's conception of defining an *ousia* is a problem concerning how the zoologist conceives and insures the unity of an animal.

1.4 Montgomery Furth

Montgomery Furth is the second major commentator of Aristotle's zoology to propose a solution to the problem of one or many differentiae. This appears in his work entitled *Substance, Form and Psyche: An Aristotelean Metaphysics*. Like Balme, Furth

takes the central books of the *Metaphysics* to be too abstruse to support decisive interpretation. Since there is little agreement in interpretation, Furth concludes that it is hard to begin a study of Aristotle's metaphysics with the *Metaphysics* itself. But when Furth turns to the biological writings, he does not read them to clarify Aristotle's metaphysical theses as Balme does but rather looks for problems that the *Metaphysics* will resolve. He understands the biological writings to raise the problem that the form of an animal is complex, specifically, it is composed of many differentiae, but being formed in Aristotle's philosophy implies being a unity. Being a unity also follows from the assumption that an *ousia* is one. The task of the science of metaphysics is to solve the following problem on Furth's interpretation: how is the form one when it is complex, since it is composed of many differentiae? So, for Furth, the problem of the unity of the *ousia* is solely in relation to the form and its intrinsic plurality. There is no issue of whether or not to include material in the definition of an animal. The material of an animal, for Furth, will just take on the characteristics of the form, the many differentiae.

Once again, let us begin with an outline of how Furth characterizes the problem and the way he conceives of the relation between metaphysics and zoology for Aristotle. Furth sees Aristotle's *Metaphysics* as proposing a deep theoretical foundation for the biological sciences, since zoology studies sensible *ousia* but cannot answer how it is one. The task of metaphysics, then, is to unearth a "deep grammar of being." The grammar of being for Furth is exposing the true predicative nature of a being. Furth calls this predicative nature of a being a grammar insofar as it expresses the underlying structure of a being. But Furth recognizes that this by itself will not solve the problem of how the form is one, since the grammar of being on Furth's interpretation is understood in terms

of a differentia informing some material as proposed in *Metaphysics* H.2. The problem is that there must be many differentiae that belong to the being of an animal. The grammar of being, though, does help point towards a solution. Furth claims that Aristotle's new conception of division, proper differentiation, i.e., taking the difference of a difference, is less of a cut or division and more of an articulating out a certain aspect of the underlying generic potential. Thus, all of the many differentiae belong to and further qualify one genus, which is intelligible material and understood as a potential for a certain actuality. The argument in *Metaphysics* H.6, then, resolves the problem of the unity of a complex form. According to Furth, this argument must be understood as discussing solely the form itself in that its form and intelligible material are one as actuality and potentiality. Furth, following Rorty, reads the genus as material, so he reads the question of *Metaphysics* H.6 of how the form and material are one as the same question as how the genus and differentia are one.⁴⁵ Understood in this way, the solution stated in H.6 states that the form's unity is "that of actualization (i.e., the differentiae) to potential actualized (i.e., the genus), that is, of actuality to that of which it is the actuality".⁴⁶ What this means is that the differentiae as a whole actualize the potential of the genus, since any differentia according to Furth's interpretation just is a further determination of this potential of the genus. We need to flesh out this solution in more detail below, but we should already notice that Furth, although differing from Balme in the nature of the problem, has at least one move in common with Balme. Furth also denies one side of the

⁴⁵ Rorty argued in the early 1970s that Aristotle, at least in *Metaphysics* ZH treated the genus as material—the same material as the material constituents of an individual *ousia*. This argument has been accepted by numerous scholars of Aristotle's zoology including Balme, Furth, Lennox, et al. See Rorty, "Genus as matter: A Reading of *Metaphysics* Z-H" in *Exegesis and Argument: Studies Presented to Gregory Vlastos*, *Phronesis* suppl. Vol. I, edited by E. N. Lee, A. D. P. Mourelatos, and R. M. Rorty, 1973.

⁴⁶ Furth, *Substance, Form and Psyche*, p. 246.

disjunction in the problem: form is not expressed by one, final differentia. But Furth locates this dismissal not just within the biological writings but also in the *Metaphysics* itself, specifically H.2.

Furth sees Aristotle develop his conception of *ousia* in three distinct writings: the *Categories*, the biological writings, and the *Metaphysics*. We need not concern ourselves with Furth's analysis of *ousia* in the *Categories* for it has little bearing on the problem of one or many differentiae. After the *Categories*, Furth next turns to the biological writings to see how Aristotle develops the notion of *ousia* in terms of living beings. He notes the reason for Aristotle's need to posit form: to move beyond the realm of Empedoclean mixtures, the mixture of the four elements, and account for the structure, which is more than a mixture, of any animal. This step is important, for there are many relevant structural features of an animal. Thus, any animal will have many differentiae that articulate out these different structural features. Each of these differentiae belongs to the form of an animal. But being formed and being unified are tightly linked together. Thus, the science of zoology raises a problem it cannot resolve when at *Parts of Animals* I.3 claims that the form of an animal is complex; it must be expressed by many differentiae. In this particular passage, it is because Aristotle argues that dichotomy cannot grasp the particular form of an animal, where dichotomous division only follows out one line of division to seek out the definition. This is where Furth notes that the differentia is no longer considered merely a cut or dividing a genus into parts but rather it is a further determination of the genus itself. This new conception of the differentia, along with the genus as a potential, is important for understanding what Furth calls Aristotle's grammar

of being. The *Metaphysics* works out this grammar of being to provide the deep theoretical commitments in Aristotle's zoology.

Furth claims that the central books of the *Metaphysics* take up the problem of the form being composed of many differentiae as the zoology asserts yet the form is a unity. Furth finds textual evidence to support this claim in the *Metaphysics* in two ways. The first way locates aporetic statements in Zeta concerning the parts of a form, which Furth interprets as many differentiae. Furth finds these passages at Z.11 1037a18, Z.12 1037b10, Z.13 1039a14, and H.3 1043b32. The second way is a direct statement that an *ousia* has many differentiae. This passage occurs at H.2 1042b15-31. Thus, Furth does not read Z.12 as asserting that a single, final differentia defines an *ousia* but rather that this text explains what Furth, following Pellegrin, calls vertical unity.⁴⁷ Vertical unity is of a single line of differentiation under the assumptions of proper differentiation. This is opposed to horizontal unity, which would be the unity of all the differentiae together, precisely the unity that Furth takes the *Metaphysics* to address. The question of *Metaphysics* ZH, according to Furth, is how this complex of differentiae, which is the form, is one? Before Furth can answer this question, we must first discuss the grammar of being.

Furth takes this task of uncovering the grammar of being as one of the main tasks of the *Metaphysics*. The grammar of being reveals what is being minimally but also confirms the fact that it is the differentia that makes a thing be what it is. Furth understands the analysis of uncovering this grammar as one that eliminates the subject from the analysis. If we are analyzing the being of a threshold, we cannot include any mention of the threshold in the analysis. Aristotle shows how this analysis is possible in

⁴⁷ Ibid., p. 242.

Metaphysics H.2 by appealing to artifacts as examples, which are analogous to *ousiai*. The grammar reveals that being is fundamentally some differentia informing a material—the differentia makes the subject, the material, be the kind of thing it is. Furth insists that this grammar is rich enough to cover the multiple layers of differentiation necessary to discuss the being of an animal. Furth provides the following schema as the grammar of being: there is a *S*, a *S* exists $\rightarrow D$ informs a *M* (or some *M*). But as he says, “It seems, then, that a great deal is packed into that ‘*D*’ of Eta 2, which calls for unpacking and elaborating.”⁴⁸ But this schema is not enough to solve the problem of how many differentiae are also one. There is one more additional step. The many differentiae need to belong to one generic potential and together they actualize that potential.

The many differentiae ultimately belong to a generic material of which each differentia is the actualization of some potential that the generic material possesses. But the trick is that this generic potential is not the sensible material but the intelligible material. This latter is what belongs to the form by itself. This generic material is also the proximate material, following Rorty, et al., which is one with its form or the many differentiae in the argument of *Metaphysics* H.6. In other words, the form just is all of the differentiae together in act of this one being which has the generic potential for a certain kind of action. All of these differentiae together make it possible for this generic potential to be fully actual in the individual animal. But this just is the form for Furth or as he stresses the potential-actuality distinction of H.6 must be visualized within the specific form itself. For example, the form of a bird includes a specific kind of wing, feather, beak, two footedness, a certain shape and angularity of the chest, as well as numerous other attributes. Each of these attributes when specified for a particular kind of

⁴⁸ Ibid., p. 256.

bird is a differentia. All of them together make possible the generic potential to fly. But this generic potential is intelligible material and can be one with the form according to the argument of H.6. Thus, the many differentiae are one as a form in act or more specifically as the first actuality of the body with organs, which is how Aristotle defines the soul in *De Anima* II.1. A first actuality is also a potential for a certain kind of action. Thus, a bird's soul or form is the capacity to fly and all the differentiae together make this capacity to fly one thing by fully realizing the generic potential. This solution then exploits both the fundamental grammar of being and the nature of how the differentiae belong to a generic potential. This solution differs from Balme's insofar as the many differentiae inform the material, making the material be the same as the form, whereas Balme sees, at least in actuality, that no real distinction can be drawn between form and material.

But there are two fundamental problems with Furth's solution to the problem of one or many differentiae. The first involves his interpretation of the texts that he believes Aristotle either alludes or states that a form is composed up of many differentiae. The first of such texts are the aporetic texts in *Metaphysics* Z which assert the complexity of the definition because it has parts, e.g., Z.10. Aristotle never states directly in Zeta that the parts are many differentiae. But even if we ignore this problem, which really requires an interpretation of the surrounding passages, Furth's claim that H.2 asserts that an *ousia* is defined many differentiae is a stretch as well. Furth translates the relevant aspect of the passage as follows: "Of *some things* the 'being' will even be defined by all of these [marks], in that some [parts] are mixed, some blended, some bound, some solidified, and

some employing the other differentiae, as are Hand, or Foot.”⁴⁹ The italicized words point out the problem. Aristotle only asserts that some things are defined by many differentiae, most of which he is obviously referring to artifacts. Of course, he also mentions hand and foot. But this points to a deeper problem: what are the many differentiae of a foot or hand? Are these differentiae the proper material or the form? Furth does not address this question but simply assumes that it is the form, since for him, the form just is the many differentiae.⁵⁰ But even Furth admits that proper material of an object can be expressed as a differentia. For example, the threshold defined in H.2 must appeal to an appropriately shaped and sized wood or stone.⁵¹ Furth has not made clear whether these differentiae, appropriately shaped wood and stone, are material or part of the form. These differentiae are formal belong to an actual door; this is the conclusion of *Metaphysics* H.6. But that a differentia is formal does not imply necessarily that it is part of the form. Both Furth and Balme make this assumption because *Parts of Animals* I.3 seems to imply this, but both lack textual evidence for this claim in the *Metaphysics*.⁵²

The second problem is a deeper problem. It appears on Furth’s account that the unity of the form is contingent upon the unity of the generic material that underlies these many differentiae. It is the genus that accounts for the unity of the many differentiae. But the argument of *Metaphysics* H.6 states otherwise. Aristotle explicitly states that the essence, which is form, is what is responsible for the two being one, i.e., form and material, since the essence of both is the same (1045a33). The generic potential is not

⁴⁹ Ibid., p. 103. Italics are mine. This translation is Furth’s taken from his translation of *Metaphysics* (VII-X) published by Hackett Publishing Company.

⁵⁰ See, for example, Aristotle’s discussion of a hand in *PA* IV.10 where the various differentiae or potentials of a hand are unified by the hand’s work or function—its ability to grasp (687b10-24).

⁵¹ Ibid., p. 256.

⁵² On Balme’s view of this issue, see “Aristotle’s Biology was not Essentialist”, pp. 294-5. Balme, though, sees this view following from H.6, not as a prior claim to this conclusion as Furth claims.

sufficient to be the cause this unity. The generic potential, according to the various senses of “one” laid out in *Metaphysics* Δ.6, is one insofar as it underlies these differentiae, much like material (1016a26-32). But the generic potential of say a bird underlies both the unity of an eagle as well as a hawk or a blue jay or a hummingbird. If the generic potential is the cause of the unity of the differentiae, it would lead to the conclusion that a hummingbird and an eagle are also one *ousia*, since each has the same cause for being one. But this is obviously absurd. There must be an additional unity beyond just the generic potential that accounts for why an eagle has a certain unity and a hummingbird has a different unity. But Furth’s view also leads to a problem in Aristotle’s zoology. Some animals do not belong to a generic potential other than animal. The genera Aristotle establishes and studies in the zoology are those like the bird or fish kind (*PA* I.4 644b4-5), which Aristotle calls “greatest genera” at *History of Animals* I.6 490b7-9. This kind of genus is the kind of generic potential of which Furth is thinking. But Aristotle admits that there are species that do not fall under these “greatest genera”, such as human beings, ostriches, bats, etc. These latter species would then lack sufficient unity for there is no generic potential to which they belong other than that of the form. But Furth requires something other than form, since it is complex of multiple differentiae. Once again, we see the main issue of the problem of one or many differentiae is what accounts for the unity of an *ousia*.

1.5 Pierre Pellegrin

Pierre Pellegrin comments on the problem of one or many differentiae from a different perspective than the two previous scholars. He is concerned with the nature of

Aristotle's classification of animals within his zoology and its role in science for Aristotle. Pellegrin begins with the recognition that Aristotle arrives at his classification of animals through his method of division. This method of classifying aims to arrive at definitions of animals rather than merely present a classification of different animal characteristics and classes. Pellegrin also notes that the biological sciences do not aim to define the same thing as the science of metaphysics. This follows from Pellegrin's reinterpretation of Aristotle's classification of animals. Zoology is primarily concerned with defining parts. Aristotle's zoology, then, defines an animal species indirectly (if does so at all) according to Pellegrin. Pellegrin believes that this will help resolve another issue in Aristotle's zoology: Aristotle does not arrive at a complete definition of an animal anywhere in the biological writings. Often scholars have viewed this as a failure of Aristotle's zoology. Pellegrin's reinterpretation of Aristotle's classification of animals shows that the failure is in the scholarship and not with Aristotle's zoology. Aristotle is very successful in defining the parts of animals, which is the true aim of the zoology, and, in turn, will constitute a definition of an animal for the science of zoology.⁵³ Pellegrin backs this up with two theoretical points. First, only the parts of animals, according to Pellegrin, contain enough logical information to be divided by the new method of division—taking the difference of a difference. Second, Pellegrin claims that Aristotle considers parts to be *ousiai* (Z.2 1028b9), and an *ousia* is what admits of definition primarily (*Met.* Z.5 1031a1-2). Pellegrin does not, though, see a tension between Aristotle's two kinds of definition for Pellegrin recognizes that each science has

⁵³ Pellegrin still acknowledges that Aristotle never presents a completed definition of an animal anywhere in his biological writings, but his main point is that this is not the purpose of zoology. Its main aim is to define the parts, which Aristotle does well according to Pellegrin. See Pellegrin, "Aristotle: A Zoology without Species", in *Aristotle on Nature and Living Things*, pp. 95-115.

its own proper object. Aristotle's *Metaphysics* studies the form and how it is one whereas Aristotle's zoology studies the proper attributes of each animal. With this recognition, Pellegrin states that the problem is dissolved: each science demands a different answer and there appears to be little to anything that connects the two at least in the writings of Aristotle. Let us now sketch out this answer in more detail, turning to Pellegrin's book *Aristotle's Classification of Animals* and beginning where he starts with the controversy of the modern interpretation of Aristotle's classification of animals.

Pellegrin connects the failure of scholarship to understand Aristotle's classification of animals with anachronism—trying to impose taxonomic thinking upon Aristotle's method of classification. He claims that this anachronism is clear from the controversy that arose in modern times in the 19th century, most significantly through the work of J. B. Meyer, from the fact that Aristotle's classification of animals appears to be incomplete and incoherent. Meyer and most scholars up to the date of Pellegrin's work *Aristotle's Classification of Animals* assumed that Aristotle's use of the terms *genos* and *eidos* had a taxonomic sense. This means that the terms *genos* and *eidos*, usually translated as genus and species, refer to fixed levels of reality that “presuppose a distribution of animals into stable and recognized families.”⁵⁴ In other words, *eidos* should always pick out the species, under which only particulars fall, and *genos* should always pick out a class of animals at a specified degree of universality, under which the *eidē* fall. But Aristotle's practice of classifying animals in the *History of Animals* defies this interpretation. Pellegrin shifts the question of Aristotle's classification from why does it fail in terms of taxonomy to how does it function within his own thought. He

⁵⁴ Pellegrin, “Logical difference and biological difference: the unity of Aristotle's thought” in *Philosophical Issues in Aristotle's Biology*, p. 313.

focuses on the logical use of these terms, genus, species, and differentia, to answer what is the role of classification in Aristotle's zoology.

Aristotle employs the method of division to help classify animals. Division is a way to help locate definitions. This is where Pellegrin's interest in Aristotle's classification of animals connects with the problem of one or many differentiae: what aspects of an animal that can be defined will be limited both to Aristotle's logical use of *genos*, *eidos*, and *diaphora* and his critique of dichotomy. Let us first turn to Pellegrin's analysis of Aristotle's use of *genos*, *eidos*, and *diaphora*. Pellegrin prefers the Greek terms transliterated rather than Latin terms of genus, species, and differentia expressed in English (or, literally, in French, the language in which he writes) to avoid any implication or confusion that Aristotle is using these terms taxonomically. The problem before Pellegrin's work is that scholars claimed that Aristotle employs these terms inconsistently. Pellegrin's response to this kind of critique is to show a way in which Aristotle uses these terms consistently throughout his whole corpus. Pellegrin argues that each of these three terms, although they have a distinct biological application, only has one logical sense. He appeals to *Metaphysics* I.3 and I.8 to characterize the logical sense of genus as "that enclosure beyond which there is nothing but pure otherness, but within which, in its very unity, the diversity of *eide* is produced."⁵⁵ Since *eidē* are contrary to each other, a genus is always used to refer to a unity of contraries. This also entails that a genus is capable of further division. *Eidos* or species is always used in such a way that it falls under some genus. The species that fall under a genus are determined by contraries or *diaphorai*. A *diaphora* or differentia and its genus make up the definition of a species, i.e., an *eidos*. Pellegrin shows by numerous examples within the biological writings and

⁵⁵ Pierre Pellegrin, *Aristotle's Classification of Animals*, p. 56.

the *Metaphysics* that these terms are always used according to this relationship.⁵⁶ There is nothing contradictory about using these terms at different levels of generality insofar as these relations, which are also spelled out in Aristotle's *Organon*, are maintained consistently. Pellegrin arrives at the following conclusion: "one may say that the concept of *genos* is classificatory but not taxonomic: as the term does not designate a fixed level of classification."⁵⁷ I accept Pellegrin's view, and it will be important when we turn to Aristotle's empirical inquiry of zoology to see that his theory of definition is put into practice. Now that we have a grasp of the logical sense of *genos*, we must now ask what serves as a *genos* in Aristotle's biology.

Pellegrin answers that a *genos* in the biology is most often either a kind of part or a function. This can be glossed from Aristotle's texts where he carries out divisions, but Pellegrin also provides a more philosophical reason for this fact. Aristotle rejects the kind of division that does not take the difference of a difference. This limits the number of divisions that one can make in each line.⁵⁸ This also demands a certain amount of logical information of a kind so that it may be submitted to a series of such divisions. Pellegrin claims that only the parts or functions have enough logical information to be divided as such. Aristotle, then, is classifying by kinds of parts and thus defining animals by their very parts. Since an animal has a variety of parts not falling under one line of division, dichotomous division will not work to define an animal. Instead, the definer must begin with many lines of division simultaneously. Pellegrin calls one of these lines

⁵⁶ Most scholars of Aristotle's biology now accept this view of these terms. See Lennox, *On the Parts of Animals I-IV*, p. 168-69.

⁵⁷ *Aristotle's Classification of Animals*, p. 69.

⁵⁸ Pellegrin is opposing Aristotle's use of division with that of Plato. Plato, especially in the *Sophist* and the *Statesman*, constructs long chains of division that arrive at one, final differentia. Aristotle's criticizes this method as lacking unity, since each cut is a distinct reality than what it cuts. But if one takes the difference of a difference, e.g., footed as two-footed or many-footed, then the final difference includes the previous cut and the many differentiae of that line are really one.

an axis of division. Since *Metaphysics* Z.12 claims that there is only one, final differentia, non-dichotomous division arrives at a different definition. Even worse, there is nothing to unify all the different lines of division under or as one definition, since Aristotle rejects conjunction as a sufficient kind of unity. Pellegrin's solution, as already stated, is that each definition is sufficient for its respective science since each concerns a distinct object.⁵⁹ But how does he respond to the problem of the unity of the definition of all the parts. Pellegrin states the following:

It must be admitted that our passage of the *Parts of Animals* is less demanding, for the unity of the thing defined, than the texts cited from the *Metaphysics*. In the *Parts of Animals*, once Aristotle has gotten rid of the hypothesis of dichotomy, he is in fact satisfied with coordinating several characteristics obtained by several axes of division. Indeed, there is no reason for him to raise here the metaphysical problem of the unity of the definition, since his objective is to show that his method is superior to that of the Platonists, in that it can approach a definition of the animal from several directions. But whatever can do more can also do less. If the true definition, allowed by the rules promulgated in the *Metaphysics*, has more unity than the definition by conjunctive aggregation of characters, *a fortiori* it has this much unity.⁶⁰

Every animal is composed of several axes of division, each axis having its own unity. Pellegrin's claim is that this unity is more than the Platonists' use of division provides, thus, the definition as a whole, even though it still lacks unity, at least expresses each part as a unity. It is this unity that is significant in zoology according to Pellegrin, since zoology takes the parts as *ousiai*, not as parts of an *ousia*, i.e., each part is its own *ousia*. Pellegrin appeals to *Metaphysics* Z.2, where Aristotle lists parts of animals as a candidate of what counts as an *ousia*, to back this claim (1028b10). As for the lack of unity of the definition that includes all of the parts, Pellegrin is simply assuming that the unity requirement is not as strict in biology as it is in the *Metaphysics*. Unfortunately, he does

⁵⁹ Pellegrin states that the objects are distinct explicitly in his article, "Logical difference and biological difference: the unity of Aristotle's thought", in *Philosophical Issues in Aristotle's Biology*, p. 313.

⁶⁰ *Aristotle's Classification of Animals*, p. 32.

not provide an argument for this position. Pellegrin concludes that zoology is not about species but about parts: a moriology.

But Pellegrin must answer to several objections. The first problem is whether we should accept that Aristotle considers parts as *ousiai*. Although *Metaphysics* Z.2 does list parts of animals as *ousiai*, *Metaphysics* Z.16 qualifies this and shows that parts can only be potential *ousiai* (1040b5-8). Parts are not *ousiai* at all then, since actuality is prior in being to potentiality. Thus, there must be a definition prior to defining each one of the parts. This would appear to be the definition of the essence, which *Metaphysics* Z.12 shows that there is a method to arrive at a unified definition even if this definition appears to have parts. More significantly, the definition of the essence is necessary for the zoologist to be able to understand why a certain part belongs to that kind of animal. Pellegrin has a response to this issue. His claim is that the parts of an animal do not admit to this kind of unity. Different parts belong to an animal in different ways, e.g., the locomotion of an animal may explain why an animal is footed in a certain way but not why it has a lung. This is why Aristotle employs different classificatory schemas at different times. But this raises an even bigger problem. This suggests that there is no fundamental unity of an animal. If this is so, then an animal cannot be an *ousia*, at least according to the understanding of the *Metaphysics*. Also, Pellegrin, in making this move, cuts off any relation between metaphysics and zoology for Aristotle. The problem, as I see it, is that Pellegrin, himself, falls prey to anachronism. He claims that Aristotle is only defining parts and not the species. Evidence seems to point in his favor except for *Metaphysics* Z.12. There Aristotle is defining the form and, in consequence, the species, and he is defining the animal by having a certain part, e.g., a certain kind of footedness.

Pellegrin assumes that a definition of a species and a definition via parts are different for Aristotle, but Z.12 really seems to suggest otherwise. We, today, are used to classifying and even defining animals via classes, but Aristotle argues that the definition of an animal is of the soul, and the soul is a first actuality and a function. It is possible, then, on Aristotle's understanding to define an animal by means of its primary part, if this part is what makes the animal be the kind of thing it is and is its potential for its primary function. But Pellegrin is right to be hesitant of this solution. The biological writings do not appear to confirm this reading; there seems to be few if any passages in the biological writings that claim some feature is the essence of a particular kind of animal. This points to the fact that a theoretical solution to the problem of one or many differentiae is not sufficient, one must show that Aristotle carries this solution out in his practice of zoology.

1.6 James G. Lennox

James G. Lennox argues, in a very sophisticated and carefully argued manner, what may well be the commonly accepted view, namely, that there is no solution to the problem of one or many differentiae. Lennox, being one of the more prominent followers of Balme, argues that Aristotle's zoology is improving or clearly stating what the *Metaphysics* intends to state and that the biological writings apply the logic of the *Posterior Analytics* to the science of zoology. Lennox appeals to both of these arguments to show that there is no solution to the problem of one or many differentiae, but this section will concentrate primarily on the relation between the *Metaphysics* and the biological writings. The core of Lennox's argument is that *Parts of Animals* I.3 presents

a more complex methodology than that presented in *Metaphysics* Z.12. On these grounds, there is no problem, only a development or a refinement of Aristotle's thinking about biological entities. But Lennox does not abandon all claims made in the *Metaphysics*, rather he sees the *Metaphysics* as groping towards what the biological writings will work out in detail concerning the nature of animals. Lennox, though, must make one major adjustment to Balme's views to argue his interpretation: Aristotle's zoology was essentialist, but it is what Lennox calls "teleological essentialism" rather than "typological essentialism" that is normally attributed to Aristotle's zoology and the one Balme rejected in the article cited above. Teleological essentialism preserves Aristotle's commitment that an *ousia* is one, but this kind of essentialism does not demand the strict unity of the definition. Instead, an essence coordinates functions and characteristics of animal together for the animal to thrive and perform within the environment it dwells. Why is the essentialism in Aristotle's zoology not typological? Lennox answers that the kind is not defined by one identical feature that is the same in the kind but by a plurality of attributes that fall within a range. In Aristotle's zoology, those of the same kind differ by the more or less in relation to the attributes they hold according to that kind while those animals of a different kind have attributes that are only analogous to other kinds.⁶¹ For example, all birds have feathers, but these differ by the more and less, whereas fish lack feathers but instead have scales. Typological

⁶¹ Lennox uses "form of a kind" to translate εἶδος and "kind" to translate γένος. He claims that, following Pellegrin and Balme, the terms "species" and "genus" suggest taxonomic categories to the modern reader, and Aristotle's classification of animals is not taxonomic. Although I may agree with the latter claim, it is not clear that the use of γένος and εἶδος in the *Metaphysics* are used in either a taxonomic or classificatory sense. They are used to define the essence of an *ousia*. Thus, I see no need to change the translations of these terms. In respect to the *History of Animals*, Lennox and others may argue it is necessary to translate these terms differently to avoid reading this text as taxonomic, but that is another issue. See Lennox, "Kinds, Forms of Kinds, and the More and the Less in Aristotle's Biology", in *Aristotle's Philosophy of Biology*, Cambridge, Cambridge University Press, 2001, see especially the note at the bottom of p. 160.

essentialism does not allow kinds to have particulars under it with a range in respect to the essential features but the particulars can differ in this respect to incidental features. I will now present this argument in more detail as it appears in his article “Kinds, Forms of Kinds, and the More and the Less in Aristotle’s Biology.”⁶²

Lennox’s main concern in this paper is twofold: first, to show that Aristotle can hold both that individuals with the same form do not differ by the more and less in respect to that form yet entities having this form may differ by the more and less in respect to other things belonging to the same genus, and second, to argue that Aristotle is not committed to a typological essentialism in his zoology but rather a teleological essentialism. The second point will follow from first, granted that Lennox can show how Aristotle can maintain the first point. Lennox posits the following answer to address the two issues of the first point:

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.⁶³

Lennox explains that Callias and Socrates may have the same definition qua man, but some of these features of man fall within a range, e.g., pale or dark complexion of flesh. But this difference in complexion is only incidental. More importantly for Lennox, this relation does occur at various levels of generality with animal features that are essential. For example, hummingbirds and eagles have the same features qua bird, but these same features in respect to the individual species fall within a range. Hummingbirds have a

⁶² This is found in *Aristotle’s Philosophy of Biology*. Lennox re-titled this paper from its previous title of “Aristotle on Genera, Species, and ‘the More and the Less’”, found in the *Journal of the History of Biology*, XIII, pp. 321-46, in acknowledging Pellegrin’s argument that genus, species, and differentia have a taxonomic connotation for the modern reader.

⁶³ Lennox, “Kinds, Forms of Kinds, and the More and the Less in Aristotle’s Biology”, p. 167.

long, straight beak and short wings whereas an eagle has a short, hooked beak and long wings. The above view is worked out in part by the *Metaphysics* but only made clear in the biological writings. This view can be clarified by understanding Lennox's rejection of *Metaphysics* Z.12 as an account of unity of a sensible *ousia*.

Lennox rejects only part of the conclusion of *Metaphysics* Z.12. He accepts that proper differentiation proves that final differentia is one with the kind or genus, but he rejects the claim that the *ousia* is defined by one, final differentia. He appeals to two aspects of division in the biological works for this rejection. First, division in the biology always begins from an extensive kind, such as fish or bird, each of which has forms fall under it that differs by the more and the less. *Metaphysics* Z.12, on the other hand, begins from the genus "animal" instead, which does not have forms under it that differ only by the more and less but also by analogy, e.g., animals may differ by being many-footed or footless but the protective covering of animals differ by analogy—feathers of a bird are analogous to the scales of a fish (*PA* I.4 644a20-2). Second, *PA* I.3 argues that the particular species or form cannot be defined by one, final differentia but one must begin with many lines of differentiation. Z.12 only begins and ends with one line of differentiation. But the claim that Z.12 only appeals to the genus animal is irrelevant because Z.12 claims to define a human being (1037b12), and a human being does not fall under an extensive kind according to the biological writings (*PA* I.4 644b6-7). Aristotle could only begin with the genus animal rather than something like the genus bird or fish. The second claim, though, strikes at the heart of the problem, for human being is the example both in Z.12 and in *PA* I.3. Each method seeks to define human being, and Aristotle claims in the *Posterior Analytics* that a definition is of an essence (II.3 90b4, cf.

II.13 96a22-3, cf. *Met.* Z.4 1030a12). Under these assumptions, then, the conflict holds, and Lennox is right to claim that there is no solution. But we should note that this conclusion rests on the assumption that the object of definition is the same in each case. If this assumption does not hold, the problem either disappears or takes on a new form. The new problem would be that an animal has two distinct definitions, which would imply that it has two essences. It seems that this problem motivates Lennox to claim that Aristotle has abandoned the conclusion of *Metaphysics* Z.12 that an animal is defined by one, final differentia.

Aristotle is now left with the view that an animal is defined by a plurality of attributes. These attributes exist undifferentiated at the level of the kind, but nothing prevents these attributes from further differentiation most of the time.⁶⁴ For example, the attributes that belong to a bird are beak, wings, feathers, two-footed, etc. But since these attributes are of the same quality, they can differ by the more and less (*Cat.* 10b26-8). The role of the more and less is to distinguish within a kind different forms of that kind, e.g., an eagle is short-legged with a hooked beak whereas a crane is long-legged with a flat, long beak. These attributes, admitting to the more and less, are appropriate for the lifestyle and environment of each bird. Thus, the more and the less distinguish the attributes of birds into distinct forms of a kind, what is normally translated as species (εἶδος). This does not conform to the norms of typological essentialism, but Lennox is careful to avoid the claim that Aristotle's zoology is not essentialist: the animal must be one in some way to be an *ousia*. Thus, Lennox must answer how all these parts hold together as one indivisible particular. Lennox responds with the following:

⁶⁴ This last caveat covers times when a privative characteristic, e.g., footless, belongs to a generic kind, e.g., fish. The differentia "footless" cannot be further differentiated because there are no differences proper of a privative term (*PA* I.3 642b21-23).

Ultimately, then, the ‘formal unity’ of a number of animals turns on their having just the proper conformation of each part, and just the proper range of activities, for the life they have to live in a specific environment. This will involve their having a *fully coordinate* set of structures and activities suited to that life... the overall *unity* of their differentiae will suit them to their life and no other, and distinguish them from the individuals of other forms suited to other lives in different environments.⁶⁵

This is Lennox’s characterization of teleological essentialism. But there is a problem: what accounts for the fully coordinated set of structures and activities and the overall unity of an animal? If it is just that the parts of an animal happen to fit together in a certain way that make possible a working structure or whole, then the unity of an animal is left open to chance. But this is clearly rejected by Aristotle in *Physics* II.8. It is part of Aristotle’s rejection of Empedocles’ theory of evolution. If it is the environment that influences what unities are permissible to thrive, once again, the unity is open to chance in one way, since environmental influences are outside the being of an animal. But this latter hypothesis itself points to the key problem. The hypothesis presupposes a unity prior to the environment selecting which unity will thrive, for there must be fully formed entities that are selected by reproducing and passing on their traits. Lennox does not have an account of this unity, yet his position demands it. It is not that Lennox is wrong about Aristotle holding a teleological essentialism, but rather that Aristotle’s own account that an *ousia* must be defined by many differentiae threatens the unity that this kind of essentialism demands.

This actually points to a problem with his first step of the argument. Lennox takes the kind to be constituted by the features with range. This is textually ruled out in

⁶⁵ Italics are mine. See Lennox, “Kinds, Forms of Kinds, and the More and the Less in Aristotle’s *Biology*”, p. 177.

several places in *Parts of Animals*.⁶⁶ When discussing birds, Aristotle clearly states that it is the flying nature that is in the *ousia* of a bird and not the features with a range (*PA* IV 693b10-3). Thus, bird as a genus is defined primarily by a feature that is identical in every bird: its ability to fly. It is possible that this carries down to the level of the species of the genus where a certain feature defines the very being of that species. But what is important here is that Lennox's argument does not follow: Aristotle can have both typological essentialism and have kinds that have features with range but only insofar as those features belong to that animal because of the nature of the genus or the nature of the form. It is also the case that Aristotle's essentialism is also teleological: those features that follow from the nature of the kind are those which enable the animal to perform both its primary function and the other kinds of activities it needs to thrive in the environment it inhabits. But Lennox's attempt to dissolve the problem of one or many differentiae points to a deeper issue: do *Metaphysics* Z.12 and *Parts of Animals* I.3 intend to define the same thing? If they do not, how can a thing have two essences? I will argue a third option: they define the same thing in a different way. *Metaphysics* Z.12 defines the form by itself and *Parts of Animals* I.3 presents a methodology that seeks the definition of the composite. This methodology both seeks the essence and divides the particular genus or species by the kind of parts that belong to that genus or species *per se*.

1.7 Edward Halper

Although Edward Halper has not commented directly on the *Parts of Animals*, he provides an interpretation of the central books of the *Metaphysics* that helps resolve issues concerning the problem of one or many differentiae. Most importantly, Halper

⁶⁶ For example, see *PA* IV.10 693b10-13 and *PA* IV.13 695b19-22.

does not read *Metaphysics Z* as an aporetic text, like Balme, Furth, and others, but rather he claims that it comes to the conclusion that form is essence and is *ousia*. It is this conclusion that will provide a path towards solving the problem of one or many differentiae. This involves recognizing that form and essence are one, as argued in Z.6, and identical with the ultimate differentia (Z.12) and actuality (H.6) and fulfill the requirements of being *ousia*. These requirements may at first appear to be contradictory. The first is that *ousia* is one in formula because it is knowable. But since a formula is universal, it would seem to follow that *ousia* must be a universal. The second is that *ousia* is one in number because it does not belong to something else nor is something else responsible for it being what it is. But what is one in number is an individual and not, Aristotle claims, a universal, since a universal is a one over many. *Ousia*, then, must be both universal and individual. A reader must put this in its proper context to understand how both can belong to *ousia*. Aristotle concludes or claims several times in *Metaphysics Z* that form is *ousia*.⁶⁷ Halper claims that it is possible for form to have these two apparently inconsistent properties if each property is understood as a way in which the form is one. Form has the unity in formula characteristic of the universal as well as the numeric unity characteristic of individuals. The form itself is neither, but by exploring its unity, we come to see the peculiar sort of being it has. A single form exists in multiple composites.⁶⁸ But whether one accepts this or not, the key to his interpretation in relation to the problem of one or many differentiae is that essence is one in formula. At the heart of the argument that form is essence and essence can be one in

⁶⁷ The more important of these conclusions or claims come at Z.6 1031b15-18, Z.11 1037a29, and Z.15 1039b21-2.

⁶⁸ Halper points out that Aristotle uses both universal and individual in an extended sense in the *Metaphysics* and the *Posterior Analytics*. Aristotle uses “universal” to mean primary at E.1 1026a29-31 and uses “individual” to refer to the species at *APo.* II.13 97b28-31.

formula is *Metaphysics* Z.12. We must turn to Halper's interpretation to see how such a thing is possible, since any definition has parts, namely, genus and differentia, and Aristotle assumes that parts of a definition refer to parts of a thing (Z.10 1034b20-4).

Metaphysics Z.12 addresses precisely this question, which was initially raised in the *Posterior Analytics* but was not answered there. What drives this question is the assumption that *ousia* is one, which is stated very early in Z.12 (1037b27). More importantly, it is implicit in Aristotle's argumentation through *Metaphysics* ZH because he shows unsuccessful candidates for *ousia* to be unsuccessful on the grounds that they lack strict unity—the unity that belongs to an *ousia*. But since Aristotle has already stated that definition belongs properly to essence or form in Z.4, the question can also be stated as how is the form one? Halper is questioning the standard interpretation that not only is Z.12 an insert but that it is also peripheral to the main argument of *Metaphysics* Z.⁶⁹ On the contrary, Halper claims that “[i]n arguing for the unity of form, Aristotle is, in effect, supporting its claim to be *ousia*.”⁷⁰ Since definition for Aristotle is by genus and differentia, the question is how is it possible for these two elements of a definition be one? Aristotle's argument has several steps, but he shows that any part of the definition is actually either included or implied by the final differentia. As Halper shows, the argument does not simply rely on the assumption that the genus is matter or nothing apart from the forms that are under it. Aristotle wants to build a case that genus and differentia are one by disabling arguments against this view. The argument has two steps. The first step is to show that the final differentia includes the previous differentiae insofar as one

⁶⁹ Both W. Jaeger and W. D. Ross hold this position, and its most recent defense is by Myles Burnyeat in *A Map of Metaphysics Zeta*. See Jaeger, *Studien zur Entstehungsgeschichte der Metaphysik des Aristoteles*, Berlin: 1912, p. 53-62, Ross, *Aristotle's Metaphysics*, Vol. I, Oxford: Clarendon Press, 1924, p. xxx, and Burnyeat, *A Map of Metaphysics Zeta*, pp. 42-4.

⁷⁰ Halper, *One and Many in Aristotle's Metaphysics*, Columbus: Ohio State University Press, 1989, p. 111.

takes the difference of a difference, called proper differentiation. For example, when one divides footed, it should not be by something incidental to this difference, such as winged or white, but something that belongs properly to footed, such as two-footed or four-footed. If the latter method is employed, then we can understand that the two differentiae are really one, since footed is contained within two-footed. A sign of this is that it is superfluous to say footed twice. In other words, proper differentiation allows one to predicate a differentia of its proper differentia. The second step of the argument is to show that the genus is also not an independent part of the definition. The genus is not susceptible to the same solution as a plurality of differentiae, since, according to *Topics* Z.6, a genus cannot be predicated of its differentiae (144a36-b3). Halper solves this by showing that the argument assumes complete division of the genus, so that there is no remainder of the genus—the genus as such does not exist apart from its forms or species. It must also be the case that each differentia is unique to a genus. If that holds, the final differentia by itself expresses the whole definition for it includes all previous differentiae and the initial genus. The definition is one through proper differentiation.

Halper is quick to point out that it is not proper differentiation that conflicts with the claim in *Parts of Animals* I.3 but the fact of whether one, final differentia is sufficient to express the whole essence of an animal. *Parts of Animals* itself asserts proper differentiation (643b17-23). But, if that is the case, and there now need to be a plurality of differentiae to express the essence, then proper differentiation does not preserve the unity of the definition as argued in Z.12. Halper appeals to *Metaphysics* H.6 where Aristotle stresses the unity of the composite through its function, but, according to Halper, this is not a direct attempt to resolve the issue of one and many differentiae.

Halper suggests a solution to this problem without working out the details.⁷¹ He cites the passage in *Part of Animals* I.5 which claims that the parts of an animal are subordinate to the whole body (645b14-20). Halper interprets the *Parts of Animals* is an inquiry into the definition of an animal which cannot be arrived at without knowing all the proper parts of animal. Multiple differentiation aims to find all of these parts and cannot grasp the essence apart from this. This solution is supported by the fact that Aristotle distinguishes between metaphysics and physics as sciences. Halper characterizes this difference in the sciences as follows: “Metaphysics considers in virtue of what something is, and in practice this comes to considering why it is one. Biology is concerned with all the essential attributes and properties of the thing.”⁷² But Halper does not explore the biological writings to see if they support his solution. This is unfortunate, since he states in his book that Aristotle’s biology seems to presuppose the unity that the *Metaphysics* assumes of *ousia*. This unity is necessary to show that all the essential attributes belong to one thing, linking and coordinating all the parts through the essential natures of animals. He suggests that this is sufficient to show that the two projects of defining are not necessarily inconsistent. As stated before, Halper is providing a path which one can follow to present a rigorous solution to this problem. But Halper stresses caution when trying to use one Aristotelian text to shed light on issues and problems in another text, especially here since they concern different sciences.

⁷¹ This is found in n. 3. Halper, “*Metaphysics* Z 12 and H 6: The Unity of Form and Composite”, *Ancient Philosophy* 4, 1984, pp. 146-159.

⁷² *Ibid.*, p. 115.

1.8 David Charles

In his thorough and detailed book *Aristotle on Meaning and Essence*, David Charles approaches the problem of one and many differentiae from a different perspective than most of the other commentators addressed by this dissertation. He is directly concerned with Aristotle's conception of definition and explanation in the *Posterior Analytics* and how it is applied to both the *Metaphysics* and the biological works. What is unique about Charles is that he does not see a conflict between there being a unified definition of many differentiae through one basic cause. His claim is that, by pursuing many lines of differentiation of the genus, the scientist can locate the essence of a thing by appealing to the structure of a demonstration. But Charles, like so many other commentators of Aristotle's zoology, argues that *Metaphysics* Z.12 fails to account for the unity of a definition. His argument, though, is contingent upon Aristotle's conception of scientific inquiry; Z.12 does not employ the resources developed in the *Posterior Analytics* to account for the unity of an essence and middle term. Charles claims that the *Posterior Analytics* stipulates what he calls "the unity requirement", which, if the scientist subscribes, will enable him to articulate and know an *ousia* as a unity. Charles' conception of the unity requirement is pertinent to my view of how to solve the problem of one or many differentiae. But Charles argues that Aristotle fails to uphold this unity requirement in his scientific explanations in the zoology. Aristotle does not find a unified cause that accounts for why all the *per se* attributes, the many differentiae, belong to the same *ousia*. This is what Charles calls a "crisis in Aristotle's thinking about definition" in relation to Aristotle's biological works.⁷³ I will now provide

⁷³ Charles, *Aristotle on Meaning and Essence*, p. 312.

a more detailed account of Charles' position so that we may see how this crisis pertains to the problem of one or many differentiae.

The pertinent aspect of Charles' book for this dissertation begins with his argument for the fact that definition and explanation are interdependent for Aristotle. This interdependency thesis is an attempt to overcome a difficulty in interpreting the second book of the *Posterior Analytics*. This book proposes what appears to be two distinct ways to define a thing: by genus and differentia and by finding the one, basic causal feature of a thing. Charles calls the latter explanation in that a cause answers a why question. The former concerns definition since it exposes the what of a thing. But Aristotle claims in *Posterior Analytics* II.2 that it is the same to know the what and the why (90a32). Charles takes this to support his thesis that explanation and definition are interdependent for Aristotle. If these two are interdependent, then the problem of the two distinct kinds of definition vanishes. Each kind of definition would be dependent on the other. Charles articulates this as follows: "[A] feature can only be a *differentia* if it is explained in the appropriate way by the essence of the relevant phenomenon. Both definition and explanation have a role to play in the determination of *differentiae*. Neither is complete by itself."⁷⁴ What this means in relation to the problem of one or many differentiae is that division finds the many differentiae, but we do not know what differentiae belong to a kind apart from explanation, which demands one, basic cause that explains why each feature or differentia belongs. So why is it that Charles does not take the cause to be the one, final differentia that explains why all the other differentiae belong?

⁷⁴ Ibid., p. 245.

Charles claims that Aristotle solves the problem about the unity of a definition raised in *Posterior Analytics* II.6, why is a human being a two-footed, tame animal and not animal and two-footed, if a simple unity explains why each of these differentiae that divide the genus animal belongs to a human being.⁷⁵ According to Charles, the scientist begins from a genus, say number, and locates the various species under the genus. Next, the scientist finds the relevant differentiae of this genus, e.g., odd, even, prime, composite, etc., that will be definitional properties of the species. Finally, the inquirer can find the essence by seeking the middle term that explains why these various differentiae belong to this kind, e.g., why odd and prime and prime in this way belong to the number three (*APo.* II.13 96a32-8). Such a method of inquiry makes clear Charles' conception of the interdependence of explanation and definition. The definitional features of a kind will be precisely those things which are explained through a demonstration.⁷⁶ There is an interdependence because explanation by itself cannot find the terms, the differentiae, it explains, and differentiae arrived via division carry with it no necessity as an explanation via demonstration. Thus, each method of defining depends on the other and produces a complete definition of a thing through its cause and its defining attributes. We should already note that this dissolves the problem of one and many differentiae, except that the cause is not a differentia—it is the simple unity that is the cause of the many differentiae belonging to a thing. A differentia always implies a plurality since it falls under a genus. Charles' contribution to resolving the problem of one or many differentiae is precisely this—it is what he calls his the unity requirement,

⁷⁵ Ibid., pp. 234-5.

⁷⁶ In case one might accuse Charles of confusing a differentia with a property he has this response. In respect to the genus, the definitional features are differentiae, but in respect to the species they are properties.

which is possible through the structure of a demonstration. I will now turn to this aspect of Charles' interpretation.

Charles' detailed analysis of most of the second book of the *Posterior Analytics*, which argues how one discovers an essence, exposes why Aristotle prioritizes demonstration to express claims of understanding and its relation to the unity requirement. The problem Charles begins from is that an essence, which serves as the middle term of a demonstration, cannot itself be deduced from a demonstration without the threat of an infinite regress. Deduction (συλλογισμός) or syllogistic reasoning requires a middle term. The essence, then, if it were deduced would be understood through yet another middle term, ultimately leading to an infinite regress if every middle term and essence could be deduced. But if one claims to know the definition of an essence apart from the structure of a demonstration, it is not clear what guarantees this knowledge. There is no necessity in our understanding apart from demonstration. Division cannot necessitate that the final term arrived at is actually the definition; it only picks out terms. Charles calls this requirement the "definitional constraint." There are two other conditions to insure one has found an essence: the "Priority Condition" and the "Unity Condition." Both are guaranteed by the structure of a demonstration: the essence, as a middle term, is prior in explanation to the terms it explains, and if the scientist uses the same essence to explain why all the *per se* attributes, then we can know that they all belong to the same thing. But it must also be the case that the essence itself, the middle term, is one. Charles calls this the unity requirement. He articulates this as follows:

The appropriate method for arriving at definitions should legitimize the claim that the *definiens* is a unity...⁷⁷ This feature should have the following properties: (a)

⁷⁷ Charles, *Aristotle on Meaning and Essence*, p. 192.

It should be linked immediately to the relevant matter in such a way as to explain why the matter is as it is. (b) It should explain why the relevant matter is possessed of certain necessary, *per se*, properties (e.g. being biped). (c) It should constitute what it is to be the composite substance. (d) Its unity should be basic and not further analysable. Thus, it should be a non-complex cause (of the appropriate type) specific to the kind in question.⁷⁸

He derives these conditions from the aporiai raised in *APo.* II.3-7. Charles argues that *APo.* II.8-10, along with II.13-18, show a way to solve these aporiai and fulfill these conditions. The solution is what demands a strong interdependence between explanation and definition.

Posterior Analytics II.8 provides two examples of how the practice of definition and scientific syllogisms are connected. One of these is as follows:

Thunder/Noise belongs to all fire-quenchings.
Fire-quenching belongs to the clouds (all clouds of kind K).
 Noise belongs to the clouds (all clouds of kind K). (93b9-12)⁷⁹

Charles glosses this example in several ways. First, this is an example where we have proved some attribute belongs to a subject necessarily. Further, if the conclusion of a demonstration states that noise belongs to the clouds, then the middle term of this syllogism would be prior in explanation to noise in the clouds. This is how a demonstration fulfills the priority requirement. Also, no definition is deduced in this example, but it is obvious how to connect the conclusion to the definition of thunder. Charles argues that this is how a definition can be known necessarily although the deduction is not of the definition. This is his interpretation of the very difficult passage in chapter 8 of second book of the *Posterior Analytics* where Aristotle argues that one

⁷⁸ Ibid., p. 291. Although these two passages are far apart textually, the “this feature” refers back to the feature discussed in the passage first quoted on p. 192. Both passages are discussing the unity requirement. Further, we will see that this unity condition mirrors what Aristotle argues for in the first book of *Parts of Animals*.

⁷⁹ This is Charles’ formulation of the syllogism at 93b9-12. Ibid., p. 198.

kind of definition can be made clear by a deduction and by a demonstration.⁸⁰ Finally, the unity of the middle term and definition here is the fact that it is a unified cause explaining why noise belongs to the clouds: fire-quenching. This solidifies the fact that the middle term is prior to what it explains. Charles takes this also to explain away the problem that Aristotle raises in *APo.* II.6: why is two-footed terrestrial animal one and not many? More specifically, when we express the definition of man as two-footed terrestrial animal, why is this one expression and not many, such as animal and terrestrial and two-footed? Charles explains this in the same way: there is one unified cause for why footed, two-footed, and animal (and terrestrial) belong to one thing, i.e., the essence of man.

Reading the second book of the *Posterior Analytics* this way, Charles' view is that there is no theoretical conflict between there being one primary feature of a thing, its essence, and the many features that this essence explains. Any definition of a composite *ousia* will have both. But, for Charles, this will also involve denying that *Metaphysics* Z.12 solves the problem of how the method of division can arrive at a unified expression, which can then serve as a middle term for a demonstration. Given the interdependence thesis, what follows is that the essence and what the essence explains, the *per se* attributes, cannot be found separately and must be found in reference to the structure of a demonstration. Z.12 attempts to find the essence apart from the interdependence model developed in the *Posterior Analytics*, thus, the one, final differentia that is the form and the *ousia* fails to answer why the other features that belong necessarily do belong. There

⁸⁰ This is Charles' gloss of the claim made at 93b16-7: "Although there are no deductions and not demonstrations of what something is, nevertheless what something is is made plain through deductions and through demonstrations." Translation by Jonathan Barnes, *Posterior Analytics*, Oxford: Clarendon Press, 1993, p. 57.

is no reference made to demonstration in the methodology argued for in Z.12 to find the one, basic causal feature that is the essence. But this does not mean that *Metaphysics* ZH ends in aporia for Charles. He argues that, starting with Z.17, Aristotle switches to the *Analytics*-style model of discovering the essence along with the *per se* attributes. The culmination of applying this method is *Metaphysics* H.6: it accounts for why form and material as actuality and potentiality are one. The material just is the many differentiae that belong to this object through the essence, and the essence just is the form and the unified cause. This answer is possible through the structure of a demonstration, which allows one to find the definition of the composite *ousia*. Thus, according to Charles, Aristotle is successful in the *Metaphysics* in explaining that all the *per se* attributes belong due to a unified essence. On the other hand, Charles argues that the biological writings fail to arrive at the same conclusion.

The problem that the biological writings present is that Aristotle employs different middle terms to prove that different *per se* attributes belong to the same *ousia*. This breaks up the animal into different unities. Thus, Charles, Lennox, and Pellegrin all arrive at the same conclusion, which was made first by Balme: *Aristotle's practice of zoology never finds a unified cause for all the per se attributes of an animal.*⁸¹ This is the real problem lurking behind the problem of one or many differentiae. Charles' analysis of the *Posterior Analytics* shows how it is at least possible for Aristotle to have a theoretical solution to the problem. Thus, the real answer to this problem can only be fully addressed by a close look at the details of Aristotle's zoology. But I would like to

⁸¹ Both Furth and Halper agree with this claim, though Furth argues that the biology cannot resolve this issue by itself and must depend on the *Metaphysics* to resolve it. Halper, on the other hand, although differs in interpreting the central books of the *Metaphysics*, agrees in principle with the way Charles' arrives at this conclusion, although would disagree with at least some of the detail.

question a few aspects of Charles' theoretical solution in relation to his understanding of both the unity requirement and the interdependency thesis with their relation to *Metaphysics* Z.12. This will help show how it is possible to avoid the "crisis in Aristotle's thinking about definition that Charles' draws from the biological writings.

Although I agree with Charles that Aristotle provides both a unity requirement and explanation and definition are intimately related in the *Posterior Analytics*, I disagree with the way he understands them. I will begin with a problem concerning Charles' understanding of the unity requirement. He claims that the unity of the middle term must be simple and not further analyzable.⁸² But this is not directly stated in the *Posterior Analytics*. Charles' reasoning for holding this is clear though: if the middle term and essence is complex, it has parts, and then there is the obvious question of what makes the parts one. Charles avoids this problem by claiming that the unity is simple. Charles also implies that this rules out using division. But Aristotle addresses this question explicitly in *Metaphysics* Z.12 and answers that division can arrive at a unified term if it follows the rules of proper differentiation. Charles does not accept this argument on the grounds that Z.12 does not answer how any line of division can unify the terms mortal, two-footed, and wingless.⁸³ Appealing to this example, Charles ignores the very fact that proper differentiation rules out such an example as producing a unified expression in the final term through a line of division. But the line of division that picks out footed, two-footed, and split-two-footed is successful in picking out a term that is unified. The definition as

⁸² See above p. 48-9, where the unity requirement is quoted. Charles does footnote his unity requirement realizing that it runs into a certain difficulty. Aristotle often claims that the soul has parts but also the soul is the essence of an animal. Charles's response is that the soul can have parts as long as they are understood to be dependent upon the unity of the soul. See Charles, *Aristotle on Meaning and Essence*, p. 291, footnote 34.

⁸³ Ibid., pp. 282-3.

such is both simple in that split-two-footed is really one unit, but it is also complex in that it entails being footed and two-footed as well. This will be vital to my interpretation that Aristotle's practice of zoology does find a unified definition of an animal in *Parts of Animals*.⁸⁴ Why does Charles fail to see this?

This leads to my second criticism of Charles. Charles believes that no definition can be found independent from the structure of the scientific syllogisms, for all definitions appeal to a unified cause to explain why certain features of the definition belong to this kind of thing. For example, being quenched by fire, the cause of thunder, explains why a noise in the clouds belongs to the definition of thunder. Thus, Charles rejects *Metaphysics* Z.12 as an attempt to find the unified cause and essence of a thing because it makes no appeal to the structure of a demonstration. This relates to his understanding of the interdependency thesis: one cannot find the basic cause apart from finding the features that belong to that thing *per se*, and these are found by division, but one cannot find these features apart from the fact that there is one, basic cause for these, and this appeals to the structure of the scientific syllogism. The problem is that *Metaphysics* Z.12 may not be presenting a methodology for finding the middle term but only answering how a definition composed of genus and differentia can be one. Charles is still right in holding that division can never assure us that the term found is the one, basic cause apart from the structure of a demonstration. We can only recognize that this term found by division is the one, basic cause when we realize that all the necessary

⁸⁴ This claim should not be mistaken with the claim that Aristotle finds a complete definition of an animal in *Parts of Animals*. This is not possible, since one must appeal to the efficient cause to find certain features of an animal such as organs for reproduction and the consequences of having such organs. But it is also the case that the zoologist cannot understand the positioning of the sexual organs apart from knowing the fundamental features of an animal, e.g., snakes cannot have external genitals being footless creatures that move on land. Further, we will see that this "success" of finding a unified definition will have to be qualified in other ways as well, but my argument will be none of these qualifications sacrifice the claim that the definition is really a unity.

features of this kind of thing are understood to belong because of the essence, which is defined by a single term. In other words, the interdependency thesis is much stronger than what Charles argues. Definition via division and definition via explanation can and do articulate the same definition. What guarantees that these can be the same definition is that demonstration requires a definition as a middle term, and the one inquiring after the definition of an *ousia* will use this structure to seek it out. The facts grasped empirically serve as conclusions of demonstrations. What will explain the fact will also be the definition (see section 3.3). But it is also the case that division can pick out the *explananda* or what will be explained by the essence and the middle term. For, these are just terms as well that need to be picked out. Thus, Charles' mistake is to read *Metaphysics* Z.12 as accomplishing both the task of picking out the term that can serve as the essence and definition of a thing as well as showing that this term will also explain the other necessary features of a thing. All *Metaphysics* Z.12 purports to answer is how division can arrive at a unified term, thus fulfilling one aspect of the unity requirement – that the basic feature of a thing is a simple unity, and nothing else. In other words, it simply shows that a definition of a sensible *ousia* is possible not how to seek it out.

1.9 Survey of the Literature Pointing Towards a Solution

Although the above survey of the literature leads us to conclude that the real problem of one and many differentiae is whether Aristotle can resolve the issue in his practice of zoology, there are certain theoretical issues that need to be clarified and resolved to show that a solution is possible for the problem of one or many differentiae. Clarifying and resolving the theoretical issues are necessary steps in showing that

Aristotle's practice of zoology is consistent with his theoretical commitments. In respect to the above survey, it has become apparent that there are two assumptions made by most of these scholars that have prevented them from solving the problem of one or many differentiae within the context of Aristotle's philosophy. The first assumption is that, since *Metaphysics Z* does not state any clear conclusion, it must be aporetic and leads to no positive conclusion about the nature of sensible *ousia*. Most of the above commentators then turn to *Metaphysics H* for Aristotle's views on how to define a sensible *ousia*.⁸⁵ But, if Halper's analysis can be supported against those holding an aporetic view of *Metaphysics Z*, and Z.12 is the key in showing how sensible *ousia* is essence, then this forces us to accept that Aristotle defines an *ousia* by one, final differentia. The consequence seems to be that Aristotle either qualifies or abandons his version of essentialism in his zoology. Most of the commentators qualify Aristotle's essentialism in both the *Metaphysics* and the zoology with the exception of Balme, who abandons essentialism altogether. But Aristotle asserts in *Parts of Animals* that essence and defining *ousia* are what enable Aristotle to have a coherent science of zoology (642a25). This actually makes the difficulty of one or many differentiae even more acute. Most authors avoid this problem by positing some kind of developmental hypothesis, claiming that the zoology is Aristotle's most mature writings on the nature of *ousia* and either these writings further clarify this concept, e.g., Balme, or modify it in significant ways, e.g., Lennox. In not accepting this kind of solution, I am faced with a

⁸⁵ Many of them acknowledge that Aristotle begins an inquiry at *Metaphysics Z*.17 and continues in *Metaphysics H* that leads to positive results concerning the definition a sensible *ousia*. See Balme, "Note on the *aporia* in *Metaphysics Z*", pp. 303-4, Montgomery Furth, *Substance, Form, and Psyche*, pp. 249, and David Charles, *Aristotle on Meaning and Essence*, pp. 283-300. James Lennox does not make his view on this matter explicit, but certain passages in "Kinds, Forms and Kinds, and the More and the Less in Aristotle's Biology" suggest such a view. See pp. 171-3. Halper and Pellegrin do not hold this view.

difficulty: could it be possible that Aristotle holds that an *ousia* is defined by both a single differentia and many differentiae? Exposing the second assumption will show a way to relieve this difficulty.

Almost all of the commentators above accept that *Parts of Animals* I.3 defines the same object in the same way as *Metaphysics* Z.12. If this were not the case, then the problem of one or many differentiae would not arise. There would simply be two different ways to study an animal for Aristotle. I will claim that this is precisely what Aristotle argues. Different sciences can study the same object in different ways. But this really just raises the same problem again. Both sciences make claims about the nature of the definition of an animal. Can there be two distinct definitions of the same thing? I will argue that the two definitions are in one way the same yet in another way distinct. *Metaphysics* Z.12 argues how the elements of the definition of a form can be one, insofar as the definition of a sensible *ousia* just is the one, final differentia. This just is the definition of the form by itself. *Parts of Animals* I.3 defines the composite, form and material, which includes the plurality of attributes that belong to an animal, but these many attributes can only be shown to belong to the same thing insofar as they all follow from the same essence, which just is the form.

But showing that the two passages define the same object in different ways presents its own difficulty. The problem is that Aristotle asserts that definition is always of an essence. An objection to my solution is that, if there are two definitions, then there are two essences. I avoid this problem by saying that there is only one definition expressed in two different ways, since the essence of the thing is the same in both definitions. Aristotle provides a way to understand this in *Metaphysics* H.6. In speaking

about the unity of form and material of a composite *ousia*, Aristotle claims that both form and material have the same essence (1045a33). Under this assumption, not only does the unity of form and material as a problem disappear but also it is at least theoretically possible that there are two ways of defining the same thing: the essence as form and actuality and the composite as both form and material (and potentiality). But since all the material together unified by the essence just is the essence, the definitions are also the same. So, in one way, the form is defined in both cases, and, in another way, one definition is solely of the form and the other is of the composite. This answer is also supported by textual evidence in *Metaphysics* H.2 1043a16-21. Aristotle uses the example of a house, which can be defined by expressing the differentia, shelter for possessions and bodies, or by expressing the differentia with the material, shelter for possessions and bodies made out of wood, brick, nails, etc.

But relieving Aristotle of this second assumption points to a deeper assumption that needs some justification. Aristotle claims that distinct sciences can study the same thing in different ways. This implies that there should be some distinction between the way in which metaphysics studies *ousia* and the way in which zoology, falling under physics, studies the same thing.⁸⁶ I must show that Aristotle makes such a distinction, and if he does, it seems reasonable to expect this distinction to play a vital role in solving the problem of one or many differentiae.

⁸⁶ As already noted, both Halper and Pellegrin appeal to this distinction in their writings. Both see the issue in terms of unity and plurality, but Pellegrin gives us little guidance on the precise nature of this distinction. I will follow Halper, who takes his view directly from Aristotle: physics, of which zoology is a part, studies the attributes insofar as it is in motion and metaphysics studies the attributes insofar as it has being. I will discuss this distinction more thoroughly in the next section, 1.11. See *Metaphysics* K.4 1061b30-1 for this distinction.

1.10 Aristotle's Distinction between Metaphysics and Physics as Sciences

This distinction between the way the two sciences study *ousia* will provide a path into a solution to the problem of one or many differentiae. This will not only help resolve theoretical issues of this problem but will also address issues in how Aristotle's practice of zoology employs his theoretical commitments. If Aristotle studies the same thing in different ways in these two sciences, we should not expect the definition of a thing expressed in the same way in each science. The basic distinction between the two sciences is that metaphysics studies form by itself and the physics studies form and material. This is precisely why the two passages, *Metaphysics* Z.12 and *Parts of Animals* I.3, make different claims about the definition of an animal. Since the form is a unity, it is articulated by something that is expressed as one. The composite, on the other hand, has a plurality of parts, each of which will have its own articulation. Thus, the definition will be composed of many differentiae. Unfortunately, I will only be able to hint at how this distinction will help show that Aristotle does employ his theoretical commitments in the practice of zoology. The theoretical commitments must be worked out in detail first. I will proceed in this section by locating in several passages where Aristotle distinguishes between the two sciences explicitly or implicitly and show how this distinction confirms the view that the two sciences will present the definition of an animal differently.

The first passage I will look at is from *Physics* II.2. This chapter compares how physics, mathematics, and optics study the same object, albeit in different ways. Physics does not abstract away the material of a thing but studies both form and material, whereas mathematics abstracts away all material and motion from a thing and simply studies an object as a pure unit or as its shape (193b32-5). Optics, on the other hand, studies the

mathematical entity, the abstract magnitude, as natural (194a8-11). But this chapter also ends with a passage on the way physics differs from metaphysics or first philosophy, as Aristotle himself calls it. Aristotle, here, states the following:

To what extent should the physicist understand form [εἶδος] or the whatness? Up to a point, just as the doctor understands sinews and the smith understands bronze, for each of them [sinews and bronze] is for the sake of something, and the physicist is concerned with what is separable in kind [εἶδος] but exists in matter; for both man and the Sun beget man. As for separate form [εἶδος], how it exists and what it is, this is a task to be settled by first philosophy (194b10-15).⁸⁷

We should note that Apostle translates εἶδος in line b12 here as “kind”, maybe so to avoid confusion between “form” at both the beginning and the end of this passage, which is also a translation of εἶδος. The three instances of εἶδος may actually refer to the same kind of thing: what makes a thing be the thing it is. Aristotle, though, contrasts form that exists in material with form that is separate. Metaphysics studies the latter. But this is ambiguous. It could mean that metaphysics studies only form that is separate from material or it could mean it also studies form that is separate in formula (τῷ λόγῳ). The latter is how Aristotle characterizes the form of a sensible *ousia* (*Metaphysics* H.1 1042a29). Turning to a passage in *Metaphysics* K will provide evidence that metaphysics also studies form in respect to sensible *ousia*. It also sheds more light on the distinction between metaphysics and physics as sciences.

Aristotle states the following in K.4:

But philosophy does not inquire into the attributes which belong to a part of being qua a part of being; it investigates each of such parts but only qua being. The science of physics pursues its investigation in the same manner as mathematics; for physics investigates the attributes and the principles of things qua motion and not qua being. But we said that the first science is concerned with the objects of physics to the extent that they are beings, and not qua some other thing (1061b25-32).

⁸⁷ Translation by Hippocrates G. Apostle, *Aristotle's Physics*, Grinnell: The Peripatetic Press, 1980, p. 29.

This passage asserts that metaphysics also studies the objects of physics insofar as they are beings. Metaphysics then studies what makes a physical object be. The answer in the Central Books seems to be that form makes a sensible object be and be an *ousia*. Thus, metaphysics will seek out the definition of a sensible *ousia* only in respect of the form. An objection may be raised that *Metaphysics* H seems to seek out a definition of the composite and not just the form, but, in response, one way to read the argument of *Metaphysics* H.6 is that the definition of the composite is reducible to the definition of the form. Form and material have the same essence (1045a33).

But the above passage also makes clear how the science of physics will study an object: qua motion. To understand this claim, we need to return to Aristotle's *Physics*. The first book of this text answers how it is possible for a thing to come to be or move. The answer is that motion requires three principles: form, material, and privation (I.7 190b17-191a3). Physics, then, must study the material as well as the form. Further, what comes to be has parts, so if the physicist studies how something comes to be, he must grasp the nature of each of the parts and how they fit together as a whole. This is how Aristotle approaches zoology; the zoologist will grasp the attributes an animal has in virtue of the sort of *ousia* it is (*Parts of Animals* I.1 641a23-25). In order to accomplish this kind of explanation, the zoologist must seek out the definition for each part to see how the part connects to the whole. This, I will argue, entails seeking many differentiae, since each part is also a unity and defined by a differentia.

This also explains how Aristotle proceeds in his inquiry into the nature of animals in his zoology. He is seeking the middle term that will explain why all the various parts belong *per se*. But, as most commentators of the zoology agree, an animal is complex

and admits to various levels of explanation. I will argue that these various levels of explanation are an attempt to locate the proper level of explanation of any animal through its genus and/or form. Many animals share a generic unity with other members of its kind, e.g., bird and fish, which must be understood prior to grasping the form of each species that falls under that generic form. Some animals, though, fall outside of such genera (though, of course, not all genera), such as human being, ostrich, bat, etc. and so Aristotle seeks their form directly. A clearer picture of this claim will have to wait until the fourth and fifth chapter. Let us now map out a solution to the problem of one or many differentiae.

1.11 Mapping out a Solution to the Problem of One or Many Differentiae

The solution to the problem requires both clarification of Aristotle's theoretical commitments in his zoology, that they are consistent with his claim in *Metaphysics* Z.12 that the form is defined by one, final differentia, and a careful look at the empirical inquiry of animals in *Parts of Animals* to show that the practice employs these same theoretical commitments. To argue both points, the rest of the dissertation will be divided into four chapters. The first two chapters will argue that Aristotle's conception of definition in the *Metaphysics* and in *Parts of Animals* are consistent with each other. These two chapters will show that the standard assumptions in the literature, as discussed above in 1.9, need to be discarded. The first assumption, that *Metaphysics* Z is aporetic and comes to no positive conclusion about *ousia*, will be argued away, following Halper, by showing that *Metaphysics* Z argues that form is *ousia* and *Metaphysics* H argues that the composite is also *ousia* through form. The second assumption, that *Metaphysics* Z.12

and *Parts of Animals* I.3 define the same thing in the same way will be argued away in the third chapter. I will argue that multiple differentiation concerns finding the terms that define, not the form by itself, but the form with the material. I will also argue that the theoretical commitments developed in the first book of *Parts of Animals* are consistent with my interpretation of *Metaphysics* ZH on *ousia*. The last two chapters, on the other hand, will show how Aristotle employs these theoretical commitments in his empirical inquiry of animals. In the fourth chapter I will give an interpretation of how Aristotle's inquiry is organized in the *Parts of Animals* in relation to certain features of demonstration and division developed in the second book of the *Posterior Analytics*. The fifth chapter will concentrate on the detail of the explanations and how they point towards Aristotle explaining a species through a unified middle term.

I will now map out my solution in some detail and give a general motivation for this solution. What is unique about my solution, compared with the rest of the literature, is that I accept the fact that Aristotle can define an animal both with one differentia and with many differentiae without contradiction. To clarify, one way is to express the definition of an animal as a single differentia, what I called above the "metaphysical definition". Another way to express the definition is by many differentiae, what I called above the "physical definition." The many differentiae that make up this definition just are the *per se* attributes of that animal.⁸⁸ But a definition of an *ousia* is one, so the

⁸⁸ My usage of metaphysical and physical to qualify each definition has more to do with where Aristotle argues for the conception of each definition than it has to do with the science each articulation is found in. The distinction will fall apart in a way when we recognize that the physical definition presupposes the metaphysical definition, and the metaphysical definition of any particular *ousia* is only found after doing the empirical research of zoology. This is because, for Aristotle, one must know most if not all of the *per se* attributes to know which middle term will demonstrate these attributes. This creates a kind of circularity that Aristotle recognizes of which one can get out of by fitting these terms into demonstrations to see which one is responsible for the other terms belonging to this kind. See *De Anima* I.1 402b10-403a2 for Aristotle's recognition of this circularity.

definition via many differentiae is made one by the fact that each differentia belongs because of the essence of an animal, which just is the one, final differentia. This second way of expressing the definition may seem to be superfluous. In a way, it is. But it is not superfluous to the science of zoology. The two ways of expressing the definition are demanded by the way in which the inquirer approaches the object: insofar as it is, the metaphysical definition is sought, and insofar as it is movable and has parts, the physical definition. The question is whether anything in Aristotle's writings merits this move. I will show that one interpretation of Aristotle supports this move.

Now that we see a distinction between the two sciences is possible, I can show that there is no conflict between the metaphysical definition of an animal and the physical definition. *Metaphysics* Z.12 provides an argument that there is a way to define the essence as one thing without having any parts, which just is the form. Although Aristotle often states that form is a distinct object from the composite, which is form and material, we can understand the two to be of the same object insofar as the essence of each is the same thing—the form.⁸⁹ But the argument in *Metaphysics* H.6 makes this claim stronger: form and material are one in a way. In another way, they are distinct. The two ways of expressing the definition make this clear. All of the material together unified by the essence just is in a way the essence, since each has the same unity. The argument in H.6 assumes that the material present to the composite is the worked up material that is proximate to the form, and, in a way, it is one and whole. But this proximate material, in another way, has many parts, and each part is distinct in its being, in a way, from all of

⁸⁹ For the claim that form and the composite are distinct objects, see *Metaphysics* Z.3 1029a2-5 and *Metaphysics* H.1 1042a26-30. Aristotle also admits that they have distinct definitions in *Metaphysics* H.2 1043a14-21. This will be qualified by the argument found in *Metaphysics* H.6 that form and material are in a way the same. For the claim that both the form and the material have the same essence, see *Metaphysics* H.6 1045a33.

the other parts. For example, human hands are not feet nor feet hands, but each in order to be must be constituted in such a way as to belong to a rational animal—a human being. So, each, in a way, have the same definition, for the definition of a human being is necessary to understand each part. This also helps clarify the way the two sciences study the same object. The science of metaphysics must show that a thing is one for it to be an *ousia*. Form is one, and the composite is one in a way, so each is *ousia*, although the composite is a derivative *ousia*. Zoology studies the different parts as distinct from each other so the scientist can grasp how and in what way the thing comes to be. It also enables the scientist to understand, in the case of most animals, how each engages in locomotion. But the zoologist can only understand the parts completely if he can grasp why they belong to this or that kind of animal. This is through the essence. The zoologist, then, appeals to the structure of a demonstration to show that each animal really is one by demonstrating that each part belongs due to the same essence. Each of these parts will be for the sake of the essence—the soul, which is the potential for a certain action or work. Thus, the essence and the form of an animal is the final cause for why the parts belong. Form and final cause are identical (*Phys.* II.7 198a25-6). Thus, the unity of the definition of the composite is through the form as final cause. This is the thesis of this dissertation. So, since the form is the essence, and the essence is defined by one primary feature, Aristotle’s essentialism is typological. But since the essence is the end and the final cause for the other parts, Aristotle’s essentialism is teleological. The two are not mutually exclusive. But it may not be best to depend too heavily on this terminology and just let Aristotle’s arguments work out the kind of essentialism to which he subscribes. Finally, if the zoologist can only grasp the function of each part

empirically, and if the *Metaphysics* demands the structure of the scientific syllogism to grasp the unity of the composite *ousia*, then it is precisely Aristotle's scientific logic that allows there to be a relation between his metaphysics and the science of zoology. This needs to be spelled out in more detail.

The *Metaphysics* argues that the science of zoology is possible in that animals are *ousiai* and the *ousia* of each is its essence. Science is possible if there is an essence that serves as a middle term. This allows the scientist to have knowledge of why the numerous parts of animal belong to it. This can be seen most clearly in the first chapter of *Parts of Animals* where Aristotle states twice that the zoologist grasps why the parts belong through the essence and the *ousia* (639a33 and 641a23-24). But there is another side to this relation. The *Metaphysics* only argues on what conditions something is an *ousia*, i.e., by having an essence that can be defined as one thing. It does not find the definition of any particular *ousia*. This turns out to be the job of the zoologist. How do they find the definition of an animal? By studying the parts of animals, the zoologist finds the counter-predicates, for example, all animals with a certain kind of wing have feathers, and all animals with feathers have a certain kind of wing.⁹⁰ This is arrived at empirically. Once the zoologist finds enough of these, he has good reason to believe that he has located a genus, from which he can begin to ask what accounts for all of these predicates belonging to the same thing. The zoologist appeals to the structure of a demonstration to find what accounts for all these predicates belonging to this kind. This is the middle term and also the essence. Thus, the discovery of the nature of the essence of an animal cannot occur apart from the empirical investigation. By beginning with what is posterior in nature, the parts, the zoologist inquires into what makes all these parts

⁹⁰ One must qualify wing because certain insects have wings but not the kind with feathers.

belong to one thing. This just is the essence. Science, then, is not deductive for Aristotle but rather inquiry. The inquiry of zoology ultimately serves as a justification that animals have essences by finding the middle term. Now, one could object and say that having an essence is not falsifiable, for even if the zoologist does not find a unified essence to account for all the counter-predicates, one can always just claim that the failure is the scientist and not the thing. This is correct in a way. But Aristotle's claim is that one cannot begin to have a science of a thing that lacks an essence. This will be made clear by the arguments in the third chapter. Further, it is questionable that Aristotle could arrive at the conclusion that *ousia* is essence apart from empirical knowledge of sensible objects such as animals. I will argue this in the second chapter. Finally, we should see that the problem of one or many differentiae is not a problem that arises because the theory demands one thing and the practice the other, for the very nature of zoology is to study the plurality of parts of each animal. These parts are themselves unities that have essences in a way, for they have something that makes each of them be one part. The discrepancy between the two definitions is not a conflict in Aristotle's thought but rather in us not seeing that they are the same definition articulated in different ways. But this does not settle the ultimate question of whether Aristotle actually finds the essence of any animal in his empirical investigation of animals nor whether that essence is ultimately one or many, the latter implying that there is no one essence of an animal, at least for Aristotle. This, as we have already seen, is the heart of the problem.

The final two chapters of this dissertation will work out the details of how this theoretical solution is applied in practice in the three books following the theoretical discussion in *Parts of Animals*. The fourth chapter will show how to connect the

theoretical claims to the practice of zoology. Most importantly, this chapter will discuss why it is the case that there are multiple levels of explanation of any animal and how the nature of the essence and the structure of demonstration are designed to handle this issue. The final chapter will show the actual practice of zoology aiming at a unified explanation of all the parts of animal. It is not clear that Aristotle arrives at a complete definition of any animal, but I will argue that the kinds of explanation presented in these three books aim at a complete definition through a unified essence.

CHAPTER II: THE METAPHYSICAL SOLUTION

2.1 Introduction

The problem of one or many differentiae is primarily about what Aristotle considers to be the appropriate way to define an animal. It is natural to turn to *Metaphysics* ZH where in various passages Aristotle investigates how to define a sensible *ousia* (Z.4-5, Z.10-12, H.2-3, and H.6).⁹¹ Aristotle's paradigmatic example of an *ousia* is an animal. So, the investigation into how to define a sensible *ousia* is also an inquiry into how to define an animal. But this investigation is found embedded in a larger investigation of what is *ousia* (Z.1 1028b4). Aristotle attempts to answer this question, what is *ousia*?, in *Metaphysics* Z by exploring four candidates for *ousia*, one of which is essence, the others being the underlying thing, the universal, and the genus (Z.3 1028b33-36). Essence is that which admits of definition in the proper sense (Z.4 1030a11-12), being said *per se* (1029b13-14) and not being predicated of another thing (1030a3-4). Aristotle claims that he has reached the conclusion that *ousia* is essence in *Metaphysics* H.1 (1042a17), but it is not clear how he arrives at this conclusion. I will follow Halper's interpretation that essence is *ousia* because essence is one in the ways characteristic of

⁹¹ In Z.4-5, Aristotle is concerned with the logical requirements of the definition of an *ousia*. Z.10-11 determine what part of the *ousia*, form, material, and/or the composite, is included in the definition. Z.12, although often read as an insert, answers how a definition composed of genus plus differentia can be one. H.2-3 again returns to the discussion of whether just form can be defined or the composite as well as the material. Finally, H.6 considers how a definition of an *ousia* can be one if the thing is composed up of form and material.

ousia. Aristotle assumes that *ousia* is both one in number and one in formula.⁹² The argument of *Metaphysics* Z.12 shows that essence is one in formula insofar as its definition consists of one constituent—the final differentia (1038a19-20). The arguments of *Metaphysics* Z.13-16 show that essence, insofar as we understand it as an Aristotelian form, is one in number in not being a one over many, a kind of universal. Thus, according to these assumptions about *ousia* and Halper's interpretation, the arguments of *Metaphysics* Z commit Aristotle to the first disjunct of the problem one or many differentiae, namely, that an animal is defined by one, final differentia. *Metaphysics* H, on the other hand, argues that the composite is an *ousia* on the same assumptions: it is both one in formula and one in number. Halper reads the argument in *Metaphysics* H.6 that form and material are one to show that the composite is one in both ways. The formula of the composite just is the definition of the form insofar as they have the same essence (1045a33), and, insofar as the material is one thing through that essence, the two constituents parts of a composite is really one in number, but only in a way. The issue of the composite being defined by many differentiae does not arise in *Metaphysics* ZH for Halper.

This reading of *Metaphysics* ZH is contrary to the views of scholars who also focus on the biology. Most follow Balme and read *Metaphysics* Z as aporetic, coming to no positive conclusion on how to define a sensible *ousia* or even what is *ousia* for a sensible thing.⁹³ Balme has good support for his view. Aristotle claims that an animal is defined like the snub—the definition must make reference to the material (E.1 1025b30-1026a4). This view also appears consistent with the biological writings. Aristotle

⁹² Halper finds this assumption about *ousia* implicit in Z.1 insofar as *ousia* is assumed to be one in formula and one as a substrate. See *One and Many in Aristotle's Metaphysics*, pp. 30-1.

⁹³ See Balme, "The *aporia* of *Metaphysics* Z", pp. 302-06.

pursues many differentiae to define an animal in those writings. These differentiae are often definitions of material parts. For Balme, this sits well with his reading of *Metaphysics* ZH, since it is not until *Metaphysics* H.6 that Aristotle solves how to define a sensible *ousia*.⁹⁴ Balme interprets this chapter to argue that material can be included in the definition of an animal because form and material are really one, in a way, as actuality and potentiality. As we saw in the literature, most scholars follow this reading of *Metaphysics* ZH even if they disagree on some details. Another standard view in the literature that supports this reading is taking *Metaphysics* Z.12 and H.6 to be a doublet.⁹⁵ This serves double duty in that often scholars read H.6 as a more refined and newer view of Aristotle than Z.12, eliminating the very tension between one and many differentiae. Some scholars such as Furth read Aristotle as asserting that the form is defined by many differentiae in *Metaphysics* H.2.⁹⁶

To defend Halper's view, I will show that there are three things wrong with Balme's reading or readings of this sort. First, form as essence is the cause of the composite thing being an *ousia* (Z.17). The cause of something being an *ousia* must itself be an *ousia*. So, essence is *ousia*. Further, *ousia* admits of definition most of all (Z.13 1039a20). On these assumptions, the essence of an animal will have a definition separate from its material. I will argue this view in the next section (2.2). Much of the

⁹⁴ See Balme, "Aristotle's Biology was not Essentialist", p. 295. For other scholars who agree with this view see Furth, *Substance, Form, and Psyche*, pp. 250-57, Lennox, "Kinds, Forms of Kinds, and the More and the Less in Aristotle's Biology", pp. 167-72, and Charles, *Aristotle on Meaning and Essence*, pp. 294-300.

⁹⁵ Werner Jaeger and W. D. Ross take H.6 to be a doublet, a repeat, of Z.12. Jaeger, *Studien zur Entstehungsgeschichte der Metaphysik des Aristoteles*, Berlin: Weidmann, 1912, pp. 53-61. Ross, *Aristotle's Metaphysics*, Vol. II, Oxford: Clarendon Press, 1924, p. 206. Both Balme and Furth, as noted in the first chapter, take H.6 to be the solution concerning how to define a sensible *ousia*, though Furth takes H.6 to solve a problem within the nature of form. Balme, "Aristotle's Biology as not Essentialist", p. 295. Furth, *Substance, Form and Psyche*, pp. 246-7. David Charles also agrees with this view insofar as he reads Z.12 as a failure and H.6 as a successful explanation of why form and material in the definition are one. Charles, *Aristotle on Meaning and Essence*, pp. 276-83 and pp. 294-300.

⁹⁶ See Furth, *Substance, Form, and Psyche*, pp. 250-57.

argument will focus on showing how Aristotle arrives at the conclusion in H.1 that essence is *ousia* albeit an essence that is not separate from the particular, sensible thing. Second, Balme's reading of *Metaphysics* ZH confounds the object under discussion in each book. He reads these two books, as do most scholars, as a continuous (or relatively continuous), sustained argument about sensible *ousia*. Although this is correct in a generic sense, it ignores the fact that *Metaphysics* Z focuses on primary *ousia*, which turns out to be essence, and *Metaphysics* H focuses on the composite or secondary *ousia*. There is a real problem with the composite thing being an *ousia*. Given that essence is *ousia* and any composite has an essence, the composite does not appear to be an *ousia* but an intrinsic plurality. If *ousia* is one for Aristotle, especially one in number, then the composite *ousia* seems impossible. I will argue in section 2.3 that *Metaphysics* H shows in what way a composite living being can be an *ousia*.

Finally, the last problem with Balme's reading is that it confounds the science of metaphysics with the science of physics, of which zoology is a part. Balme expects the two sciences, since they study the same things, living beings, they study them in the same way. Aristotle, though, makes a distinction between the way in which different sciences study the same objects differently (*Physics* II.2 194b1-9, cf. *Met.* K.4 1061b30-31). It may just be that the way to define an animal differs in the two sciences. But this would run into even deeper problems: it would be unclear how the sciences study the same thing, if the definition of something tells what it is to be that thing. But there is another solution to this problem. *Metaphysics* seeks out the answer what is the being of a thing, i.e., what is the *ousia* of a sensible thing? As Myles Burnyeat points out, Aristotle answers four times in *Metaphysics* Z that form is *ousia* (Z.3 1029a29-30, Z.11 1037a5-6,

Z.15 1039b22, Z.17 1041b27-33).⁹⁷ The science of zoology, on the other hand, studies the way in which the material parts belong to a thing due to the form. Zoology takes the material to be formal, in a way, since material must be defined in terms of form for Aristotle. I will make this argument more clear as I develop Aristotle's view of form in *Metaphysics* ZH. Let us now turn to *Metaphysics* Z and work out how Aristotle argues that form as essence is *ousia*.

2.2 Essence as *Ousia*

Aristotle states the conclusion that essence is primary *ousia* and the definition is the formula of the essence at *Metaphysics* H.1 1042a17. My claim is that Aristotle cannot arrive at this conclusion without showing that a sensible *ousia* is defined by one, final differentia. Since essence is what admits of definition in the proper sense, this argument, in conjunction with the arguments that show essence is also one in number, has as its consequence that essence just is primary *ousia*. In presenting this reading of *Metaphysics* Z, I will follow Edward Halper's interpretation in his book *One and Many in Aristotle's Metaphysics* that the arguments found in the central books of the *Metaphysics* assume that *ousia* is one. But Aristotle also assumes that something can be one in various ways (Δ.6). Halper makes clear that there are two ways in which Aristotle assumes that *ousia* is one: *ousia* is one in formula and one in number. Aristotle, then, argues that essence is *ousia* by showing that the definition of essence expresses something that is one in formula and only an essence has a definition in the proper

⁹⁷ Myles Burnyeat points this out in his work *A Map of Metaphysics Zeta*, Pittsburgh: Mathesis Publications, Inc., 2001, pp. 9-10.

sense.⁹⁸ This may at first seem to be a circular argument, but what Aristotle is really arguing is that only essence has the sort of unity that entitles it to be *ousia*. Aristotle allows other things to have essences, such as a number or part of an animal or other subsidiary things, but these essences depend on the essence of the *ousia* to which they belong (Z.4 1030a18-27). The subsidiary essence cannot be defined apart from adding the definition of the essence of the *ousia* to which they belong. Aristotle also argues that essence is *ousia* in the second sense, being one in number, negatively insofar as essence is not a plurality of accident and *ousia*, essential attribute and *ousia*, form and material for generation, genus and differentia, nor something that, like the universal, exists in a plurality.

This interpretation of *Metaphysics Z* must overcome certain challenges. The most relevant challenge to this interpretation comes from David Balme, who argues that Aristotle maintains that form cannot be defined apart from material.⁹⁹ Aristotle claims in *Metaphysics E.1* that a living being is defined like the snub, it must include some of its material in the formula as a distinct constituent in addition to the form (1025b30-34). Balme, then, reads *Metaphysics Z* as aporetic, for a definition cannot include material, since it is indefinite, yet a living being is an *ousia* and must have a definition. This tension is best exhibited by the apparently contradictory claims made in Z.10 and Z.11. The former argues that an essence of a sensible thing is defined apart from its material, but the latter argues that a living being cannot be defined without reference to motion, and motion requires material for Aristotle. But it is not this aporia alone that causes

⁹⁸ Halper makes this argument throughout his investigation of the section on essence in his book, but states it most explicitly on p. 65.

⁹⁹ See Balme, "A Note on the *Aporia* of *Metaphysics Z*", p. 303, Furth, *Substance, Form, and Psyche*, pp. 241-3, and Charles, *Aristotle on Meaning and Essence*, pp. 276-83

problem for the interpretation I will defend. Aristotle argues in Z.13-16 that no *ousia* is a universal. A definition is of the universal and is the formula of an essence. These chapters of *Metaphysics Z* lead to the opposite conclusion of Z.4-11 that essence is *ousia* (Z.11 1037a5-6).

I will respond to these challenges below. I will follow Halper's interpretation that Aristotle is assuming that *ousia* is one in various ways. On Halper's view, *ousia* is assumed to be both one in formula and one in number. These assumptions really are behind the apparent aporia between Z.4-11 and Z.13-16. But I will begin my defense of Halper's interpretation by addressing Balme's view of the problem of the snub. Balme views the problem of the snub as both a logical and ontological problem. The logical problem is that the formula (λόγος) of something like the snub, that which includes its material in the formula, admits to certain fallacies that exclude this kind of formula from being a definition (ὁρισμός). In section 2.2.1, I will argue that the form and essence of a living being does not admit to the logical problem of the snub. Further, Aristotle presents arguments in Z.7-9 that support this view. These arguments show that form is a separate principle of a living being and that which can be one. The ontological problem is that essence is that which admits to definition without material but no living being can be defined without material. In section 2.2.2, I will address this issue by presenting an alternate reading of Z.10 and Z.11 that shows these two chapters are not just consistent but making similar points on the same assumptions. I will conclude this section by showing how Z.12, normally considered an insert, is really the pinnacle of the discussion of essence as *ousia*. Z.12 argues that there is no reason to deny that the formula of an essence is one. In section 2.2.3, I will turn to the arguments of Z.13-16 to show how they

further the view that essence is *ousia*. According to Halper, these chapters indirectly show that essence is one in number without sacrificing being one in formula. Plato's Forms do not share the same fate. Finally, I will conclude this section in 2.2.4 by showing that Z.17 confirms the view that essence is *ousia*. *Ousia* is also a cause and a principle, and Aristotle argues in Z.17 that form as essence is the cause of being in the composite thing. Form is the cause of the being of the material. Such a view rules out that *Metaphysics Z* is aporetic. Instead, it is an extended argument that essence is *ousia* by showing that essence best fulfills the qualifications assumed to belong to *ousia*: being one in formula, being one in number, and being a cause and a principle. The first qualification is possible only insofar as essence is defined by one, final differentia.

2.2.1 The Snub: Z.4-9

Aristotle claims that the nature of an animal is defined like the snub—it must include its material in the formula (E.1 1025b34). This claim leads to various problems raised in *Metaphysics Z* in Aristotle's examination of essence as *ousia*. How Aristotle solves this problem will determine whether Aristotle accepts that an animal is defined by one, final differentia or not. I will argue that Aristotle resolves these problems in *Metaphysics Z*. I will follow Balme in acknowledging two separate problems: a logical problem and an ontological problem. The former concerns the nature of the formula itself and what kind of formula is a definition. The latter problem concerns whether the being of an animal is just the form or a form in a certain material. Aristotle will answer this question by showing whether the form can be defined by itself or whether it must include the material in its formula. This section will only address the first problem. The

second problem will be addressed in the next section (2.2.2). We will now turn to the first problem, which, for lack of a better name, I will call the problem of the snub. We will first develop the problem of the snub and address why it is serious problem for Aristotle's view of sensible *ousia* such as an animal.

Aristotle states in *Metaphysics* E.1 that the formula (λόγος) and definition of a sensible *ousia*, an object of physics, is defined like the snub, i.e., it must include some material in the formula (1025b30-34). This passage expresses both the logical and the ontological problems, but I will leave the discussion of latter until section 2.2.2. The logical problem is that the material will serve as the subject for the form, but no essence is predicated of another thing (Z.4 1030a3-4). So, insofar as the form of an animal is defined like the snub, it will not be an essence. There are also additional logical problems when defining things like the snub. Aristotle presents these problems in *Metaphysics* Z.5. Insofar as the snub is concavity in a nose, the snub cannot be said by itself, for snub is not just concavity but concavity in a nose, nor can snub nose as a compound be defined for it leads to babbling (τὸ ἀδολεσχεῖν) or saying the same thing twice.¹⁰⁰ Babbling occurs when the definition includes the same term more than once, e.g., in trying to define the snub nose, to speak of a snub nose is to include two “noses” instead of one. The second mention is superfluous; it should be eliminated or not said, but the real problem in respect to something like the snub is that the definition intrinsically contains this redundancy. For, the term “snub” by itself cannot be defined without including nose. So, if snub means a concave nose, then the snub nose is the concave nose nose. So, if no definition is properly formed when it contains the same

¹⁰⁰ Aristotle discusses the problem of babbling at *SE* 13 and gives a solution to why babbling is not a real problem at *SE* 31. I will argue later why Aristotle cannot appeal to this solution in Z.5 in respect to defining snub or snub nose or any other *per se* attribute or composite.

term more than once, what is snub or like the snub will not admit to definition. If a sensible *ousia* is like the snub, and Aristotle assumes that *ousia* admits to definition most of all (Z.13 1039a19-20), he must give up one view or find a way to eliminate the contradiction. I will argue that Aristotle shows in *Metaphysics* Z.4-5 is that the definition of a sensible *ousia* does not admit to the logical problems raised about the snub. The main reason why is that the problems raised in *Metaphysics* Z.5 only concern *per se* attributes and the composite to which they belong, not to an *ousia*. This chapter even draws this conclusion (1031a1). This means that neither *per se* attributes nor the *per se* composites can be *ousia*. But there are good reasons to discuss this problem thoroughly. First, one of the problems remains relevant: the definition of an essence cannot admit of an addition, but including material in the formula, since an animal is defined like the snub, would seem to be an addition. Second, clarifying why the problems in defining a *per se* attribute or *per se* composite, e.g., snub nose, do not apply to the definition of an animal, as I will argue, will also help resolve the ontological problem raised in Z.10-11 concerning the definition of an animal. But there is a deeper issue here that needs to be explored as well through this inquiry: what kind of formula is a definition? Aristotle does not equate a formula with a definition: the formula must be of something primary (Z.4 1030a5-11). Aristotle, in Z.4-5, is showing what kinds of formula admit of being of an essence negatively by showing which kinds of formulae fail to be primary. This is the prior question to determining any logical problems with the definition of things like the snub. Aristotle explores this issue in the previous chapter, *Metaphysics* Z.4. There he claims that he will investigate the definition of an essence logically (λογικῶς) (Z.4 1029b13). I take the view that investigating essence logically minimally implies that

such an investigation will presuppose criteria on what kind of formula (λόγος) is a definition (ὁρισμός). Since a definition is the formula of the essence (Z.5 1031a12), these criteria will be important in determining whether an animal has an essence. Aristotle arrives at the conclusion twice that only *ousia* has an essence and definition (Z.4 1030a29-30, Z.5 1031a11-13). He qualifies this by saying that other things can have an essence in a secondary way (Z.4 1030a18-27). I will develop below how Aristotle arrives at this conclusion below.

In *Metaphysics* Z.4, Aristotle claims that an essence belongs to the thing *per se* (καθ' αὐτό). Aristotle assumes that a definition is the formula of the essence (Z.5 1031a11), so the obvious conclusion is that only the thing with a definition has an essence. The conclusion of this chapter is that only *ousia* have a definition which is said *per se* in the proper sense, in that it is not predicated of something else (1030a10-11). Aristotle arrives at this conclusion by showing various ways in which the formula of a thing fails to be said *per se*. Now, according to *Posterior Analytics* I.4, there are four ways in which *per se* is said of a thing in (73a34-b16). The discussion below will make clear that Aristotle is concerned with the first sense of *per se* mention in *APo.* I.4. Something is said *per se* in the first sense when what is said is an element in a definition, such as line is in the definition of triangle. The claim is that nothing can be said *per se* in this sense if there must be an addition or what Aristotle calls “not an addition” to the definition to express the being of the thing. Scholars commenting on Z.4 are often puzzled about the relevance of such a problem in respect to a formula being a definition

to the issue.¹⁰¹ Simply put, why does a definition that contains an addition fail to be said *per se* of a thing? Halper answers that Aristotle is assuming that the essence of something primary is one, and an addition to that definition expresses the thing as a plurality.¹⁰² The same problem applies to what Aristotle calls “not an addition”, so, following Halper, I will refer to both as “additions”. Interpreting the problem of addition to be a problem of unity not only makes sense of why definition by addition fails to be of an essence but it also makes sense how Z.4 contributes to Aristotle’s discussion of essence as *ousia*. Let us turn to the argument to see this clearly.

Aristotle is arguing that both an accidental attribute, e.g., the pale of a man, and an accidental composite, that which is composed of thing and accident, e.g., pale man, fail to have a definition for they fail to be said *per se* of anything. Any formula of them would either add something or fail to add and, on these grounds, fail to be the formula of one thing. The argument is by example—showing that both the pale and the pale man fail to have a definition. Aristotle assumes that any thing that must be defined via addition will fail to be said *per se*. Addition has two senses, as Halper argues.¹⁰³ The first sense is when the thing being defined, e.g., pale, must be added to something else to be defined, e.g., to man. Pale is an attribute that belongs to something else and that something else is not what it is to be pale.¹⁰⁴ So, the formula of pale alone would fail to add something that belongs to the pale in the way, in respect to the snub, the formula of concavity fails to add the nose in which it lies. The second sense is when the thing being defined has to have

¹⁰¹ W. D. Ross raises this problem as well as David Bostock. See Ross, vol. II, p. 172 and Bostock, pp. 88-90.

¹⁰² Halper, p. 55.

¹⁰³ Halper, p. 52.

¹⁰⁴ “What it is to be” is another way to translate the Greek “τί ἦν εἶναι”, which I normally render as “essence”.

something else added to the definition. For example, in order to define pale man, the definition of pale needs to be added to the definition of man. The problem in each case is that the thing being defined, either pale or pale man, is an intrinsic plurality, for an addition occurs when the two terms are not together what it is to be one thing. On the assumption that essence belongs only to things that are one, each thing fails to have an essence and, so, a definition as well. Therefore, what is said *per se* of a thing is whatever expresses a thing as a unity, where the thing itself is one as well. Since attributes and accidental composites are not one intrinsically, they do not have essences in the proper sense. Since *ousia* are assumed to be one, it alone is that which has an essence and a definition (1030b4-5).

Aristotle modifies this claim in a way that supports Halper's interpretation of the argument. Aristotle claims that something can have an essence in a secondary way insofar as the what is (τὸ τί ἔστί) belongs to each of the ways of being, e.g., quality, quantity, relation, etc. (1030a17-20). This is consistent with his view that each being is one insofar as it is a being (*Metaphysics* Γ.2 1003b22-36). His argument in Γ.2 is that saying that something is a being and saying that it is one being are not saying something different. So, the reason why various other kinds of beings other than an *ousia* have an essence, at least in a way, is because they are one thing. But the primary sense in having an essence is being one in the primary sense, i.e. being a this (τόδε τι), and not being predicated of something else (1030a10-11, 17-20). *Ousia* is both of these, so Aristotle concludes that only an *ousia* has an essence and a definition. Another passage at the end of Z.4 helps confirm this reading as well:

There are also definitions and essences of the others in a similar manner, but not in the primary sense. If we posit this, it is not necessary that there be a definition

of a term if the term and its formula have the same meaning, unless the formula is of a certain kind, namely, a formula which signifies *one thing*, not one by continuity as in the case of the *Iliad* or of things bound together, but one in any of the main senses of “one” (1030b6-11).¹⁰⁵

Now, this reading of Z.4 rules out Ross’ interpretation that this chapter merely formulates rules for giving a proper definition of a thing.¹⁰⁶ In other words, on Ross’ view, a formula fails to be a definition due to the fault of the definer not the thing. But Aristotle’s language of the chapter is excluding certain *things* from having a definition in the proper sense (e.g., 1030a23-24). Now that we have a clear understanding of what kind of thing has a definition and what it means that an essence is that which is said *per se* of a thing, we can turn to *Metaphysics* Z.5 to see if it contributes to this discussion and strengthens Aristotle’s conclusion that only *ousia* have an essence and a definition.

Metaphysics Z.5 continues the discussion of essence logically, but it no longer considers accidents or accidental composites but *per se* attributes, such as snub, and *per se* composites, such as snub nose. Aristotle refers to such things as being coupled (συνδεδυασμένον). He begins Z.5 inquiring into whether things that are coupled have essences (1030b14-16). The question makes sense, for things such as the snub are said *per se*, albeit in the second sense of *per se* in *Posterior Analytics* I.4 (73a37-40). These things cannot be defined apart from that which they belong. Aristotle points out that the problem of addition applies to such entities, for, in the case of snub nose, what it is to be snub is not what it is to be a nose (1030b14-28). The only difference here from the argument in Z.4 is that things that are coupled, e.g., snub nose, are not accidental composites. This by itself would seem to rule out defining an *ousia* in such a way, but Aristotle claims that an animal is defined like the snub (E.1 1025b34). For this reason,

¹⁰⁵ Italics are mine for “one thing”.

¹⁰⁶ See Ross, *Aristotle’s Metaphysics*, Oxford: Clarendon Press, 1949, pp. 169-70.

Z.5 has received careful attention. I will show that the logical problems raised in Z.5 are not problems for a definition of an animal.¹⁰⁷ Aristotle raises both the problem of addition in respect to defining things that are coupled as well as an additional aporia in Z.5 (1030b28-1031a1) in respect to defining the snub. Scholars are of a mixed opinion on the relevance of this passage. On the one hand, Balme focuses much of his attention on the logical problems raised in this passage for he assumes that these same problems also arise for the definition of an animal. On the other hand, W. D. Ross argued that Aristotle solved these problems elsewhere (*SE* 31 182a4) and is confused why Aristotle does not seem to accept these solutions here.¹⁰⁸ I will argue that, although the aporia raised does not affect a definition of an animal, Aristotle is correct in ignoring his solution argued in *Sophistici Elenchi*.

The additional aporia is simply stated as follows: either snub nose cannot be said at all or else the same thing will be said twice. The argument here leads us to this aporia by showing that, on the one hand, snub nose cannot be said because its formula will contain an indefinite number of noses in its definition, and, on the other hand, snub nose when defined will contain two noses in the formula instead of one.¹⁰⁹ The problem arises because, although a snub nose is a concave nose, it is not the case that “concavity” is the same as “snubness”. Thus, the snub cannot be said apart from its material, for it is shape in a nose. So, “snub” is a *per se* attribute of a nose in the second sense.¹¹⁰ Since snub always implies a nose, the definition of snub nose will contain two noses. On these

¹⁰⁷ Balme provides a detailed analysis of the various arguments in this chapter in his article “The Snub”.

¹⁰⁸ See Ross, Vol. II, p. 174.

¹⁰⁹ Both Halper and Balme read the argument this way. See Halper, *One and Many in Aristotle's Metaphysics*, p. 60. See Balme, “The Snub”, pp. 308-9.

¹¹⁰ The same argument would apply to odd or even in respect to number and male or female in respect to animal. Both are *per se* attributes of their respective genus.

grounds, Aristotle concludes that essence does not belong to such a thing (1030b34-35). Why is that? The definition, in repeating nose, is not expressed as one thing, for if the snub nose were one thing, there would only be one nose in its formula. As Halper stresses, this is a problem with the formula of snub nose, not a problem with their being two noses present in the thing.¹¹¹ But Aristotle continues the argument. He shows that if we assume the snub nose to have an essence, its formula would turn out to be indefinite, insofar as another nose will arise from defining the snub (1030b35-1031a1). Why is that? On the one hand, a thing with an essence is one, yet the elements of the definition of snub nose are two. Since snub is not the same as the concave, a nose is always present in the formula of snub, but since snub is not a nose, snub is always defined separately from nose. So, another nose arises in the formula. The point of the argument is that the formula of a *per se* composite will be indefinite for the elements in the formula are not one but two, yet one element intrinsically refers to the other, so the two together cannot be separated, i.e., snub of nose. So, Aristotle has now shown how one arrives at the aporia. But the aporia is not solvable except on the grounds that we deny a *per se* composite has an essence. This is precisely the conclusion Aristotle draws in saying that only an *ousia* has a definition and has an essence in the proper sense (1031a1,11-14). Ross, then, is wrong to believe that Aristotle solves this problem in *SE*. The solution in that text accepts that the terms have no meaning apart from their relative or to that which they are attributed (181b25-37). But the primary question of Z.5 is not if the term or terms have meaning or even a formula, but if the thing, either snub or snub nose, has a definition and whether its formula admits to being a definition (1030b14-16).

¹¹¹ See Halper, pp. 62-3.

Do these same arguments presented in Z.5 also hold for the definition of an animal, since an animal is defined like the snub? The answer is complicated. Aristotle assumes that an animal is an *ousia*, so it would have to have an essence. The arguments of Z.4-5 do not seem to imply to an animal. These arguments only concern the compound of an attribute and that to which it is attributed. The form of an animal, even if it is attributed to material, is not an attribute of that material. But someone like Balme could argue that Aristotle accepts the analogy to the snub breaks down in this respect yet still would argue the same problems would arise for the definition of an animal. But there is good reason not to hold this view. Aristotle's view of the material to which a form is predicated is different than that of the material to which snub is predicated. Aristotle states that the material for the form of an animal is indeterminate (Z.10 1036a9). Unlike the nose to which the snub belongs that has its own formula even as material for the concave, material in this sense has no formula whatsoever by itself. Ironically, on the one hand, this absolves the definition of an animal from logical problems raised at Z.5 1030b28-1031a1, but, on the other hand, this solution makes acute the ontological problem. How can material be included in the definition of an animal at all, if the form cannot be defined without reference to the material (Z.11 1036b29-30)? This is yet another sign that Aristotle accepts the view that an animal is defined like the snub (E.1 1025b34). We can now see that the additional aporia of Z.5 does not hold for the definition of an animal, but the logical problem of addition still stands, if Aristotle insists that material must be included in the definition of an animal. I will turn to Z.6-9 to provide some evidence that Aristotle considers it possible for the form to be defined by

itself. But even if this is so, we are left with another puzzle: how is the definition of an animal like the definition of the snub?

Although there are problems interpreting certain aspects of the arguments in Z.6, it is clear that its arguments seek to show that the essence must be identical with the thing (ἔκαστον). Without this identity, the thing would be intrinsically unknowable in that the thing would always be other than what it is to be that thing. On the one hand, that an essence and thing must be identical seems undeniable, if there are essences, but, on the other hand, given such a strict qualification, there are apparently very few things that have essences in this strict sense. Once again, Aristotle is not determining what things have essence specifically, but rather he is arguing if the thing has an essence, the essence must be identical to the thing (ἔκαστον). What is this thing? Some scholars take the thing to be the composite.¹¹² Aristotle does not answer explicitly, but some of the arguments may help us determine what the thing is here. The second argument (1031a28-b3) concludes that the things said *per se* (καθ' αὐτά) are identical to their essence on the grounds that if they were not, there would have to be a prior *ousia* that is the being of that thing, and so on ad infinitum, for, if they were not identical, there would be two things present, thing and essence. But there must be *ousia*, so there would have to be a prior thing that is identical with its essence. Since accidental composites and *per se* composites have been ruled out as being that which is said *per se* in the previous two chapters, it seems that the thing here spoken of is neither the composite nor the material but the form. To show that animals have essences, Aristotle needs to argue that form is a

¹¹² See Ross, Vol. II, p. 176 and Balme, "Note on the *Aporia* of *Metaphysics Z*", p. 303. Both interpret the essence to be identical with what appears to be the composite, i.e., they interpret the ὄντα here to be the composite.

separate principle of an animal and give us reasons why form is one and the being and the essence of the animal. This argument is developed in Z.7-9, which argues that a form does not come to be. Inasmuch as anything that changes must be a plurality, what does not come to be can be one. Let us now turn to this argument to see how Aristotle can use this argument to show that it is possible for the form and essence of animal to be defined independently of material.

Metaphysics Z.7-9 is often read as an insert, either by a later editor or even Aristotle himself.¹¹³ It is not significant in respect to the argument I am developing whether Z.7-9 is actually an insert. I will follow Halper in his interpretation that these chapters argue that the form of an animal is one because it is ungenerated.¹¹⁴ This makes form a likely candidate to be *ousia*. But we should note a problem. Aristotle claims that an animal is defined like the snub because an animal is a this-in-that (E.1 1025b34), and Z.8 confirms this view (1033b19). Does this claim in Z.8 imply that the form cannot be defined apart from its material? Insofar as the chapter argues that form is a separate principle and one, it would seem to imply that the essence of an animal can be defined apart from its material. This conclusion would appear to contradict the claim that a sensible *ousia* is defined like the snub. I will show how Aristotle avoids contradicting this claim in the next section (2.2.2) on *Metaphysics* Z.10-12.

There are actually, in my view, two different ways Aristotle argues that the form of an animal is a likely candidate to be an *ousia*. The first way contains two arguments in Z.8 (1033a24-b4, 1033b5-19) that the form does not come to be, and in not coming to be,

¹¹³ W. D. Ross, David Bostock, and Myles Burnyeat are a few examples who hold the view that Z.7-9 is an insert in their respective commentaries. See Ross, *Aristotle's Metaphysics*, Vol. II, p. 181, Bostock, *Metaphysics* ZH, p. ,119-20, and Burnyeat, *A Map of Metaphysics Zeta*, Pittsburgh: Mathesis Publications, 2001, pp. 29-38.

¹¹⁴ Halper, pp. 89-94.

the form can be one. This is the way Halper reads these two arguments. Aristotle does not draw this consequence explicitly, but, at the very end of the chapter, he does stress the indivisibility of the form (ἄτομον) (1034a8). One way of being one for Aristotle is being indivisible in formula (*Met.* Δ.6 1016a32-35). As already stated, essence is assumed to be indivisible in formula. This would imply that form could admit to definition and be essence as well as an *ousia*. The first argument (1033a24-b4) starts from the elements of a motion. Everything that comes to be comes to be out of something, e.g., some material, by the agency of something, e.g., the form of the thing that either is the efficient cause or is in the agent as efficient cause, and finally comes to be something, e.g., the composite. Now, if form (or also material) came to be, it would be the case that they would require a previous material out of which they come to be as well as a prior form that serves as the agent of the motion. But the same assumption applies to the form in this argument: either it comes to be or it does not. So, if form does come to be, there would need to be an infinite number of forms to generate that one form, for to stop this regress it is necessary to posit that there is some form that does not come to be.¹¹⁵ The cause of the initial movement, at least in a being that exists by nature, is the form of the parent. It causes the material to take on a form, but what comes to be is the composite whole, not the form, for this would lead to an infinite regress. No single act of

¹¹⁵ Bostock objects to this argument in respect to material. Material can be generated, e.g., bronze from its material components. But the claim is not that all material is ungenerated but rather that the material pre-exists the coming to be of a compound, e.g., the bronze of the bronze sphere. If the material does not pre-exist, then it must come to be, but it must come to be from some other material, and so on ad infinitum. The making of bronze is not itself a making of material but a making of a compound, its elements mixed together, where both the form of the bronze and the material elements pre-existed the coming to be of that bronze. The argument does not assume material is ungenerated simpliciter as Bostock seems to suggest, but the material for each coming to be is not generated but already present for that coming to be. See Bostock, pp. 130-31.

generation can be composed of an infinite number of agents, so it is impossible for any form to come to be.

The second argument (1033b5-19) exploits the same assumptions and shows that this leads to the conclusion that, if form comes to be, the form would be composed of two things: form and material. Aristotle takes this as absurd. The claim is argued in respect to a sphere coming to be. Since a sphere is a shape equidistant everywhere from the center, it is hard to see how this would come to be. Which part of the formula of the sphere is the material and which part is the form? The problem seems less to do with the fact that the formula has parts, for Aristotle accepts that all formula have parts (in a way) (Z.10 1034b20; cf. Δ.6 1016a34), and more to do with the assumption that form and material are each a *this* (1033b16-19). Something cannot be two *thises*.¹¹⁶ If the formula contains form and material, then so would the form itself. Aristotle, then, in this argument, seems to be denying that the form is a plurality and implying that the formula is one. This is why Aristotle can conclude this chapter with the claim that Socrates and Callias are same in form—because this kind of form is one and indivisible (1034a6-8). Assuming that *ousia* is one in formula, Z.8 is a necessary step for the claim that form is the most likely candidate to be essence and also to be *ousia*. An objection to this claim could be as follows: material also does not come to be, thus, it is equally likely that it is also one and *ousia*. But such a conclusion does not follow in respect to the material. Aristotle clearly accepts that material is indeterminate (Z.3 1029a10-11, cf. Z.11 1037a27) and could be or not be (Z.7 1032a21), but essence admits to a formula and is

¹¹⁶ Aristotle will address how the composite *ousia* is just one *this* in *Metaphysics* H.

the very thing that just is and is never other. So, under these assumptions, material is not a likely candidate to be essence or *ousia*.

The second way Aristotle argues that form is a good candidate is the argument for what has been called “the synonymy principle”, that producer and thing produced are same in form.¹¹⁷ Although this principle appears to be merely an assertion Aristotle makes in Z.7-9, it is confirmed by the argument above that the form of an object does not come to be. If form does not come to be during the process of generation, the form must already be present in the agent either as the form of the agent, in the case of natural generation, or in the mind of the agent, in the case of an artifact coming to be. Why is this principle important for the claim that form is a good candidate for *ousia*? The sameness of form in the producer and the thing produced implies that the formula for each is the same. Thus, in conjunction with the previous argument that form does not come to be, it is now the case with the synonymy principle that they are the same in formula and this formula can be one. Thus, form can admit to definition and be the essence of the thing.

Now, we can see that both arguments do not apply to the snub. The primary reason is that the snub is an attribute of a nose. Even if the form of the snub does not come to be, it is still the case that the snub is a plurality precisely because it cannot be defined without reference to a nose. The arguments above suggest that the form can be defined by itself. But the arguments are not conclusive. The same arguments apply to artifacts, e.g., the bronze spherical ball, and to attributes such as health, which do not turn out to be *ousia* (H.2 1043a4). Aristotle must continue to investigate the definition of an

¹¹⁷ I borrow the name, “synonymy principle”, from Myles Burnyeat. See *A Map of Metaphysics Zeta*, p. 35.

animal. He pursues the inquiry further in *Metaphysics* Z.10-11. But the previous point may give us pause. One might be curious here at this part of the *Metaphysics* why Aristotle is relying so heavily on his analogy of artifacts to nature if he does not consider artifacts to be *ousiai*. Most of the arguments in Z.7-9 discuss artifacts and not those things that exist by nature, like animals (Z.7 1032a12-25, Z.9 1034a33-b6). But a reasonable response here is that the arguments apply equally to both. The formal cause in both cases is the same as what is produced. The efficient cause is different in kind in the case of artificial production, but this difference may be a sign that an artifact is not an *ousia*. So, we should not read these arguments to conclude that anything that has a form is an *ousia*. That conclusion does not follow. Aristotle actually raises the problem of whether the form of an artifact can be defined apart from its material in Z.7 (1032b18-1033a5). This is precisely the problem Aristotle takes up in Z.10-11. But it does not seem to be the case that this problem is present or entailed by the arguments in Z.4-6. Thus, Z.7-9, viewed in this way, serve a necessary step from the logical questions about essence in Z.4-6 to the more substantial discussion of essence and its being in Z.10-11. This discussion will raise what Balme calls the ontological problem of whether form can be defined apart from its material. Let us turn to that discussion now.

2.2.2 The Definition of the Form: Z.10-12

From the previous section, we can draw two conclusions. The first conclusion is that only *ousia* admits of a proper definition, though other beings may be defined through their relation with *ousia* (Z.5 1031a1, cf. Z.4 1030b4-5). If a definition is the formula of an essence (Z.4 1030a6) and essence and thing are identical (Z.6 1031b11-14), then we

can draw an implicit conclusion. Essence just is *ousia*. This conclusion is only tentative. The problem is that essence must not admit of plurality, either in definition or in number. So, Aristotle must show two more things. First, he must show that it is possible to define an essence without parts. This will show that essence is one in formula. Second, he must show that essence also fulfills the other assumption about *ousia*: it is one in number. I will complete the argument for the first proof in this section and reserve Aristotle's proof for the latter in the following section (2.2.3). Given the arguments of *Metaphysics* Z.7-9, Aristotle has shown that the form is one because it is distinct from the material for generation. This would seem to imply that the definition of a form is also one. This would only be the case if the form has no parts. Aristotle raises the question whether the form has parts in *Metaphysics* Z.10-12 according to Halper's interpretation.¹¹⁸ To decide whether the form has parts, Aristotle makes the following assumption: as the formula stands to thing, so too does the parts of the formula stand to the parts of the thing (Z.10 1034b20-23). Aristotle answers the question about whether the form has parts by showing whether the formula of the form has parts. Aristotle arrives at the conclusion that there is no reason to accept that the form has parts, for the final differentia defines the form (Z.12 1038a19-20).

There are three problems I need to address to support this view. First, the standard view in the literature is that Z.10 and Z.11 contradict each other.¹¹⁹ Z.10 argues that form is defined apart from its material whereas Z.11 claims that form must refer to material because the form of an animal cannot be defined apart from motion. Second,

¹¹⁸ See Halper, pp. 97-118.

¹¹⁹ See Ross I, p. civ, Balme, "A Note on the *Aporia* of *Metaphysics* Z", p. 303, and Bostock, pp. 159-65.

another standard view of the literature is that Z.12 is an insert.¹²⁰ Z.12 is normally assumed to be an insert for two reasons. Scholars read it as a doublet of *Metaphysics* H.6. They also do not read it as solving the problem near the end of Z.11: if every definition has parts, what makes the definition one formula of a thing (1037a18-20)?¹²¹ Below, I will first argue that Z.10 and Z.11 do not contradict each other but both prove that the form can be defined apart from its material. I will then argue that Z.12 shows that, even though the definition has parts, the formula is really one, for the formula only needs to include the final differentia. The other parts of the formula are implicitly included in this differentia. I am left with a problem on this interpretation, the third problem I will address: in what way is an animal defined like the snub? I will argue that an animal is defined like the snub because the definition of the form must make reference to the material. The form is the way in which the material is held together. Although form must refer to material, in being that which holds the material together, this does not imply that material is also included in the definition; form is ontologically prior to the material. Aristotle argues both in Z.10 and Z.11 that the material parts of the composite *ousia*, e.g., hand, foot, finger, etc., cannot be defined apart from the form, for each part includes in its formula the formula of the form. I will proceed by formulating Balme's version of the aporia of *Metaphysics* Z and show how the tension present in defining a sensible *ousia* is resolved in Z.12.

¹²⁰ See Jaeger, *Studien*, pp. 53-61; Ross I, p. xxx, Bostock, p. 176; Burnyeat, pp. 42-44.

¹²¹ The main reason why scholars hold this view is because of Aristotle's language. He states that he will investigate this later (σκέπτεον ὕστερον) (Z.11 1037a20). See, for example, Jaeger, p. 55 and p. 60, Ross, Vol. II, p. 204, and Burnyeat, p. 41. All of these scholars hold that Z.12 is an insert. But the term "ὕστερον" can mean "next, later, or last" (*LSJ*, intermediate, p. 850). All of these meanings seem consistent with the investigation happening in the next chapter, which also concludes, in a way, the discussion of essence as *ousia*. Z.13 picks up the discussion of the universal as *ousia*.

Balme constructs this aporia in his article “Note on the *aporia* of *Metaphysics Z*.”¹²² He appeals to the fact that the essence of an animal is defined like the snub, meaning it must include its material, yet material cannot be included in a definition because it is indeterminate. Balme reads Z.10-11 as leading to this aporia. If Balme’s view is correct, then we cannot take what Aristotle states in these two chapters to be his final views on the essence and definition of a sensible *ousia*. Let us look at the way Balme develops the aporia. He lists out four claims made in *Metaphysics Z* in this article that lead to the aporia that a sensible *ousia* cannot be defined. They are as follows:

- (i) Matter cannot be brought into a definition because it is undetermined, capable of being other, and so unknowable (1036a5, 1037a27, 1039b28).
- (ii) Some parts of a combined whole are posterior to the essence, therefore the definition would exclude some parts of the whole (1035b5ff).
- (iii) Definition of a natural being should include its movement (changing), but this would involve its matter (1036b29).
- (iv) The definition can only be a unity if its subject is a unity, but a combined whole contains material parts (1037a19).¹²³

These claims lead to several difficulties. First, material cannot be included in a definition, but, since an animal is defined like the snub, the definition must include material. So, an animal does not admit to definition. Second, if an animal were defined including form and material, the definition would have parts implying that the thing would have parts and not be a unity. So, the animal would not be an *ousia*. I will now show that Balme’s view is not correct, thus, we can read Z.10-11 as Aristotle’s mature views on essence.¹²⁴

My first step is to show that Aristotle has no problem accepting the second claim, for the formula of the essence is only of the form. We should recognize that Balme takes

¹²² This article is found in *Philosophical Issues in Aristotle’s Biology*, pp. 302-306.

¹²³ See p.303 in *Philosophical Issues in Aristotle’s Biology*.

¹²⁴ This claim is, of course, also contingent upon showing that Aristotle’s views on essence in the biological writings are at least consistent with the views expressed in Z.10-11.

the combined whole to be under discussion in Z.10-11 because Aristotle accepts that an animal is defined like the snub. This ignores the arguments of Z.7-9. Balme could respond that these chapters are additions of a later editor.¹²⁵ But his claim also ignores the conclusion of Z.10: the parts of the formula are only parts of the form.¹²⁶ Z.10 begins with the question what parts of the thing (τὸ πρᾶγμα) are parts of the formula (1034b20-24). The problem is twofold. Aristotle accepts that any formula has parts. The question naturally arises what are the parts of any formula? Does the formula of the whole include the formula of the parts, e.g., does the formula of the circle include the formula of the segments of which it is composed? Aristotle really reduces this question to ask whether the parts of the formula are parts of the form, the material, and/or the composite? Second, if parts of the formula are prior to the whole, then will the finger of a human being or an acute angle be prior to the whole, i.e., the finger prior to the human being or the acute angle prior to the right angle? Halper understands these very problems to address the unity of the definition of an essence. A question about whether a thing has parts is a question about its unity. The formula of an *ousia* must be one. But the argument we find in Z.10 only excludes something which would make the definition a plurality: the material. Aristotle, on this view, is only arguing that it is possible for the form to be defined as one in Z.10 on the grounds that the material of a thing is not included in the formula of the essence. He will conclude that the formula will be only of the form and its parts (if it has parts at all). To arrive at this conclusion, he raises and

¹²⁵ See, for example, Bostock, *Aristotle's Metaphysics ZH*, pp. 119-20.

¹²⁶ In a way, Balme does not make this mistake. He claims, though, that this conception of a matterless essence is *per impossible*. See "Aristotle's Biology was not Essentialist", p. 294. I will argue that this view is flawed.

solves the following problem: why are the parts of the syllable included in the formula whereas the parts of the circle, the segments, are not?

Aristotle argues by example that the parts of the formula are parts of the form. Flesh is not included in the formula of concavity, nor bronze in the formula of a statue, but flesh is included in snubness and bronze in the composite statue. So, material parts are not present in the formula of the form but are present in the formula of a composite. This explains why the segments of a circle are not part of the formula; they are part of the intelligible material of the circle, not the form. On the other hand, the letters of a syllable are part of the form, for part of what it is to be a syllable is to be composed of letters. Aristotle backs these claims up with the following: what the thing dissolves into when it ceases to be are parts of the composite. The segments of a circle are left when a composite thing ceases to be circle, but the letters of a syllable are not, with the exception of the written letters or individual sound of each letter. The same holds of animals, as Callias dissolves into flesh and bones when he is no longer alive (1035a32).¹²⁷ The snub nose does not have the same fate, for it is a composite. Composites are destroyed into their parts (1035a25-26). Aristotle contrasts this with form, for it is without material. How is the form different from the material or the composite? Aristotle has just supplied the answer in Z.7-9: form does not come to be. What does not come to be can be one: so the perishing of such a thing either does not happen or happens in some other way. This is exactly what Aristotle claims in Z.10: either form does not perish or not in this way

¹²⁷ This claim seems problematic. In a way, Callias does not perish into flesh and bones for the material parts of an animal are only properly so in respect to belonging to a living thing. Aristotle states explicitly that parts of a living thing are only potentially alive when they belong to a living thing (*De Anima* II.1 412b25-26). Aristotle also accepts that a dead hand or a dead finger is not properly a hand or a finger (*PA* I.1 641a4-6). In another way, though, the living being does perish into its material parts insofar as what is present once the soul has left the body are the material parts without soul.

(1035a28-29). But some commentators are puzzled by Aristotle's claim in this passage.¹²⁸ Aristotle's point here is that since the material is not part of the form, but it is the material that loses the form, we need not assume that the form perishes when the composite ceases to be. But, more importantly, Aristotle distinguishes once again the form of a living being from the snub. They are still alike, but the snub does perish when the composite ceases to be whereas the form does not perish at all or not in the same way.

But Balme can respond that this cannot be Aristotle's final view of the form of an animal. Since an animal is defined like the snub, the formula of an animal should include its material. But Aristotle denies this view explicitly in Z.10. The first step of the argument occurs in the next passage (1035b3-14). Aristotle comes to the opposite of Balme's claim (ii) at the end of this passage: "Thus, such parts which exist as matter and into which the whole is divisible as into its matter, are posterior; but those which are parts of the formula or of the *ousia* (that is, *ousia* according to the formula) are prior, either all or some of them" (1035b11-14). Let us look at how Aristotle arrives at this conclusion. In 1035b3-14, Aristotle returns to the second problem mentioned at the beginning of the chapter (1034b28-31): if the parts are prior to the whole, then what prevents the acute angle being prior to the right angle or the hand prior to whole, for each is defined in respect to the whole? Aristotle can now resolve this problem. The definition of the acute angle or the hand presupposes a prior definition: the acute angle presupposes the definition of the right angle, for that is how it is defined, and the hand presupposes the definition of the whole human being. Given Aristotle's assumption that the parts of the definition are prior in being to the whole thing, it follows that the definition of the whole

¹²⁸ Burnyeat, *A Map of Metaphysics Zeta*, p. 33. He claims that the disjunct here is superfluous if Z.7-9 is not an insert and even contradicts these chapters.

human being, which just is the essence, is prior to any definition of its parts. This makes sense. We cannot understand a hand apart from what it is for the sake of or its work (ἔργον). But the work of the hand is not intelligible apart from the kind of thing to which it belongs. This is consistent with Aristotle's zoology, for he defines a hand in respect to a thing that has a rational capacity (*PA* IV.10 687a16-23).¹²⁹ But even if these parts are not included, such as hand, foot, etc., like the syllable, the form could still have parts. Aristotle still needs to exclude this option. This occurs in *Z*.12, so we will leave it aside for later.

Aristotle next claims that the soul is the *ousia* that the formula is of, and this is the form and the essence of the animal (1035b14-16). Further, Aristotle asserts that no material part of an animal can be defined apart from this formula of the soul, for any part must be defined by reference to its work (ἔργον) and this work includes the essence of the animal (1035b16-18). So, the formula of the form will be prior to the composite (1035b18-20). It is not a problem, then, if some material parts of the whole are posterior to the definition and the formula, since the formula of the form does not include the material, otherwise the form could not be one. This blocks Balme's claim (ii). Now, what will also follow, since form is the definition of the composite as well, is that the composite whole will be prior to its material parts. There is one exception to this claim. There is at least one part that is not posterior to the composite whole, for there is a part in which the formula and essence is (1035b25-26). Aristotle does not commit himself to which part this is, it could be either the heart or the brain, but this part is neither prior nor posterior to the composite whole. But this does not violate the definition of an animal

¹²⁹ I will argue in Chapter V of this dissertation that this pattern is the norm in Aristotle's zoology. *Parts of Animals* is full of explanations of this kind, where the part is defined in respect to the whole, and it is consistent with the theoretical principles developed in the first book (*I*.1 641a24-25).

being separate from its material, for the definition of an animal is still prior to both the composite and the material parts.

The problem now is that the argument of Z.10 seems to go too far. Insofar as the formula of the essence excludes all material, it is not clear how each essence will be distinguished from another one. But it is also the case that the nature of an animal seems intrinsically to refer to the material insofar as an animal is defined in respect to motion (Z.11 1036b28-31). Scholars interpret this claim to imply that the formula of an animal must include its material, as Balme does.¹³⁰ This seems to conflict with the results of Z.10 that the formula only has parts of the form. I will now show how these two chapters can be read as making consistent claims about the definition of the form of an animal.

The problem raised in Z.11 appears to be the same or similar to that of Z.10: what sorts ($\pi\omicron\iota\alpha$) of parts belong to form as opposed to the composite whole (1036a26-27)? Once again, Aristotle answers this question by exclusion. He answers explains what sorts of parts do not belong to the form. This will defend the view that the form is one by, once again, by showing that it is at least possible to define the form as one by excluding certain kinds of parts. Aristotle then raises a problem in respect to this question. Given that no material parts belong to the form, how does one differentiate one form from another? This problem extends beyond the sensible *ousia* to the mathematical objects as well (1036b7-10). The problem is that if each object is one and its formula is one, then each definition and thing appears to be reduced to number, e.g., a line is defined as “twoness”, or to unity itself. The former option leads to the fact that different things, e.g., the two and the line, will have the same formula. The latter option leads to the

¹³⁰ See, for example, Ross, Vol. II, p. 203.

conclusion that there is only one thing. Aristotle takes both of these results to be absurd. His solution seems to be, not as it is often understood that material must be included in the definition of a thing, but rather that the definition must refer to some material parts of the thing. Let us turn to Aristotle's solution to see what he means.

And the comparison which Socrates the Younger used to make is not stated well; for it departs from the truth and attempts to create the belief that a man may exist without his parts just as a circle does without the bronze. But the two cases are not similar; for an animal is sensible and cannot be defined without motion, and so it cannot exist without its parts existing (ἐχόντων) in a certain manner (πῶς). For it is not any manner whatsoever that a hand is a part of the body, but only when it can perform its function (ἔργον), so it must be alive; if not, it is not a part (1036b25-31).

The two claims in this passage are that an animal cannot be defined without motion and not without its parts holding (ἐχόντων) in a certain way. But how can a thing be defined in respect to its motion without including the material? Motion presupposes material (*Physics* I.7 190b10-12). Let us turn to the argument in the passage.

The argument addresses the problem raised at the beginning of the chapter: which sort of parts are the material parts of the *ousia* and which parts are parts of the form (1036a27-30)? Aristotle answers that the parts of the form are clear if they can be separable from the material (1036a31-34). But those forms that are clearly separable are those of the mathematical, such as circle and triangle. A circle or triangle can be present in wood or bronze or gold or any other material. The form of an animal is not clearly separable, for the form is never realized in different material. A human being is always realized in flesh, bones, sinews, etc. But Aristotle answers that these parts, flesh, bones, sinews, are still material parts. What the argument above (1036b25-31) addresses is why these parts are still material parts and not part of the form. The form makes the material be what it is. A material part of an animal is not a part unless it is part of the whole and

alive, and the soul is such that it is the form of the whole and what makes the parts alive. We can see that the point is made by the exact same argument in Z.10 that answered why the formula of material parts is not prior to the whole (1035b3-14). The formula of the soul, here, is part of the formula of the part, e.g., hand or finger, so the formula of the soul is prior. So, why is Aristotle stressing that a form cannot be defined apart from motion and its material parts holding in a certain way? This claim has the implication that the form can be defined apart from the material, yet the form presupposes the material, being a work of that material, so the form of an animal, although one, can be differentiated from other forms. Let us understand this last claim.

The claim that an animal cannot be defined apart from motion and apart from its material parts holding in a certain way can be interpreted in at least two ways. The first way has been the standard interpretation. Motion requires material, so, the definition of an animal must require material as well. But the passage does not say this about the material parts. Rather, the passage states that the definition must make clear that the parts hold together in a certain way. The second interpretation, proposed by Halper, understands the form to be a function or work of the material.¹³¹ The form is the actuality (*ἐντελεχεία*) of the material (1036a7). As such, the form will be what holds the parts together to perform this work. This is not to be understood in a mechanistic manner, such as nails or glue holding together an artifact, but rather the rational structure of a thing organized for a certain activity and work. This view not only has the advantage of making these two chapters, Z.10 and Z.11, consistent (since they do appeal to the same argument at key junctures), but this interpretation is also consistent with other passages in

¹³¹ See Halper, p. 107-8.

Aristotle that concern the same issue: how is the form defined in respect to the material (*De Anima* II.1 412a27-28 and *Parts of Animals* I.5 645b15-20)? These two passages answer this question in the same way as the passage above (1036b28-31): the soul is the capacity for a certain kind of action or function. This capacity presupposes some kind of motion, be it alteration, locomotion, or growth and decay. But the capacity is not possible without parts to do the work and the parts holding in a determinate way (*De Anima* II.1 412b22-26). It does not follow in *De Anima* that the material is included in the definition of the form, but rather that the material only has being and a definition in respect of the form (II.1 412b10-15, cf. 412b6-9).¹³² The same claim is implied by the above passage (1036b28-31). A part is not a part of a living thing unless it is alive, which implies that the part is defined in respect to the whole. This is the exact same claim made in Z.10 (1035b10-11). On this understanding of the argument, the two chapters are consistent and give the exact same answer: the formula of an animal does not include its material.

What Z.11 refines is that this does not imply that the formula does not make reference to this material insofar as the form is that which holds the material together as its work and actuality. In doing so, the formula of one animal can be distinct from another insofar as they do not refer to the same material holding in a certain manner. Each animal or living thing has a different capacity, thus, a different soul, so each holds its parts together in a different manner. On this view, Balme's claim (i) does not present any problems for Aristotle, for no material is present in the formula of the form of an animal. Balme's claim (iii) is blocked as well, for the reference to motion does not imply

¹³² Since part of the controversy is whether the *Parts of Animals* also does not imply that material be included in the definition of the form, I will this aside until I can show that this is also the case.

that material is included in the formula. The form of an animal for Aristotle just is the kind of thing that intrinsically refers to motion by itself as being defined as a certain kind of capacity. But I want to support this interpretation with two further points and address why Aristotle claims that an animal is defined like the snub, although this does not imply that material is included in the definition.

First, Z.10 states that the soul just is the form and essence of an animal (1035b14-16). It follows up this claim with the fact that the soul is prior in being to all the parts of the composite save one or two (1035b20-25). Of the parts that are not posterior, Aristotle says that these parts are simultaneous (ἄμα) in being with the essence, for the formula and essence are present in these parts first (1035b25-26). Aristotle is not equating the part with the essence but emphasizing that certain parts are intimately related to the essence insofar as the functioning of that part cannot be separated from the animal without the animal ceasing to be. These would be the part or parts that come to be first. Aristotle here suggests that the part may be either the brain or the heart. *Metaphysics* does not to decide the issue.¹³³ Once again, Aristotle's view is that the formula of the soul does not contain material parts and is prior in being to those parts precisely because the parts cannot be defined apart from the whole.

Second, Z.11 concludes by stating that the formula of an essence does not include material parts (1037a24-26). Aristotle emphasizes that this holds of the formula of human being, for this is of something that is a primary *ousia* (1037a28-29). Material is considered to be indefinite (ἄόριστον) (1037a27). We can now understand why. The material of an *ousia* is not defined apart from the formula of the essence. The material is

¹³³ In *Generation of Animals*, Aristotle comes to the conclusion that this part is the heart (II.1 734a16-33). One should also note that Aristotle arrives at this conclusion via empirical knowledge: he literally sees that the heart comes to be in a living being prior to the other organs, for it is the first organ visible (734a20-24).

indefinite apart from having an essence and that essence being defined apart from it. We can now say that Aristotle holds the same view of the definition of an essence of an animal throughout Z.10-11. But why does Aristotle claim that an animal is defined like the snub if material is not included in its definition? The claim is that an animal is defined *like* the snub. The likeness we can now see is that the definition of an animal must make reference to the material, whereas the form of a mathematical object does not, at least not sensible material. This is significant because the intelligibility of the form depends upon making this reference, but, as Aristotle has argued, at least on the view argued above, this does not imply that the definition includes the material as a part of the formula. The formula of the soul of an animal can be one.

There is one problem left unsolved from Balme's list of the four conflicting claims made by Aristotle in Z.10 and Z.11: how is the formula one if a formula has parts? But the problem is no longer about the composite but about the form because he has eliminated the material as being part of the formula. The problem arises for Aristotle because he assumes that, since the thing is one, so the formula of it should be one as well. Aristotle has argued that there are no possible parts of the formula other than those that belong to the form. The question now is whether the form is one despite having parts, since any formula has parts for Aristotle. Since Aristotle assumes that the parts of the formula correspond to the parts of the thing, this is a serious problem for Aristotle. On the other hand, we can see that Aristotle's conception of definition raises the same problem: definition via genus plus differentia has at least two parts. If these parts are distinct constituents of a definition of an animal, then the thing is also a plurality. But an animal

is assumed to be an *ousia*, so this would imply that its definition must not have parts. Let us see if Aristotle can solve this problem, which he raises in Z.12.

Aristotle begins Z.12 by raising an aporia that was left unresolved in the *Posterior Analytics*: why is a definition a unity if it is composed of genus plus differentia (1037b8-10)? Aristotle assumes that a definition is composed of these two elements. The genus picks out the kind of thing being defined and the differentia distinguishes the thing from other kinds of things within the genus. For example, human being is a kind of animal and is differentiated from the others by being two-footed. This example shows another aspect of defining by genus plus differentia. Rarely is the thing differentiated by one difference alone but rather by a line of differentiation, e.g., footed and two-footed. So, the problem of unity is how are these elements of the definition one, both the genus with the differentia and the multiple differentiae with each other. I follow Halper in accepting the proper differentiation solves the problem of how these elements are one.¹³⁴ There are two steps to the argument. The first step of the argument reduces the many differentiae in the definition to just the final differentia. Proper differentiation takes the difference of a difference instead of a difference that is incidental (1038a9-10). For example, a proper difference of footed is two-footed or multi-footed and not winged or white. The latter are incidental to being footed. Thus, if one takes a proper difference of a difference, the final difference really entails all the previous differentiae being a further differentiation of the initial differentia, e.g., two-footed further differentiates footed. Aristotle's claim is that any mention of a difference other than the final difference, when one has taken the difference of a difference, is superfluous (περίεργον) (1038a21). The problem now is

¹³⁴ See Halper, pp. 110-18.

whether the initial genus from which the divisions began, e.g., animal, must be expressed in the definition as well or whether the definition can just be the final differentia. This is resolved in the second step of the argument. Aristotle discusses the various senses of “genus” in *Metaphysics* Δ.28, one of which the genus is material and the underlying thing to which the specific difference belongs (1024b7-9). But Aristotle argues in *Topics* Z.6 144a36-b3 that the genus cannot be predicated of its differentiae. Thus, it seems that the genus cannot be eliminated as an element of a definition. Halper solves this problem through the very method itself. Aristotle assumes that the genus is either material or nothing apart from the species that fall under the genus (1038a5-6). If it is also the case that any differentia is proper to a genus, meaning it does not fall under another genus, and that the various differentiae under the initial genus exhausts that genus, then the final differentia also entails the genus under which it falls. In Aristotle’s example, the final differentia, two-footed, entails being an animal, for footedness as a differentia only falls under the genus animal. Further, if the whole genus animal is exhausted by the various differentiae that fall under it, it would follow that the genus need not be something over and above the species or is just material for the species.¹³⁵ But if the genus is material at all, it is intelligible material, not physical material. But the most important thing is that, since the final differentia can include all the other differentiae and the first genus implicitly, the final differentia is all that is necessary to express the form. Proper differentiation solves the problem of how the plurality of parts is really one. Thus, the final differentia just is the form and the primary *ousia* (1038a25-26). Further, the final differentia is not predicated of anything since it includes both the previous differentiae

¹³⁵ Halper, p. 113.

and the initial genus. It is superfluous to predicate anything else to it. Halper's interpretation of *Metaphysics* Z.4-12 not only shows how the form is one in formula, it also shows that this is one continued investigation. It shows that Z.12 is really an intrinsic part of the discussion of essence and is the culmination of the whole discussion that began at Z.4.

It seems as if Aristotle just proved that essence is *ousia*. Why does the investigation of what is *ousia* continue? Aristotle has only proved that essence is *ousia* by being one in formula. He has yet to prove that essence is one in number. But there is another reason why the investigation continues. Aristotle has yet to explore two of the candidates for *ousia*: the universal and the genus. Aristotle investigates these two candidates in the next 4 chapters, Z.13-16. Although these chapters only explicitly investigate the universal as *ousia* (Z.13, 1038b1-3), many scholars assume that Aristotle investigates both, since the genus is a kind of universal.¹³⁶ Following Halper, the above two issues really address the same issue: is Aristotle's form also one in number? If form turns out to be both one in formula and one in number, it seems the best candidate to be *ousia*. Let us turn to the arguments of Z.13-16 to see whether and how they argue that form is one in number.

2.2.3 No Universal is an *Ousia*: Z.13-16

These chapters of *Metaphysics* Z present numerous problems for any commentator. Z.13 explicitly argues that no universal is an *ousia*. Since Aristotle accepts that any definition is of the universal (Z.10 1035b34-1036a1), the obvious conclusion is that anything that has a definition is not an *ousia*. On the other hand, since

¹³⁶ See Owens, *Doctrine of Being*, p. 367 with 326, Ross, II, p. 164, and Bostock, pp. 232-35.

the final differentia defines an *ousia* (Z.12 1038a19-20), the conclusion is that *ousia* is a universal. This is problematic from many perspectives, but, most pertinently, the problem is that Aristotle was assuming in Z.4-12 that an *ousia* is that which admits a definition or a definition most of all (Z.4 1030b5). The arguments of Z.13-16 would seem to give credence to the view that there is individual form. Individual form is particular to the individual that has it, although generically it will have the same predicates. For example, all human beings have hair, two eyes, skin, and other generic features, but a particular human being will have brown hair, brown eyes, pale skin, and other features that altogether distinguish this human being from all other human beings. This is Balme's position.¹³⁷ But there is another way to resolve this tension between the particularity of an *ousia* and the universality of definition. Halper interprets these chapters to be rejecting the universal as *ousia* on the ground that it is not one in number, though it is one in formula. He reads these arguments to be directed against Plato's Forms. Aristotle seems to interpret that Plato also holds that a Form is one in number and one in formula. On these assumptions, Aristotle shows that when a Platonic Form is one in number, it will not be one in formula, or when a Platonic Form is one in formula, it will not be one in number. The problem arises from another set of assumptions in Plato that a Form is a one over many and separate from the sensible thing. We will see that Aristotle is abandoning both of these assumptions about form. Halper interprets the arguments in Z.13-16 to show how a form in Aristotle's view can be, in one way, one in number, and, in another way, one in formula. In turning to the arguments of Z.13-16, I will focus on how Aristotle's conception of defining an essence does not fall prey to the problems raised concerning any universal being an *ousia*. I will also show that, as a

¹³⁷ See Balme, "Aristotle's Biology was not Essentialist", p. 295.

consequence of these arguments, Aristotle's form can also be considered one in number. If this argument holds, then there is little reason to posit individual forms, as scholars like Balme do.¹³⁸ Balme's view extends to the biological writings as well, and I will consider the arguments for individual form again when discussing the relevant passages in the biological writings. Let us now investigate the arguments in Z.13-16 to see if form as essence turns out to be one in number and thus *ousia*.

There is some controversy over what is the object of discussion of Z.13-16. This is for obvious reasons, as stated above, for the conclusion of Z.13 appears to contradict the previous claim that essence is *ousia* from Z.4-12. Michael Woods argues that Aristotle does not reject the universal as *ousia* but what is said universally.¹³⁹ But this position has no support in the text, and, further, Aristotle rejects any *ousia* being a one over many (Z.16 1040b29), which seems to be the way Aristotle characterizes a universal in these chapters. So, I will simply accept that Aristotle rejects any universal as being an *ousia* and will attempt to show, following Halper, that form is not universal in the way that is detrimental for it being an *ousia*. As already stated, the universal in Z.13-16 is meant primarily as any one over many. Aristotle's conception of form is not one over many in obvious ways: it is not separate or apart (παρά) from the particular it is the essence of, nor does it belong to many instances. For example, my form as a human being may be the same in kind as another human being, but my form does not exist separately from my material and is not, by definition, common to many. This view of form also implies that it is distinct from species (εἶδος), which is the same term in Greek.

¹³⁸ See both "Aristotle's biology was not essentialist", pp. 294-95, and "Notes on the *aporia* of *Metaphysics Z*", pp. 302-4.

¹³⁹ See M. Woods, "Problems in *Metaphysics Z*, Chapter 13", in *Aristotle: A Collection of Critical Essays*, edited by J. M. E. Moravcsik, New York: Anchor Books, 1967, pp. 215-38.

Species is a one over many and derivative from the form of a thing. The irony for the Platonist will be this: by making Form separate, they make Form be either unintelligible or like a particular in a certain material. Either one would contradict their fundamental assumptions about Form for a Platonist.

Z.13 begins by announcing that it will now investigate *ousia* as universal. This follows the program set up in Z.3, having already investigated *ousia* as underlying thing and as essence. Aristotle also supplies a reason why the universal is considered a candidate for *ousia*: a universal is both thought to be a cause and a principle (1038b6-8). The obvious assumption, which is made in Z.1 (1028a31-33), is that *ousia* is the first cause and principle of all beings.¹⁴⁰ So, it would appear that Aristotle will investigate the different ways in which the universal is a cause and principle of a thing and see if any conform to what is believed to be *ousia*. Aristotle's two explicit assumptions about *ousia* in Z.13 are that the *ousia* of each thing is proper to it (ἴδιος) and is not predicated to another thing (1038b10). If *ousia* is not predicated of another thing, this would seem to imply that *ousia* is numerically one. On the other hand, what is proper to an *ousia* may be universal, e.g., being two-footed belongs not just to this or that individual but anyone who is a human being. But if the formula is a universal, it will be predicated of something (*Categories* 5 3a18-28). It seems as if the contradiction that is generated between the investigation in Z.4-12 and the one in Z.13-16 is present in these two assumptions. An *ousia* is what is most knowable, and a thing is known through its formula (Z.1 1028a34-37), but it is also separate, a this (τόδε τι) (Z.1 1028a34).¹⁴¹ What

¹⁴⁰ The passage cited in Z.1 actually states that *ousia* is primary in formula, in knowledge, and in time. The formula is a cause and kind of principle (see *Metaphysics* Δ.1 1013a14-17 and *Physics* II.3 194b27).

¹⁴¹ We can see that these two assumptions are not unique to Z.13. Both assumptions are also made in Z.3, where the stripping argument (1029a7-26) assumes that *ousia* is knowable and since the ultimate material

is separate and a this would be an individual. What Halper argues, really following Aristotle's own clues, is that form is what can be both universal and particular, although in different ways.¹⁴² The Platonists really thought the same thing. They made Form be both universal and individual, at least according to Aristotle (*Metaphysics* M.8 1084b13-32). The problem is that the Platonists did not distinguish the senses in which a thing is both universal and individual and, as said above, they separated all Forms from the particulars. We will see that this generates a number of the problems found in Z.13-16 with *ousia* being a universal.

The first argument of Z.13 (1038b9-15) is good place to start to see Aristotle is defending that his own conception of form as *ousia*. If we read Aristotle as simply assuming that *ousia* is one in number (1038b15), then the problem with why any universal cannot be *ousia* becomes obvious.¹⁴³ A universal belongs to many things, and so if it is the universal that is the *ousia* of all these things, either it will be the *ousia* to all of them or to none. If the universal is the *ousia* of all of them, then, on the assumption that *ousia* is one in number, all of them become one thing. There really is no difference between the universal being the *ousia* of all of them or of one them. It leads to the same conclusion: the absurdity that many things become one. This seems to be Plato's view. The Form is separate but still the *ousia* or all the particulars that participate in it. Aristotle leaves open the option that the universal could be the *ousia* of none of them. This seems to be his own view. The universal is not the *ousia* of anything. He will defend this view in the other arguments of Z.13. The problem is does Aristotle's

of a thing is not said in its own right nor has any character, it is intrinsically unknowable. Hence, material is not *ousia* as the underlying thing. Z.3 also rejects material as *ousia* insofar as it is not a this as well (1029a27-28).

¹⁴² See Halper, pp. 231-44.

¹⁴³ For this reading and its justification, see Halper, pp. 121-23.

conception of form suffer the same problem? It seems not. The form is always of a particular for it is not separate from the sensible thing, yet its definition is still universal. There is no reason why this kind of universality of the definition of the form implies that all of the particulars of that form are one thing. This is because Aristotle's form is not a one over many.¹⁴⁴

The second argument does seem to raise explicit difficulties for Aristotle's view of form. The claim is that no *ousia* is predicated of another thing. The universal is predicated of another thing. Thus, no universal is an *ousia*. Aristotle does claim that the form is predicated of the material (H.2 1043a5-6). Does this imply that form cannot be an *ousia*? Form is identical with the thing (Z.6). If we are asking whether the form is predicated of this thing, the answer is no, so there is no problem with form being *ousia*. If we are asking about whether the form is predicated of the material, the answer is yes. But there is no real problem with form being *ousia*. The material to which form is predicated is potentially a this (H.1 1042a27-28), and its being is caused by the form (Z.17). Hence, the form is not predicated of another thing.¹⁴⁵

The third and fourth arguments also clarify how Aristotle's view of form and essence differ from that of the Platonists and those who hold that the universal is *ousia*. These arguments assume that the universal is present in the essence but is not identical with the essence, as animal is present in horse and man but not the being of either (1038b16-18). The problem is that the universal will still be part of the definition, and if the parts of a definition are prior to the thing, as Aristotle assumes in Z.10, then the

¹⁴⁴ Halper defends the claim that form is both one in formula and one in number but in different ways. See Halper, pp. 242-44.

¹⁴⁵ For this view, see Alan Code, "The Aporetic Approach to Primary Being in *Metaphysics Z*", *Canadian Journal of Philosophy*, suppl., 1984, pp. 1-20.

universal will be prior in being to that which it belongs. Thus, the universal, e.g., animal, must be the *ousia* of that thing, being prior (1038b22-23). If it is not, then a different absurd consequence follows. An *ousia* would be composed of something that is not *ousia*, e.g., a quality. It is clear that Aristotle's view of definition does not fall prey to this problem, for there is only one thing that defines each *ousia*, the final differentia. But this solution raises a new problem. A differentia is a quality according to Aristotle (Δ .14 1020a33-34), so if the *ousia* just is the final differentia (Z.12 1038a19-20), then the *ousia* would be a quality. This does not need to follow. Aristotle is clear that the definition is the *ousia* (Z.12 1038a19-20). Why, then, is the form not a universal? It is insofar as it admits to definition. But form is also identical to the thing that has form. This thing is not separate from the sensible particular, e.g., Socrates or Callias. So, the way in which the form is a universal, insofar as it admits of definition, is not exclusive of the way in which form is numerically one.

This understanding of Aristotle's form also avoids the problems of an *ousia* being composed of *ousiai*. Why is this? Halper suggests that Aristotle is accepting the assumption laid down in Z.10 that the parts of a definition are prior in being to the whole definition and to the thing (1034b20-22).¹⁴⁶ The problem is obvious here, if *ousia* is assumed to be one in number. The thing that is numerically one, an *ousia*, being composed of multiple *ousiai*, will not be one in number but many. Since form is defined by one term for Aristotle, the final differentia, the form will not be composed of a plurality of *ousiai*, and there is no reason to assume that it will be a plurality in actuality.

¹⁴⁶ I follow Halper in his suggestion that Aristotle is appealing to various assumptions and arguments stated or established in Z.4-5 and Z.10-11. This is because the universal is assumed to be part of the formula of an *ousia*, and since these chapters discuss the formula of an *ousia*, it is natural to expect Aristotle to use the assumptions and arguments found in these chapters in his refutation that the universal is *ousia*. See Halper, pp. 127-29.

Aristotle is assuming that what is one in number is also one in actuality. This brings us to the last argument in Z.13: it is impossible for one *ousia* to be composed of multiple *ousiai* in actuality (1039a3). Anything composed of more than one *ousiai* would be a plurality in actuality. If a universal were an *ousia*, then any *ousia* would be a plurality: both the universal and what the universal is predicated of would each be an *ousia*. Aristotle's form is one in actuality in that it is not separate from the particular to which it belongs, e.g., Socrates, but it is not predicated of Socrates; the form just is Socrates in the proper sense.

An objection to the above interpretation of these arguments is that Aristotle concludes Z.13 being hesitant to accept whether an *ousia* can be defined (1039a14-19). Why does Aristotle not defend his own view of definition from these criticisms leveled against the universal? In one sense, it should be obvious to the reader that these criticisms do not apply. On the other hand, Aristotle still holds open the possibility that there is no definition of an *ousia* because there are still more issues to explore under the universal, e.g., the definition is composed of genus and differentia (Z.14) or can an individual be defined (Z.15 1039b27-1040b7)? Aristotle must show in each case that his view of definition is superior in that it resolves the problems he raises. The textual problem for the interpretation I support is that Aristotle does not actually state these claims. But, if the claims can be constructed from the arguments to be consistent with the view of essence and its definition argued in Z.4-12, there seems to be no reason to deny that this is Aristotle's view.

Z.14 begins by claiming that the same reasoning presented in Z.13 can show problems for those who hold that Forms are separate *ousia* and hold that Form is

composed of genus and differentia (1039a24-26). Aristotle seems to be discussing the Platonic conception of Form and Genus, so I will distinguish them from Aristotle's form and genus by capitalizing the first letter when these terms are used to signify Plato's conception. Now, the key assumption for the arguments in Z.14 is that the Form is one in number (1039a28). I interpret this to be how Z.14 relates back and is an addendum to Z.13. This also supports Halper's claim that Aristotle (and Plato for that matter) simply assume that *ousia* is one in number. There is only one Form of Animal for Plato (*Timaeus* 31a-b). Aristotle uses the genus Animal and various Forms that include the genus Animal in their definition to show that Plato's view of definition of an *ousia* is flawed. Aristotle quickly shows that the view that the genus Animal is one in number presents numerous problems if one also accepts that there are Forms of Human Being and Horse and other animals as well. The latter Forms would be composed of another Form, Animal, and a differentia. But if the genus Animal is one in number, it must be the same Form present to both Forms. If each Form is separate, e.g., Horse and Human Being from each other, then Animal will be present in both and separate from itself. This, of course, resembles the argument at *Parmenides* 131a-b that a Form would be separate from itself if it is in two different particulars. David Bostock objects to Aristotle's argument on the grounds that these two arguments are not analogous and, given that assumption, Bostock argues that Aristotle would have to prove that two distinct forms cannot have a common part.¹⁴⁷ But Bostock misses the force of the assumptions. Each Form is an *ousia* and separate, so if any Form shares in another Form, it would violate that assumption, for a Form that shares in the being of another will be separate from that of which it has a share so also separate from itself. The whole point is that the Form is

¹⁴⁷ Bostock, p. 209.

like a particular—it is one in number. Thus, Aristotle's argument does not fall prey to Bostock's criticism.

Aristotle extends this problem in the next argument by asking this question: what kind of relation is there between the genus and the Form defined by sharing it, e.g., human being or horse sharing in Animal (1039b2-6)? The problem is that if the differentia of human being, two-footed, participates in Animal and so does the differentia of horse, four-footed, then, Animal is partaken of in both and would have contrary predicates. *Ousia* is assumed to be numerically one, so Animal cannot have a share of both. But it must. To avoid contradiction, Bostock suggests that the Platonist would claim that the differentia and the genus belong to a larger Form, e.g., Horse or Human Being.¹⁴⁸ Once again, this criticism ignores the fundamental assumption of the argument: *ousia* is one in number. Bostock's solution just re-iterates the problem, for the genus present in the Form Human Being or Horse is also itself a separate Form one in number. As Halper stresses, it does not matter what relation Plato appeals to in order to salvage the claim: any relation would suffer the same problem.¹⁴⁹

The argument in Z.14 continues. The second part (1039b7-15) assumes that the Genus is not one in number: the Genus Animal is different in each distinct Form. This is how Halper interprets the argument, as a dilemma that shows either side runs into absurdity.¹⁵⁰ If Animal is distinct in every distinct Form of an animal, e.g., horse, human being, etc., then a new problem arises. Any animal is called an animal according to its *ousia* (1039b9-10). Since Animal is distinct in each Form of animal, then there turn out to be an indefinite number of Animals. Animal is not intelligible as such and so not an

¹⁴⁸ See Bostock, p. 210.

¹⁴⁹ See Halper, p. 133.

¹⁵⁰ See Halper, pp. 132-33.

ousia. But Animal is assumed to be said according to the *ousia* of an animal. So, Animal must be part of the *ousia* of any particular animal, horse or human being. This would imply that the Genus is one in number, contrary to the initial assumption. Aristotle has shown that the Platonic conception of the Genus is unintelligible insofar as it is partaken of by different Forms. Aristotle's conception of the genus, on the other hand, is as a potential constituent of a formula and not an actual constituent. The final differentia is the only active constituent. Thus, on these assumptions, it is possible for an Aristotelian form to be one in number and one in formula, as long as it is not separate from the sensible thing. Aristotle does not draw this conclusion yet, for there is still one more problem to address: is it possible to define an individual?

Z.15 discusses two types of an individual and denies that either admits of definition: the particular sensible thing that has material and the particular Form separate from material. As Halper points out, Aristotle's form is individual in neither way. The form of a particular animal neither has material nor does it exist separately from the material thing. Reading Z.15 this way once again supports Aristotle's conclusion that essence is *ousia*, for essence can be both one in formula and one in number. This also makes it clear why this discussion is included in the investigation of the universal as *ousia*. If a definition belonged to an individual as such, then the universal could be *ousia*. Since a definition does not, this is more proof that the universal is not *ousia*. Let us look at the arguments briefly to see Aristotle's key claims in this chapter. The particular sensible thing does not admit to a definition, for a definition always holds of a thing, yet the particular sensible thing both comes to be and ceases to be. Aristotle states as a consequence of this argument that there is no demonstrative science of the particular

sensible thing. This is consistent with Aristotle's claim in the *Posterior Analytics* that science is of the genus (I.28 87a38) and his claim in the *Metaphysics* that knowledge is of the universal (A.1 981a5-6, cf. 981b24-25). The problem is how can there be a science of zoology, a science that has for its object *ousiai*, when no *ousia* is a universal? The answer is that the *ousiai* studied in zoology are taken up universally and this will be in respect to their formula. Zoology studies the species as abstract from the particular, so as a universal that is predicated of a particular *ousia*.

Since Plato does not take this route but asserts that his conception of Form is both particular and separate, his conception of Form runs into the contradictions present in the second set of arguments in Z.15. Aristotle begins with the assumption that the definition of any Form is composed up of names or universals (1040a9-10). Although it may be the case that these universals only belong to one thing, nothing about the definition, being composed of universals, prevents it from belonging to many *ousiai*. It is just arbitrary that there is one Form of Animal or Human Being or Horse that belongs only to one thing. The formula of each could belong to many things, each of which would be separate. Thus, the Form of each would be separate from itself. On the other hand, even if each formula only belongs to one thing, it would still be the case that there are parts of the formula, each of which would be separate in being a Form, so the Platonists would run into the same problems in Z.14. For, the parts of a definition are prior in being to the whole. Could the formula of a Form just have one constituent for Plato? This seems plausible, so is Aristotle ignoring this escape route for the Platonists? It seems not. If a Form has a formula with one constituent, then either each Form would have no relation to any other Form, for each Form will be defined by a unique term not shared by any other,

or all things would be one, since each is a unity and, as such, indistinguishable from each other. Aristotle assumes the latter absurd. The former option is ruled out on Platonic assumptions. Any Form either has a genus as a constituent in its formula, e.g., Human Being is two-footed Animal, or relates to the Form of Being or One, since each Form is and is one, e.g., Animal is one thing that is. If each Form is separate, then no Form can have being or oneness other than the Form of Being and the Form of One (but, of course, the Form of Being cannot be one nor can the Form of the One be). So, Aristotle comes to the conclusion that the individual as Platonic Form cannot be defined. Since *ousia* is what admits of definition most of all, Platonic Forms run into an absurdity. The only form left is Aristotle's, and it seems to avoid all of these problems: his form neither has material (like a sensible particular) nor is separate from the material (like Plato's Form).

Z.16 claims at the very beginning that most of what is normally considered to be *ousiai* are really potentialities, e.g., the basic elements and the parts of animals. Since the parts of animals are most properly the material of the animal, and form does not include any material, this claim follows. Further, as Aristotle stressed in both Z.10 and Z.11, a material part of an animal is not what it is apart from the form. The form is what makes the parts be what they are in the complete sense, e.g., a hand is not a hand apart from a human being. The form is what makes the human being be. This is significant, for, if the argument is understood this way, it undermines Balme's reading of *Metaphysics* ZH. There is no *aporia* either about how to define the essence of an animal or about the primacy of form and essence of a sensible *ousia*. The form is both one in number and one in formula. Each claim is argued negatively: Aristotle rules out other possibilities and only his conception of form is left as what can be both. This view is supported by the

fact that, in Aristotle's review of *Metaphysics* Z in H.1, he states explicitly the conclusion that essence is *ousia* (1042a17). We cannot yet conclude that the science of zoology is possible given that form is definable. There is another step of the argument. Physics studies form and material. This is the composite. If science is of an *ousia* or that which can be treated as an *ousia*, then Aristotle must show that the composite is also *ousia* or can be treated as such. But Aristotle has excluded material from the definition of an *ousia*. He must now argue that this material can have being and the being of it is the form. This is what Aristotle argues in Z.17. But Z.17 also considers another assumption about *ousia*: it is a principle and a cause.

2.2.4 Z.17: Essence as Cause of Being of Material: On the Possibility of Zoology as a Science

In Z.17, Aristotle announces a new beginning in his investigation of *ousia*. He states that *ousia* is both a principle (*ἀρχή*) and a cause (*αἰτία*). The problem he investigates here is what kind of thing does *ousia* cause to be. Z.1 answers that *ousia* is the cause of the incidental beings' being because they must be predicated of something else. But this has already been discussed. It is not the new beginning announced by Z.17. Another answer is that *ousia* is the cause of itself. But Aristotle almost immediately argues that no thing is a cause of itself or at least it is meaningless to ask why is each thing itself. The answer to this latter question is the same for each thing: each thing is itself because it is one thing. Aristotle finally appeals to the way scientific questions are answered, e.g., what is thunder (or why does it thunder), and he infers from this that a question concerning what something is or why it is the case is answered by showing why one thing belongs to another thing. The chapter then states that the cause

of something being is the essence either as an efficient cause or as a final cause. Aristotle then clarifies that the essence is form (1041b8). But this claim in this passage (1041b8) appears to break up the syntactic link between the other two parts of the sentence, so Christ and Jaeger bracket it in their text.¹⁵¹ These scholars suggest that it may be a marginal note by a scribe that crept into the treatise over time. Finally, Aristotle concludes the chapter with an argument that the being of a composite thing cannot be an element or a group of elements but must be something else.

There is much controversy in the literature on how to read this chapter. Part of the controversy is whether Aristotle would even ask about the being of the material (1041b5) when the focus of the chapter is the being of the composite. Another part of the controversy is whether Aristotle actually states that the cause of something being is the form (1041b8). Finally, the last part of the chapter often appears to scholars to be tacked on without much relation to the other arguments of the chapter.¹⁵² I will follow and defend Halper's view that Aristotle is asking about what is the cause of the material's being something. If this interpretation is correct it undermines Balme's view that *Metaphysics Z* is aporetic as well as his view that form cannot be defined without including the material in the definition. If form is the cause of being in the material, it must already have being distinct from the material. Z.17 argues that the being of the form is primary on the grounds that it is the cause of being in something that does not have being in itself, the material. But since the form makes the material be something, e.g., a house or a human being, form is also the cause of the being of the composite. This claim really presupposes that the form can be defined by itself because it is the being of a

¹⁵¹ See Burnyeat, *A Map of Metaphysics Zeta*, p. 60, footnote 124.

¹⁵² See, for example, Bostock, p. 244.

composite, and not the other way around, that the composite is the only thing that admits to definition or the only kind of definition we can seek, as many scholars hold.¹⁵³ I will now present a defense of Halper's view that Z.17 proves that form is the cause of being in the material and is the essence of the composite being.

What is new about the investigation of *ousia* in Z.17? Halper argues that the new beginning is not just considering *ousia* as a cause, for this assumption is prevalent in other parts of the *Metaphysics* (A.3 983a26-29 and Δ.8 1017b14-16), including Z.13 (1038b6-8). Halper claims that Aristotle is now investigating the cause of *ousia* in the composite *ousia* or what Aristotle considers to be secondary *ousia* (Z.3 1029a30-32). *Ousia* is a cause on the grounds that it causes the being of a secondary *ousia*. This is precisely what Aristotle does in Z.17. He begins by asking what does it mean to study *ousia* as a cause. He comes to the conclusion that it is to study why something belongs to something else (1041a23). For, it is not would be informative to answer that the cause of being a thing is itself. The cause of why something is itself is answered by the same thing: why the thing is one thing. This is the same for everything, which is the essence of the one (1041a18-19). This answer is not really an answer to a why question (τὶ ἐστὶ) but a that question (ὅτι ἐστὶ). The latter question just answers whether the thing is a being.¹⁵⁴ Given that Aristotle argues that being and one are co-extensive (Γ.2 1003b22-29), the above fallacious answer to the question is an answer to a that question. So, assuming that

¹⁵³ Balme holds that only the composite sensible *ousia* can be defined. See "Aristotle's Biology was not Essentialist", pp.294-95. Charles agrees but for different reasons. He claims that the definition of the form is sought only in respect to the structure of a demonstration. But this must be qualified in a way. Charles admits the claim that a form can be define by itself, since the middle term of a scientific syllogism is prior in being and explanation. It is unclear, then, why he denies the account in Z.12 as falling short of proof that a definition by genus plus differentia can be one in the appropriate way to be a definition of an *ousia*, i.e., such a definition is strictly one like the thing. See Charles, p. 285.

¹⁵⁴ For the distinction between these two kinds of question and what they answer, see *Posterior Analytics* II.1-2, esp., II.2 89b36-90a6.

a causal explanation will be informative and answers a why question, the cause explains why one thing belongs to another. We must be clear that “causal explanation” here is not merely epistemic but rather the emphasis is on being. Aristotle makes this clear in that he often mentions in Z.17 that the answer to a why question is answered by discovering what the being of the thing is (1041a32, 1041b4-5). We also need a further clarification of the question asked in Z.17, e.g., what is a human being?, because it is ambiguous. It could ask “why is this thing one human being?” or it could ask “why are these things, e.g., the material parts, a human being?” Aristotle has now argued that the why question, which is a causal question for Aristotle, answers the latter kind of question (1041a26-28). Such a claim already supports Halper’s reading. The cause is the cause of the material’s being a certain thing. If the composite thing is to be something, then the material must have being. But the composite just is material and what makes this material be something, e.g., form. So, the being of the material will also be the essence of the composite. *Ousia* really will be whatever it is that is the cause of being in the material (1041b5). What, then, is this cause?

The chapter twice suggests that the answer is form and essence (1041a28, 1041b8). Both passages are questioned as inserts. Alexander excises the first passage, with W. Jaeger following and Ross denying the need to do so.¹⁵⁵ Alexander argues that this passage would imply that essence is the only kind of cause for Aristotle although he immediately mentions two other causes in this same passage. But the context does not imply this reading. The cause in this passage may refer to the cause of one thing’s belonging to another, since Aristotle had just argued this claim (1041a23). It is the form

¹⁵⁵ See W. Jaeger, *Aristotelis Metaphysica*, Oxford: Clarendon Press, 1957, p. 163. See Ross, Vol. II, p. 223.

and essence that belongs to the material and not the other way around (cf. *De Anima* II.1 412a17-19). There is no reason to think that Aristotle is reducing all causes to the essence as Alexander and Jaeger do. The claim can be interpreted to say that essence is the cause of being in the material. The second passage (1041b8) many scholars accept as a correct emendation of the text, but disagree about whether there is a being of the material. Aristotle often implies that the being of the material is derivative or lacking. But, as argued above, this seems to be the main focus of the chapter. The problem is how does Aristotle arrive at the conclusion that form as essence is the cause of the being of the material?

The role of the argument at the end of the chapter (1041b11-33) may be to answer the above question. Many scholars often see this section as a parenthetical remark, but it provides support for the claim Aristotle needs: form is the cause of the being of the material.¹⁵⁶ Aristotle asks what makes the composite one thing like a syllable rather than a heap (1041b11-12). This seems to be the same questions as what makes the material of a thing be something, especially when we see the argument, although this argument focuses on unity whereas the former argument focused on being. Since being and one are convertible for Aristotle, the latter discussion is not different from the former. The conclusion to which Aristotle arrives shows that Aristotle slides from what makes the composite be one thing to a claim about what makes the material of a thing be something within the argument itself. The conclusion is that it is not the elements or group of elements that is the cause of being (ἀρτίον γε τοῦ εἶναι) in the composite, e.g., in flesh or the syllable (1041b25-27). Now, Aristotle reaches this conclusion by posing the

¹⁵⁶ See Bostock, p. 244.

following dilemma. If an element is a cause of the being of the composite, one will need to ask why this element belongs to that which it makes one. This would lead to an infinite regress of causes, for each element would be made one with the thing through another element. The same argument applies to what is composed of elements, for what is composed of elements would itself have to be one. Thus, no element can be the cause of being in the composite. The obvious conclusion, though not stated directly, is that it must be form, the only other constituent of the composite. Further, Aristotle says that *ousia* is not an element of the composite. He calls it a principle (ἀρχή) instead. In *Metaphysics* Δ.1, Aristotle states that a principle is the primary being from where the thing's being is or comes to be or is known (1013a17-19). This is distinct from an element, which Aristotle defines in *Metaphysics* Δ.3 as that out of which a thing is or comes to be (1014a26). If form and *ousia* are equated in Z.17, Aristotle does state this conclusion that form is the cause of being in the composite.

There is also a significant consequence for the science of zoology. If the being of the material just is the form, then studying the nature of the material parts can lead to grasping the definition of the form. This view, then, relieves the confusion of many scholars who hold either that the form cannot be defined by itself or that Aristotle abandons the unity of form in his zoology because he studies primarily the parts of animals formally, i.e., the material, in the biological treatises. If the being of the material just is the form, then, when the zoologist grasps the nature of all of the relevant parts, he will also know the form and what it is to be that kind of animal. Reading Z.17 this way also undermines Charles' view that it is only the composite that can be defined.¹⁵⁷

¹⁵⁷ See Charles, *Aristotle on Meaning and Essence*, Ch. 11.2.

Charles holds this view for two reasons. First, he believes that it helps overcome the problem raised in Z.13-16 that no universal is an *ousia*. Second, the answer to the what is it question posed in Z.17 is in conformity with the way a definition is sought in the *Posterior Analytics*, whereas Z.12's solution is not in conformity.

We can now see that both Balme's and Charles' readings of this chapter are flawed. The being of the composite *ousia* is form. For form to be the cause of the being, it must already be something and be one. If this reading is correct, Balme's view that *Metaphysics Z* leads to aporia must be denied. Form is not only what it is to be the composite thing but also, since the cause is more of a thing than the effect, form is *ousia*. Further, since *ousia* is what is assumed to admit to definition most of all, there must be a definition of form prior to the consideration of the being of the composite. Charles' view is flawed on these same grounds. But it is important to see why Charles' view is flawed to better understand the distinction between metaphysics and physics as sciences. In Charles' book, he states the following: "I have suggested that in Z.17 Aristotle introduces his *Analytics* explanatory theory in order to determine more precisely the type of form required for definition."¹⁵⁸ But the explicit theme of Z.17 is not what type of form is required for definition, or even the definition of a composite *ousia*, but rather how is *ousia* a cause. The answer is that *ousia* is the cause of being of the composite. Aristotle shows that form is the only viable answer for the cause of being in the composite. What causes being in another thing must admit to definition, but this issue was investigated and resolved in Z.4-12. Charles is assuming that metaphysics is a science that will justify that there can be the science of zoology. This may be the consequence of such a study, but Aristotle is clearly interested in the being of a thing. Further, Aristotle argues what kind

¹⁵⁸ Charles, *Aristotle on Meaning and Essence*, p. 293.

of cause or form is most relevant in scientific explanations in the *Parts of Animals* (I.1 639b12-21). No such argument is given in Z.17, rather it is assumed (1041a32). Finally, Aristotle's appeal to *Analytic* style explanations in Z.17 is not to show that this is the proper way to search for the definition of a composite *ousia* (although we can infer this consequence from the argument) but rather to find the being of a thing. Assuming that the middle term is the being of a thing, Aristotle appeals to the structure of a demonstration both to reveal the how one ought to study *ousia* as a cause and how to find that cause. Charles is right to believe that a consequence of this argument is that *Analytic* style explanations can be applied to animals in zoology, but wrong to see this as the focus of the argument. Also, there is more for Aristotle to argue to arrive at the conclusion that composite things such as animals are *ousiai*. Charles misses what is most important in this argument. The being of the composite just is the form, so form makes the material be something. So, the being of the material just is the form. Thus, studying the material is the same as studying the form. This consequence is precisely what makes the science of zoology possible and provides the way to study a composite *ousia*. The zoologist must discover the relevant material parts of an animal, and once all are discovered, what explains why all of them belong just is the form. I will develop this view in chapters 3, 4, and 5 and how this view really governs the structure of Aristotle's presentation of zoological knowledge in *Parts of Animals*.

So, the being of the composite is the form, and what the above argument really proves is that the form makes the composite be numerically one. This leads to a problem according to Halper. On the interpretation I am following, both the form by itself and the composite are both *ousia* and numerically one. It is the form that makes the composite

ousia not just be an *ousia* but also be numerically one. On these assumptions, the composite cannot be numerically one but two as both composite and form, since each is an *ousia*. The consequence of this latter point is even worse—the composite as *ousia* is really two *ousiai*. On Halper’s interpretation, these problems are what motivate the investigation of the composite *ousia* in *Metaphysics* H. I will defend this view in the next section. But as important, many scholars read *Metaphysics* H.6 as the solution to the problem of defining an *ousia*. I will argue why this reading is not plausible, although much of the work has already been done in this section: essence is *ousia*. Let us turn to *Metaphysics* H to see what arguments are put forth to what end.

2.3 Composite as *Ousia*

Aristotle stated that the composite is in a way *ousia* in *Metaphysics* Z.3 but that it is posterior to form as *ousia* (1029a30). We have seen the way in which Aristotle has arrived at the conclusion that form is primary *ousia*, and this is because form and essence are identical and essence is *ousia* insofar as essence has the kind of unity that belongs to an *ousia*. Essence can be both one in number and one in formula. The composite, though, seems to be neither of these. It does not seem to be one in number because it is composed of form and material, of which form has its own numerical unity, as just argued in *Metaphysics* Z. Further, Z.17 argued that material has its own being through the form. We just saw that this implies that the material thing is one in number. The composite *ousia*, composed of what is one (form) and something else (material), would be numerically many. The definition of the composite seems to suffer the same fate. Z.10 denies that the composite being has a definition (1036a2-5). But now the material

that is part of the definition of the composite is no longer the indefinite material of Z.10-11 that lacks a formula (Z.10 1036a5). It would be possible for there to be a definition of the composite if this material does not have a separate formula. The material does not seem to have a separate formula, since its being is that of the form. On the other hand, if the composite being is defined just by its form, such a definition leaves out an intrinsic element of such a definition, the material. But if the definition of the composite has elements, i.e., form and material, then such a definition is plurality. Aristotle would need to ask what makes them one. Both Balme and Furth read *Metaphysics* H this way, but both believe that Aristotle holds open the possibility that the composite being is defined by many differentiae. Furth takes this view a step further and finds support for the claim that form itself is defined by many differentiae in H.2.

I will argue that Aristotle is addressing these very problems in *Metaphysics* H, but not in a way that supports either Balme's or Furth's reading. In section 2.3.1, I will show that Aristotle's first step in resolving these problems is showing that form is the actuality of the material. As the actuality of the material, form is not a separate element of the composite but the being of the material and the composite *ousia*. Since actuality is what makes the material be a unity, I will rule out Furth's claim that form is defined by many differentiae. But this discussion of form as actuality does lead to the problems of the unity of the definition and the unity of the thing. I will argue in 2.3.2 that H.3-5 addresses both issues. H.3 concerns how to formulate the definition of the composite so form and material are not mere elements of the definition. Aristotle's solution is that the definition of the composite is like the definition of a number, which is made one by the differentia. H.4-5 discuss proper material, the material that is already worked up to take

on the form, and Aristotle's shows that proper material only belongs to one kind of being properly. If proper material holds of only one form properly, and if the material is the form in a way, then the composite *ousia* can be both one in number and one in formula. H.6 presents this argument in showing that form and material are one in a way understood as actuality and potential. I will show how the argument in H.6 depends upon the claim that the essence of a living being is defined by one, final differentia. I will end this discussion with a defense of Halper's view against those scholars who argue that Aristotle's argument cannot equate form and material without collapsing the ontology on which form and material are constituents of the composite.¹⁵⁹

All this has significant consequences for the problem of one or many differentia. The arguments of *Metaphysics* H that the composite being is a derivative *ousia* are also pertinent to the science of zoology. If the composite is not *ousia*, then it is not clear that the same science can study both the form and the material. The science is zoology studies both form and material. Zoology primarily studies the material parts of an animal, but it does so in order to find the definition of the form. The form can be defined without the material in which it is present, in a way, but the material parts cannot be defined separate from the form. But Aristotle uses the inquiry into the being of the material parts as a way to search for the being and definition of the form.

The mistake that motivates much of the literature on Aristotle's biology is the notion that the zoology can shed light on Aristotle's *Metaphysics* because both are pursuing the study of living beings in the same way. So, scholars like Balme deny that form by itself is *ousia*, for in the zoology, form is not studied by itself. But this is

¹⁵⁹ Michael Loux presents this criticism of the view that *Metaphysics* H.6 argues for the strict unity of form and material. His most recent critique of this view is found in "Aristotle on Matter, Form, and Ontological Strategy", *Ancient Philosophy*, 25, 2005, pp. 81-123.

precisely why the distinction between sciences is necessary. Zoology does not study the being of the animal in the same way as the science of metaphysics. This understanding of zoology will help make clear why Aristotle seeks out many differentiae to define an animal, and why this view is not contradictory of the claims in the *Metaphysics* that the form of an animal is defined by one, final differentia.

2.3.1 Actuality as the Differentia: H.2

Metaphysics H.2 discusses *ousia* as actuality and concludes that the differentia is actuality and the cause of each thing's being (τοῦ εἶναι) (1043a2-3). But Aristotle is never clear in this chapter how his arguments support this claim. I will follow Halper's interpretation that the differentia as actuality is the cause of being because it unites the elements of the material to be one thing. However, it is unclear here whether the cause of the being of a thing is one or many differentiae. The Greek states "differentiae" in the plural: ἐν τοῦτοις (1043a3). This has led Montgomery Furth to claim that Aristotle already accepted that an animal and any sensible *ousia* is defined by many differentiae.¹⁶⁰ Such a view would obviously pose a problem for my interpretation. Thus, a thorough response to Furth's reading of this chapter is necessary to defend the claim that a sensible *ousia* is defined by one, final differentia and that *Metaphysics* H.2 claims nothing to the contrary. But we will also see that my response to Furth's reading of this chapter will also be a path into understanding H.2's role in explaining the unity of the composite and how form and material as, respectively, actuality and potentiality are one in a way.

¹⁶⁰ I say "already", for most scholars take Aristotle's biological works to be some of his latest writings and the *Metaphysics*, at least the central books, as earlier writings. See Furth, *Substance, Form, and Psyche*, pp. 250-3.

Furth claims that *Metaphysics* H.2 analyzes the being of a thing as well. The analysis is that being is the differentia that organizes some generic material. Upon closer inspection, though, Furth claims that Aristotle arrives at the claim that many differentiae cause the being of a thing. Furth supports this view with the following passage:

Of some (ἐνίων) things the ‘being’ will even be defined by all of these [marks], in that some [parts] are mixed, some blended, some solidified, and some employing the other differentiae, as do *hand*, or *foot* (1042b28-31).¹⁶¹

He claims that this is clearly “a forceful restatement of the principle of both vertical depth and horizontal multiplicity of differentia.”¹⁶² Horizontal multiplicity means that a thing is defined by many differentiae. Vertical depth means that each line of differentiation is formed taking the difference of a difference. To judge the merits of Furth’s interpretation of this passage, let us contrast with a few other interpretations as well as locate it within the context of *Metaphysics* H.2. I agree with Furth that Aristotle is analyzing the being of a thing, but the being of the composite, not, as Furth argues, the being of the form. But we can leave this difference aside and turn to other ways to interpret the above passage (1043b28-31). I will then turn to the beginning of the chapter to judge which interpretation fits the rest of the chapter best.

One interpretation of this passage is by Halper. He emphasizes that the chapter is not about natural composites, i.e., living things, *per se* but about composites put together by craft (τέχνη) or what he calls accidental composites. Accidental composites can have many differentiae as their actuality, for they are not held together by one thing but many,

¹⁶¹ This is Furth’s translation, both in *Substance, Form, and Psyche*, p.254 and his translation of the central books of the *Metaphysics*, Hackett Publishing Co.

¹⁶² Furth, *Substance, Form, and Psyche*, p. 254.

e.g., held together by glue and by nails and by screws. The problem with this view is that the mention of hand and foot (1042b31) seem out of place. This may not be that much of an alarm in Aristotle's text. A second interpretation is that of David Bostock. He finds the mention of hand and foot as striking considering Aristotle is emphasizing that they are defined by many differentiae distinct from their primary function, e.g., to grasp or to stand.¹⁶³ His claim is that we can apply the same parenthetical remark at 1043a8-9 about the definition of a house being its end or purpose, to shelter things, although the text states at first that a house should be defined by the arrangement of its materials. Both of these interpretations play down the mention of many differentiae defining and causing the being of a thing, and I will argue rightfully so. I will follow Halper's line of reasoning, though, about the text.

Aristotle begins the chapter by claiming that how *ousia* as underlying thing and as material has been stated, which is as potential; so we must now look at what is the actuality of a thing. He claims that this latter is the differentia. The first reason seems to be that there are many sorts of differentiae (1042b18-19), any of which can characterize the being of each thing uniquely. Aristotle is criticizing Democritus for only holding that there are only three kinds of relevant differentiae. Aristotle then proceeds through examples of composites with other differentia beyond these three. The being in each example is a composite, e.g., honey-water, a box, a book, a threshold, dinner, etc. This is because of the nature of an actuality of a sensible being: the actuality is responsible for organizing the material to be a certain way. Aristotle's example in H.2 is the threshold. The being of threshold is the way in which the wood lies (namely, under a doorway) (1042b26). As Halper notes, the expression of the differentia in each example is always

¹⁶³ See Bostock, pp. 256-57.

verbal. The idea is that the being of thing is actively organizing the thing, i.e., the material to be a certain way. On this understanding, Furth's view runs into an obvious problem. If each *ousia* is defined by many differentiae, then what is that which unites all them to be of one thing? Furth realizes this problem and appeals to H.6 as what resolves this problem. But a closer look will show that H.2 can rule out Furth's view as well.

The obvious starting point is that Aristotle only claims that some things (ἐνίων) are defined by many differentiae, primarily artifacts, though he also includes hand and foot. This is not a clear affirmation of horizontal complexity, although, in Furth's favor, it affirms the possibility of it. Most of the examples are, of course, artifacts. They are ruled out as not being *ousia* in this chapter (1043a4). We can leave these aside as no threat to the thesis that an *ousia* is defined by many differentiae. The other kind of thing mentioned were parts of animals, hand and foot. Aristotle dismissed these as *ousia* in Z.16 (1040b5-6). These can be left aside too, in a way. But we are left with a problem. Why does Aristotle even mention them here and in such a way opposite that is normally his view? Aristotle also accepts that parts are defined by a single differentia, for they are a unified whole in a way but they cannot be completely defined apart from that which they belong. For example, Aristotle defines the hand in *Parts of Animals* as the ability to grasp so as to be the instrument (ὄργανον) for instruments (IV.10 687a21).¹⁶⁴ He then uses this definition of hand to explain its various parts, each of which is a differentia.

And for this the form of the hand has been adapted by nature. For it is divided and has many digits, and it is possible for something in a divided state also to be composite, while it is impossible for something in a composite state to be divided. And it is possible to use the hand as one, two, or many. Again, the joints of the fingers are well disposed for grasping and squeezing. And one finger extends out

¹⁶⁴ A similar passage can be found in respect to the human foot, where Aristotle even compares the two organs. See PA IV.10 690a27-b10.

of the side of the hand, and is short and thick, not long; for just as, if there were not a hand at all, one could not grasp, so too one could not grasp if this finger were not growing out of the side (*PA* IV.10 687b6-13).

This passage might suggest that the different fingers are the hand's multiple differentiae. But this would contradict the passage, for it clearly states that the differentia is the being of the thing (1042b28). But, if we accept Bostock's reading of the passage about the hand having many differentiae, where the remark has been left out that the hand's being is its function, then these problems simply disappear. The hand is defined as the capacity to grasp or squeeze, and the different fingers are the material necessity for this capacity, as the above passage states (*PA* IV.10 687b10). This reading is also supported by the discussion of the three kinds of definitions at the end of H.2. The definition of the material is expressed as a plurality of parts, e.g., stones, bricks, and timber of a house (1043a14-16). The definition of the form is defined in respect to its purpose or end, to shelter property (1043a16-18). Finally, the definition of the composite expresses both together. I will have more to say about these three definitions later.

Furth could challenge my reading of 1042b28-31 by appealing to the passage at 1043a2-4. It states the following:

It's evident, then, from these [forms of differentia], that if in fact the substance is the cause (ἡ αἰτία) of each thing's being, it's in them that it's got to be sought what the cause (τὸ αἰτίον) of the being of each of these things is.¹⁶⁵

There seems to be once again an emphasis on the plurality of differentiae, here, in respect to the being of a thing. Aristotle states that it is amongst these things (ἐν τούτοις) that we should seek the cause of the being of a thing. The reference is to the differentiae. But the use of the plural here need not refer to the many differentiae of one *ousia*; more likely

¹⁶⁵ This is also Furth's translation, *ibid.*, p. 48-49.

it refers collectively to the many different differentiae that define many composites. Aristotle's use of "cause" (ἡ αἰτία) in the singular adds more support to the latter reading. If the causes were many, why would they cause something to be one and not many? Furth's reading, along with Aristotle's claim that the differentia is the actuality, would seem to imply that there would be many actualities of one thing. For, each differentia as an actuality organizes the material to be something. Aristotle has already denied that a thing cannot be more than actuality at a time (Z.13 1039a4-5), so it is best to read the cause of the being of the composite as one differentia. At best, it seems that what could be defined by many differentiae are artifacts or the material aspects of one thing. But if artifacts are defined by many differentiae, the obvious problem for Furth is that Aristotle denies that artifacts are *ousiai* in this chapter (1043a4). This criticism assumes what this chapter, H.2, needs to prove: the differentia is an actuality that unifies material to be one thing. I will now turn to a defense of this view.

As Halper points out, H.2 never develops a direct argument that the form is actuality, but Halper addresses this issue by developing an argument that shows how a differentia can be the unity of a thing by being the function of some matter.¹⁶⁶ This argument will have the added benefit that it also undermines Furth's analysis in a different way. The first step is to show that a differentia is a function. Halper begins this by emphasizing that Aristotle expresses the differentia as a verb after a quick list of different differentia (1042b25-28). What justifies expressing a differentia as a verb? Halper points out that a differentia here only differentiates when it belongs to some matter, e.g., a threshold is different from a doorpost due to position. But this is only

¹⁶⁶ See Halper, *One and Many in Aristotle's Metaphysics*, pp. 158-67.

possible by the materials of the threshold lying in a certain way. This lying is a position, but it is what makes it a threshold as opposed to a doorpost. But this lying is a certain kind of function, which just is an actuality. Next, Halper distinguishes the function of this actuality, e.g., lying in a certain way, from another actuality, which would involve someone using the threshold as a threshold. This is the difference between first and second actuality introduced in *De Anima* II.1 (412a10-11). The example Halper uses, which illustrates this more clearly, is the binding of a book. The glue holds the book together by its activity, namely, binding the pages to each other (and often to some kind of protective cover). This binding is the differentia and also the actuality, the actuality in the first sense. But the material parts, here, the pages, the book bind, as well as the glue, are not sufficient for the book to be one thing that moves together. It also needs to activity of binding, and this is the form. The first actuality of a thing is also a capacity for something, e.g., like Aristotle's example in *De Anima* I.1, knowledge as a first actuality just is the capacity for exercising this knowledge. So, in being the first actuality, the binding makes possible the function of a book, which is to be read. The binding holds the pages together so that the book may be read. The latter activity, reading the book, is the second actuality. But the first actuality, the binding of the book, is just as much an actuality in relation to the parts of a book, so that it holds it together, as the actuality of someone reading the book and actually flipping the pages. The same holds true for the first and second actuality of a living being. The actuality of an animal, e.g., that of a bird, assuming that it is the capacity of locomotion, is just the activity of keeping the bird organized so that it can fly. This means that the bird must have wings, two-feet for landing, and a sharply pointed chest for the sake the act of flying as well as

internal organs and blood for nutrition and maintaining the bodily parts. So, the differentia of a bird will be the way in which it can fly, and this will just be the way it is organized so that it can fly that way. The difference between a living being and an artifact is that no aspect of the material of a living being has a nature independent of the *ousia*. For artifacts, that is clearly not the case. Wood in a bed can be taken from the bed and made into cabinet or a desk or a house, etc. The wood retains its nature as wood in the artifact. One might think that the possibility of transplanting organs would undermine Aristotle's view here, but the claim is still the same. The organ must be accepted by the body, and, when it is accepted, it performs just like the organ it replaced. The transplanted organ becomes one with the living organism. Rejection of the organ is a sign that the organ did not become one with the living body—it could not function properly.

Aristotle's view, then is that a thing that is one by nature, e.g., an animal, is one because of the differentia as an actuality. The bird is held together by its capacity for flying because this difference is the holding together of all the parts so that it can fly. The actuality is the cause of the composite thing's being. If there are many differentiae, each of which organizing material to be one thing, then the composite thing could not be one thing. But Aristotle has not yet proved that a living being as composite of form and material is one either in formula or in number. This is clear from the analysis of being in this chapter. The actuality cannot be what it is apart from belonging to material; actuality of a sensible being is always predicated of the material (1043a6). If this is the case, then the definition of a composite should include both form and material, like the snub. The end of H.2 is surprising, for it states that there are *three* definitions (1043a14-21).

Evidently, the composite can be defined by defining the form, but which definition expresses the being of the composite? Aristotle has not answered this but will turn to this issue in the next chapter, H.3. Further, Aristotle has not yet resolved how the composite *ousia* could be numerically one. He has not advanced on this problem left over from Z.17, but he has clarified what kind of cause *ousia* is. It is a cause of being insofar as it is the actuality of some material. Aristotle will discuss the nature of the material of a composite *ousia* in H.4-5. These two discussions, H.3 and H.4-5, will lead Aristotle to the conclusion that the composite can be both one in formula and one in number, at least in a way, in H.6. I will treat the issues in H.3 and H.4-5 together in the next section.

2.3.2 Problems in Defining the Composite *Ousia*: Resolving the Tension of the Intrinsic Plurality of the Composite in H.3-5

I will argue below that these chapters concern both the unity of the composite thing, i.e., this or that particular animal or plant, and the unity of the definition of the composite. Aristotle sees both as an intrinsic plurality of form and material and has yet to argue that either the composite thing or definition of the composite can be one. The argument for both occurs in H.6, but H.3-5 pave the way for this argument. One problem with this line of interpretation is that most of the scholars view *Metaphysics* H as an appendix adding little to the discussion of *ousia* began in *Metaphysics* Z and H.3-5 as in insignificant collection of texts.¹⁶⁷ I will follow Halper in reading H.3 as a treatment of

¹⁶⁷ W.D. Ross says of H.3 that it is “a collection of ill-connected remarks on various topics relating to essence and definition.” See *Aristotle’s Metaphysics*, Vol. II, p. 231. Neither Furth nor Charles has any discussion of these chapters in their books on Aristotle. Both have sections on that deal with H.2 and H.6 but nothing about the chapters in-between. See Furth, *Substance, Form, and Psyche*, pp.250-68, and see Charles, *Aristotle on Meaning and Essence*, pp. 283-94. Myles Burnyeat attempts to overcome this stereotype in his *A Map of Metaphysics Zeta*, but he still seems to suggest that Book H is, though deliberately organized, not fully integrated into the grand design of *Metaphysics* ZH. See *A Map of*

the unity of the definition of a composite being and H.4-5 discussing proper material.¹⁶⁸ The understanding of both issues are essential in the argument in H.6. H.3 establishes that form and material are not elements of the definition like genus and differentia, for there would fail to be a unity. H.4-5 defends the view that there is one proper (οἰκεῖα) material of a thing and this is the proximate (ἐσχάτη) material of a thing. For example, the proximate material of a human being is not blood or the four elements of which the parts are composed but the arms, hand, feet, head, etc. of the human being. Proximate material is the already worked up material that takes on the form to be that kind of thing it is, literally, the material closest (ἐσχάτη) to the form. Let us begin by taking a close look at H.3.

Metaphysics H.3 begins with a warning: we must be clear about whether a term refers to the composite being or the form and actuality (1043a29). Aristotle then claims that this is not that significant; sometimes the term refers only to the form and sometimes it can refer to both the form and the composite being. But there is a deeper issue here. There is a way in which the two are not distinct. Both Z.17 and H.2 confirm that form is the cause of the being of the material and the composite being. In this sense, form just is the being of the composite. But the problem is that the material is still distinct from the form, and, at the end of H.2, Aristotle still treats form and material as distinct parts of the definition of the composite, as noted above. As such, the composite is neither one in number or one in formula. Aristotle needs to show that the composite can be one in both ways, at least in some respect, for the composite to be an *ousia*.

Metaphysics Zeta, p. 71. Bostock argues that some of the material in these chapters were not originally included by Aristotle himself. Bostock, pp. 261-78.

¹⁶⁸ See Halper, *One and Many in Aristotle's Metaphysics*, pp. 167-79.

Aristotle begins to solve the problem of the unity of the definition in the next passage (1043b4-14), where he takes a first step clarifying in what way the definition of the composite must be conceived. The definition cannot be composed up of form and material as elements. Aristotle interprets the Platonists to treat a definition via genus plus differentia as such. The obvious problem is this: in what way would form and material be one if each is a distinct component? Aristotle rejects that the composite can be defined where form and material are distinct elements because no composite is defined as its material plus combination. The reason is that the form is not itself composite or merely the combination of elements; form is the actuality of the composite being as argued in H.2. Aristotle appeals to an example to make his point: human being is not just two-footed and animal. We may be thrown off by the example at first. Aristotle seemed to accept this definition of a human being in Z.12. But that is not the case. In Z.12 Aristotle argued that the form and the definition was just the final differentia (1038a19-20). Aristotle returns to this example, but he is not discussing the same issue as Z.12. In Z.12, the question was whether a definition via genus plus differentia can be one. The issue here is that there appears to be two constituents of the definition of the composite: form and material. Aristotle understands the Platonists to give such a definition because Aristotle interprets them to treat genus and differentia as the elements of a definition. If this is the case, Aristotle's claim here is that there is no account of the unity of these elements. What would account for the unity would just be the form of the composite (1043b11-14). Once again, the assumption is that an *ousia* is one in formula, and, with this assumption, Aristotle arrives at the conclusion again that form is the *ousia* of the

composite. By the end of H.3, Aristotle will solve in what way this definition needs to be conceived for the definition to be one.

But how is it the case that the definition of the form is not one element of the composite but could be the definition? If Aristotle reduces the definition of the composite to that of the form, then there will be no mention of the material whatsoever. But this seems improbable as the definition of the composite. The claim whether the form of the composite is eternal (1043b14-22) seems connected to the issue of separation of the form from the material. But just as a house does not exist separate from its materials, the form of animal does not either. So, if the form is always of a certain kind of material and does not exist separate from it, the material would seem to be part of the being of the composite. This may be why Aristotle raises the aporia of Antisthenes that simples cannot be defined but only named (1043b23-25). The form is a simple. But, as such, this would not be the definition of the composite only the form. On the other hand, there can be no definition of its primary constituents, for these would be simple as well. What about the two put together? If form is just put together with the material, then this is just the same problem raised back at 1043b4, the formula would just be an element of the composite and does not express the composite's unity. Aristotle's answer, then, is that form must be expressed as predicated of the material to be the definition of a composite, and it is now his task to show that this is not merely stating that the composite is its material plus combination. Aristotle here turns to the definition of number.

Aristotle likens the definition of a composite to the definition of a number insofar as both are composed up of indivisibles, neither admits to more or less, and both are made one by something (1043b32-1044a6). The latter point is the most important, so I

will discuss it first. How does Aristotle explain the unity? Both a composite and a number are made one by the differentia, which in the former case is an actuality (1044a6-9, cf. M.8 1083a1-4). What does the actuality do in a natural composite? As we saw in the example I constructed in respect to the claims of H.2, the actuality organizes the constituent parts to be that thing. This is the differentia and the cause of the thing and the definition each being one. As for being composed of indivisible elements, the parts of an animal are each indivisible insofar as each has its own nature. Thus, subtracting a part or adding a different part would affect the being of the composite. Although a bird minus a foot or a human being minus a leg are still each respectively a bird and a human being, they are defective in their nature. If the bird cannot fly, it will soon cease to be a bird, being eaten by prey or itself not sufficient to find food on its own accord. The human being differs. The end and being of human being is the ability to engage in rational thought, and such activity does not demand that two feet or even two hands be present, but a human being missing appendages does differ from other human beings. These human beings, like the bird, must depend on external help to continue their existence. But since human beings are also a social animal, the being of a maimed human being can continue in respect to the highest end, rational thought, insofar as the community at large provides for the subsistence of that particular individual. The analogy here is not perfect, on the other hand, we see that it holds enough to make the point. But insofar as a living being continues to be, even with missing parts or additional parts, the being is not changed as long as the actuality is the unity of the whole. This is the point that Aristotle stresses. The *ousia* according to the form will not admit to more or less, although the *ousia* according to the material might (1044a10-11). The unity of the definition of a

composite *ousia*, once again, is shown to be the form. But there still remain two problems. First, if the unity of the definition of a composite *ousia* is just the form, then is there not a significant sense in which the definition leaves something out: it excludes the material? Second, the question is also left open whether the composite being is itself numerically one. Both of these questions will be answered by the argument in H.6; the material is included in the definition in a way (though, of course, in a way, it is also left out) and the composite being is also numerically one in a way. This should not surprise us because a composite *ousia* is not primary *ousia* but derivative; its being is through the form. But Aristotle needs to address the nature of the material of the composite *ousia*, and he turns to this discussion next in H.4-5 arguing that the material of a composite *ousia* is proper to it, meaning the material only belongs to that kind of *ousia*. If the material is proper to the composite *ousia*, and its being is the being of the form, then the only thing needed to express the nature of the composite is the form.

Aristotle begins H.4 raising the following problem: if there is the same primary stuff for all material, how can there be material proper to any sensible *ousia* (1044a15-18)? Proper (οἰκεία) material is specific to the kind of thing which it belongs and does not belong to any other kind of thing, e.g., the material that belongs only to human beings and no other kind of thing. If all material has a common source, e.g., either the four elements or what is fundamentally the same in the four elements, then it would seem that there could be no material that belongs only to one kind of sensible *ousia*. Halper reads H.4-5 as arguments that counter objections to the claim that there can be proper material.¹⁶⁹ Once again, Aristotle offers no positive proof for proper material but defends

¹⁶⁹ See Halper, pp. 172-79.

the view from possible objections. Aristotle will identify proper material with the proximate material.

The first objection (1044a18-24) that Aristotle raises against proper material is that it appears as if a thing can come to be out of different material, e.g., phlegm comes to be from what is fat and what is sweet but also from bile. Thus, there would be no proper material for phlegm having two sources out of which it comes to be. Aristotle's response is that when phlegm comes to be from bile, bile itself must be broken down into that which phlegm comes to be from for the material to come to be phlegm. So, it is the same material out of which phlegm comes to be. The second objection (1044a25-31) is more problematic in one way, but also ends up proving that artifacts cannot be *ousia*. Different artifacts could come to be from the same material, e.g., a table, chair, and bookshelf could all come to be from wood and the same wood for that matter, though not at the same time. How then can artifacts have proper material? The cause of the material being proper to the thing, in one way, is not the nature of the artifact (as it will be for the natural composite) but the efficient cause. It is the craftsman who shapes the material in such a way that it can form a table or a chair or a bookcase. In another way, though, the nature of the artifact does determine its proper material. A saw cannot be made of wool but must be made of something hard. Even though this is the case, it is still the craftsman who decides what specific material the saw will be made of, iron or another hard metal.

This defense of the objection has the advantage of showing why artifacts are not really *ousiai*. The material will never be fully one with the form in any way. As Halper stresses, the material out of which an artifact is made will retain its own nature even as

part of the artifact, e.g., the wood of a house still has the nature of wood and will still behave as wood even when it is part of the house.¹⁷⁰

The natural composite, such as plant or animal, has its material cause comes to be from the nature of a thing and no other source. The material cause of a human being's coming to be, as Aristotle suggests, is the menstrual fluid or something of this sort (1044a35). The menstrual fluid comes to be due to the nature of the thing, through the form. Further, this material has no being apart from the composite *ousia*. Finally, and most importantly, there is one and only one material out of which the composite human being comes to be. But this also raises a problem. The material that is proper is the proximate (ἐγγύτατα) material. This would be the bones, flesh, heart, etc. of a human being and not the menstrual fluid. There would seem to be two different proper materials, the menstrual blood and the various parts of the animal, undermining Aristotle's defense of proper material. But the worked up blood is the whole body of the animal insofar as blood is basic nutrient for the whole body (*PA* II.3 650b2-12). So, in a way, these two, the blood and all the parts, are really one and the same thing, the potential for form. This actually makes another point as well. Furth's conception of the generic potential of a thing is mistaken. Furth takes it to be the generic nature of the animal, e.g., the capacity to fly in a bird.¹⁷¹ We can now see that it is the form. There is another significant result from this understanding of the proper material in respect to the problem of one or many differentiae. The proper material of an animal is one in a way, as the whole body or the blood, but, in another way, there is a multiplicity present, all the parts. On my view, when Aristotle turns to the science of zoology, the one differentia is

¹⁷⁰ See Halper, pp. 171-72.

¹⁷¹ See Furth, *Substance, Form, and Psyche*, p. 246.

the definition of the form by itself whereas the many differentiae are the parts, each of which cannot be defined apart from the form, since each has its being through the form. I will show that this view is confirmed in the first book of *Parts of Animals* in the next chapter. But we should recognize here in the *Metaphysics* that the stress is the proper material is one. Now, there is one last problem that needs to be solved in respect to the proper material of a composite *ousia*.

In H.5, Aristotle objects that sometimes material is the source for opposite things, such as the body being the material for health as well as the material for sickness. The problem for a living being is obvious. Its material would seem to be potentially a corpse, so any living being's material would not be proper, being the source out of which two beings come to be. Aristotle solves this problem by showing that the material is not actually proper to both. The material of a living body is potentially alive (*De Anima* II.1 412b25). This is not the material that is potentially a corpse but only the material that is present after the composite has deceased, just as the proximate material of wine is not potentially vinegar but the water (1044b34-1045a6). Thus, the material of a composite living being is proper to it. Vinegar is a corruption of the form of wine.

The conclusions of H.3-5 will now play a pivotal role in the argument of *Metaphysics* H.6 that proves the composite being can be one in number as well as one in formula.

2.3.3 The Unity of the Composite: H.6

We are now in a position to examine the argument of *Metaphysics* H.6. This chapter is often read as doublet of *Metaphysics* Z.12, but, if the above interpretation is

correct, that should now seem implausible.¹⁷² The investigation in *Metaphysics* H is of the composite and its definition, not the form or essence by itself. I will argue below that the chapter shows how the composite is one thing and that, if the composite is a unity, so is its definition (1045a12-14). Following Halper, I take the argument to be that the composite is numerically one because form and material as, respectively, actuality and potential are one in a way.¹⁷³ So, it follows, given Aristotle's assumption stated above (1045a12-14), that the definition of the composite is one. On the other hand, there is much to be wary of the interpretation I will present. Given that form and material are numerically one, this would seem to undermine the form-material distinction that is prevalent not only in Aristotle's *Physics* but also the *Metaphysics* itself. This is the objection of Michael Loux.¹⁷⁴ There is also the objection that the equation of the actuality and potential of a thing is just nonsense. This is the objection of David Bostock.¹⁷⁵ Both of these objections have a common theme: Aristotle cannot equate two fundamentally distinct ontological categories without destroying their distinctness from each other. I will handle these two objections after presenting an interpretation of the argument of this chapter. For now, let us begin by taking a close look at the text to determine what reading of *Metaphysics* H.6 is appropriate and what is under investigation in this passage.

Aristotle begins this chapter as follows: "Returning to the *aporia* stated earlier concerning definitions and numbers, we may ask: what causes each of them to be one?"

¹⁷² See Jaeger, *Studien zur Entstehungsgeschichte der Metaphysik*, pp. 53-61, Ross, *Aristotle's Metaphysics*, p. 238, Owens, *The Doctrine of Being in the Aristotelian Metaphysics*, p. 362.

¹⁷³ See Halper, pp. 179-84.

¹⁷⁴ See Loux, "Aristotle on Matter, Form, and Ontological Strategy", pp. 81-123.

¹⁷⁵ See Bostock, *Aristotle's Metaphysics ZH*, pp. 283-84.

(1045a7-8).¹⁷⁶ Ross takes the reference to be both back to Z.12 and H.3 1044a3.¹⁷⁷ But there is no mention of cause or the cause of unity in Z.12. This adds to the claim that Z.12 and H.6 is not a doublet. It seems more likely that Aristotle is referring back to H.3 1044a3 since it is this passage that compares the definition of a composite to that of a number. If this reference is correct, Aristotle is announcing the subject matter of this chapter to be the definition of the composite. Also, Z.12 does not mention any *aporia* in respect to the unity of a number but only, if a thing has parts, how can the definition be one. The next passage confirms that the definition and being of the composite is under discussion: “For in anything which has many parts and whose totality is not just a heap (*σωρὸς*) but is some whole besides just the parts, there is some cause, inasmuch as in bodies, too, the cause of unity is in some cases contact, in others viscosity, or some other such affection” (1045a8-12). This passage presents several problems for those who state that H.6 and Z.12 is a doublet or concern the same problem. First, Z.12 raises the problem of the unity of genus and differentia and concludes that form is *ousia* insofar as the final differentia just is the form (1038a19-20). Here, in H.6, Aristotle is discussing a thing that is not just a heap (*σωρὸς*) but a whole. It is not clear in what way genus plus differentia would constitute a heap. Halper makes a similar point in his book that the kinds of unity mentioned are those appropriate of a composite being, a thing that is one by continuity, and not the kind of unity appropriate to form, an intelligible entity.¹⁷⁸ Thus, the first two passages support the view that the composite is under discussion. But the next few passages in H.6 may seem to challenge this interpretation.

¹⁷⁶ I have changed Aristotle’s “difficulty” for “*aporia*”.

¹⁷⁷ See Ross, *Aristotle’s Metaphysics*, Vol. II, p. 237.

¹⁷⁸ See Halper, pp. 179-80.

The next sentence is: “Now a definition is one formula not by placing of things together, as in the *Iliad*, but by being a formula of one thing” (1045a12-4). Aristotle point here is that a formula is not a list of the constituents or component parts of the thing. But the question here is whether the reference to the *Iliad* is about an actual book that is put together by putting pages together or about placing parts of a story together. The issue seems to be the latter because the discussion is of definition. The unity of a definition is not just placing terms together in one expression. This adds evidence that the initial reference above is to H.3 1044a3. The issue is the same in each case: a definition cannot just be a list of constituent parts.

With this in mind, let us turn to the next passage. It seems to articulate the exact same problem as Z.12. The passage is as follows:

What is it, then, that makes a man one, and why is he one and not many, such as an animal and also a biped, if indeed there exists, as some say, Animal Itself and Biped? And, in general, a man would then be not one but more than one, an animal and a biped. It is evident, then, if we proceed in this manner, as these thinkers are accustomed to define and speak, we cannot answer or solve the *aporia* (1045a14-22).

One interpretation of this passage is obvious: animal is the genus and two-footed is the differentia and Aristotle is asking how these two are one, just as in Z.12. But there is one obvious discrepancy. Z.12 raises a problem for Aristotle’s own view and he refers to his own work, the *Analytics*, when expressing the *aporia* (1037b8-9). Here, Aristotle states that the *aporia* is present for those who say that there is Animal itself (αὐτό) and Biped itself. Aristotle makes quite a different assumption present in Z.12. He assumes that the genus is either material or nothing apart from the species. Neither of these two options would qualify the genus as a thing itself. Thus, Aristotle is presenting an *aporia* for his own thought in Z.12, but here he is raising an *aporia* for his predecessors that he can

solve by assuming form as actuality and material as potential. The language of the last quoted sentence and the sentence that follows it make this clear as well (1045a20-25). Now, in respect to form being actuality and material as potential, Aristotle has already proposed the former in H.2 and stipulated the latter in H.1 (which may follow from Z.17 as I claimed above) and made clear its meaning in H.4-5. Read in this way, *Metaphysics* H is laying down the possibility of resolving how a composite *ousia* can be one thing. All of what is said above is still consistent with Balme's and Furth's interpretation. We must continue to read on to see which interpretation remains valid.

Aristotle articulates his solution as follows:

But if, as we maintain, the one is material and the other *form*, and the former exists potentially but the latter as *actuality*, what we seek no longer seems to be an *aporia*. For this is the same *aporia* as the one which would arise if the definition of a *cloak* were to be "a round bronze"; for the name would be a sign of this formula, so that we would be inquiring into the cause of the unity of roundness and bronze. The *aporia* indeed no longer appears, in view of the fact that one is material and the other is form. What causes that which exists potentially to be in *actuality*, then, aside from that which acts in the case of things which are generated? Doubtless, nothing else causes that which is potentially a sphere to be a sphere in actuality, but this is the essence in each (1045a23-33).

Aristotle is seeking what is the cause of the unity of form and material. As raised in H.3, Aristotle interprets the Platonist to treat a definition via genus plus differentia to be a composite, like form and material. The alternate reading that Aristotle is solving the general problem of Z.12 again must interpret the example to refer to genus and differentia in some way.¹⁷⁹ But the bronze does not seem to be a genus or intelligible material. On the interpretation I support, bronze can simply be interpreted as the (physical) material of the ball and the genus Animal as the (intelligible) material of the differentia. Aristotle is not concerned with how genus and differentia are one, as in Z.12, but how two distinct

¹⁷⁹ See Ross, Vol. II, p. 238. Bostock takes the example to be confused and tries to rework it, pp. 281-82.

constituents of a definition are one. These two constituents will be one if the thing they refer to are one. This is how I interpret the above passage. The two things, form and material, are one because the essence of both is the same, the essence of the form (1045a33). This makes sense if Aristotle is speaking of proximate material, and this is what he says is one with form at the very end of H.6 (1045b18). We saw in Z.17 that the cause of the material being one thing was the form or essence. Aristotle is appealing to this premise in the above passage. Further, H.4-5 made clear that the potential of the proximate material is that which coincides with the form, e.g., the potential of the material of an animal is that which is potentially alive and already belongs to that which has a soul. The final step is to see that the essence of both form and material is the same, and since the potential of the material is a potential for a specific actuality, the actuality for which the form is a potential, the two elements of the composite are one. The form, for Aristotle, is the first actuality, which, in *De Anima*, is also a capacity (δύναμις) for a certain activity (II.1 412b27-30, cf. II.4 415a14-19). The nature of the proximate material is just the potential of the form, but, in another way, the material potential as a whole just is the same potential as the form and the first actuality. Each is the potential for the same activity.

An example here will serve us well. Think of a bird. A bird is an animal that has the capacity to fly (*PA* IV.12 693b12). This is the generic form of a bird. How is it possible for the bird to have the capacity to fly? It must have the appropriate material, which just is the material that works together for the sake of flying. This means that a bird must have appendages and features that are fit for flying, such as wings and feathers. Further, a bird must also have feet, for a bird is not always flying, and these feet must be

the kind that does not hinder the bird in flight. It must also be the case that the body of the bird, both its shape and its weight, are conducive for flying. Since a bird is an animal and a living being, it must also eat and reproduce. The beak serves as its mouth, for it cannot use its wings or feet to eat due to its shape. A bird lays eggs for reproduction and is able to protect these eggs through its nature so that most can mature and become birds. But when we see all of this material together, the various appendages and internal organs of a bird, they work together in such a way to be the capacity to fly. Thus, there is no difference between the potential of the proximate material as one thing and the actuality of the form as the capacity to fly. Form and material are one in the composite bird just as actuality and potential.

Now, a certain problem arises appealing to such an example. Isn't this the view of Furth? Furth's view is that the generic potential just is the unity of the animal. The problem with this view is that it does not account for the unity of the composite being but the unity of the universal "bird". The nature of the genus bird accounts for why a bird has wings, two-feet, beak, a certain body shape, etc. It does not account for why a sparrow has these properties in a different way than an eagle. So, in respect to a determinate kind of bird, eagle or sparrow, we will see that the form of each is the cause of its material's being organized in the way it is, that is organized so an eagle has an eagle nature and a humming bird has a humming bird nature. Only the form is sufficient to unifying the proximate material of this or that particular bird. Furth may have confused the potential of the genus with the potential of the form for both are a kind of potential for Aristotle. But only the form is a potential that is also an actuality. The form

as actuality is its ability to maintain the whole as one thing. This is done through the organization of the parts, so the parts and their organization, in a way, are the same thing.

Although Aristotle states that there need to be no further cause (τὸ αἴτιον) of the unity of form and material (1045a32), we can see that it will not be without explanation. The essence of each is the same. The form already is the cause of the material because the material is already worked up to be the capacity of that thing. But I interpret this capacity to be defined by one, final differentia. This is the *ousia* (Z.12 1038a19-20) and already something that is one, and form is the cause of unity in the material (Z.17). Thus, Aristotle's argument in H.6 is explanatory and presupposes that the form is defined by one, final differentia. If the form is not one, it is not clear what would make the composite one, i.e., both one in number and one in formula. Even if this discussion is about the definition of the form by itself, if the form has many differentiae, it still needs a cause to explain why they are all one. This will be the essence of all the material parts. So, the conclusion we reach about why the thing is one also explains how the definition of a composite is one: since form and material are one in a way, the definition of the form just is the definition of the composite. The stress here is that the two constituent parts of the definition of the composite, form and material, can be expressed entirely by the definition of the form—the one, final differentia. This differentia is the cause of unity in the composite and the cause of why the various parts of the definition are one, for the differentia is of the material and is the unity of the composite.

This interpretation faces some objections. I will focus on Bostock's objection first, for a response to him will also be the appropriate response to Loux. Now, the above example of a bird also addresses the problem that Bostock raises, but since Bostock

focuses on the bronze ball, I will devote my response in terms of this example. Bostock claims that equating actuality and potential in the bronze ball example is nonsense. He claims that the bronze will not just be potentially round and the form actually round, the material and form of a bronze ball respectively, but the bronze will be actually round as well. But this is precisely the argument; the distinction breaks down in a way. The bronze shaped into being round is both the potential and actuality of the bronze ball. The potential of the bronze ball is being round, and this is the worked up material. What makes this material actually a bronze ball is the actuality of being round; its cause is the craftsman who makes the bronze round. The worked up material just is round. So, the being round of the form is the being round of material bronze. But Aristotle is not equating all of the material of the ball as identical to the form and actuality. Aristotle only states that actuality and potential are one in a way ($\pi\omega\varsigma$) (1045b20-21). The bronze still retains the potential to be something else, a square or oblong shape. But this material that is potentially something else just is the bronze, not the worked up bronze that is the proximate material. This material is distinct in being from the form, which cannot be otherwise. So, the collapse of the distinction between form and material only occurs at the highest level—the proximate material and the form—and not in artifacts. They are not *ousiai*, so they will be even less one than the composite animal. This does not imply for Aristotle that there is no distinction of form and material at different levels. Further, it does not imply that there is no distinction at this level at an abstract level. Clearly, the hand is a material part of a human being and we can conceive of it as such even if in the composite whole, the hand with the rest of the human body is one with the form. But Bostock adds another criticism:

It implies that when we have a round piece of bronze, then the matter, i.e. the bronze, is *potentially* round, whereas the form, i.e. the shape, is *actually* round. But (a) when the bronze is round, then of course it is actually round, and not just potentially round, whereas (b) it is the bronze which is round, and the shape itself is not round at all. (This is a category-mistake on a par with Plato's mistake of supposing that the form of largeness is a large thing.)¹⁸⁰

Bostock is claiming that either Aristotle runs into the nonsense claim that the bronze is only potentially round when it is actually round as the bronze ball or he has the problem of self-predication: the form of roundness is itself round. Halper addresses the first problem.¹⁸¹ He interprets the potential here to be the capacity to roll, but this is also the first actuality of a ball. The second actuality of a ball is rolling. This avoids problem (a) above. As for problem (b), it is not clear why scholars read this claim only as a matter of self-predication. There can be another interpretation of this claim that the form of round is round. R. E. Allen shows that the claim that round ball is round (or the Form large is large) is an identity statement or applying the name to thing and so not a predication at all.¹⁸² In this sense, the form of roundness is round. Simply put, this claim does not add another predicate to the form but just states what the form is. This should not surprise us as a plausible reading of Aristotle. Aristotle does hold that the soul of a human being is a human being or at least there is a way that the soul of a human being is a human being (H.3 1043b2-4).

We can now see that the response to Loux's criticism that the equation of form and material does not eliminate the fact that these represent distinct ontological categories: the categories of constituent ontology for Loux. He claims the following: "Matter and form are supposed to be distinct items that go together to make up a third

¹⁸⁰ Bostock, *Aristotle's Metaphysics ZH*, p. 284.

¹⁸¹ See Halper, pp. 192-92.

¹⁸² See R. E. Allen, "Participation and Predication in Plato's Middle Dialogues", *The Philosophical Review*, Vol. 69 (2), 1960, pp. 147-64.

thing, the whole composed of them.”¹⁸³ I have already responded to this view above. Aristotle is not claiming that the earth, air, fire, and water that a human being is composed of is identical with the form, only the proximate material. But Loux might say that even the proximate material is a distinct component of the composite since it still is material for Aristotle. Once again, we can see that the wing, feathers, feet, beak, chest-shape, etc. of a bird are material parts and distinct from the form. But all of these material parts together worked up into the potential of being a bird is also the same as the form, namely, the capacity of flying. Loux seems to be ignoring Aristotle’s claim that form and proximate material are only one in a way (1045b21). There is, then, little reason to be concerned that the identity of form and the proximate material in the thing also does away with the distinction between these ontological categories.

2.4 Conclusion

The metaphysical solution to the problem of one or many differentia is that form is *ousia* (Z.12) and the cause of the unity of the composite *ousia* (H.6). Form is *ousia* and the cause of unity in the composite because it is one. It can be defined as a unity insofar as the final differentia expresses the definition of the form. The definition need not include in its articulation either the other differentiae or the initial genus. This would make it seem that the solution from the *Metaphysics* is at odds with the claim in *Parts of Animals* I.3 that an animal is defined by many differentiae. But there are a few signs that this may not be the case. First, Z.11 states that the form is defined apart from the material holding in a certain way. This material is the parts of an animal, which Z.16 informs us, are potentials. Z.17 gives the argument that the form is the cause of the being

¹⁸³ Loux, “Aristotle on Matter, Form, and Ontological Strategy”, p. 81.

of the material, and this once again seems to be the parts. Finally, H.6 makes the claim that the essence of the form and the essence of the material is the same. But the material here in H.6 is one, not many. The zoology breaks up this unity to understand each part's own being. But it may just be the case that the zoology assumes this fundamental unity of the material, for it also assumes the unity of the form and takes the animal to be an *ousia* (PA I.1 642b25, I.3 643a2, 643a7). Although the part has its own nature, the part is still understood through the form because it has the formula of the form in its formula. Thus, we can only understand the material parts through the form, which is the essence. The zoology exploits the way in which the material is not one, as parts, only to end up showing how they are one, because they are all understood through the form. The fundamental unity of the kind of definition sought in zoology is the same: the unity is the definition of the form. But this definition is sought through the nature of the various parts, the things which we can grasp empirically. The many differentiae, then, are the natures of the various parts, and, by seeking out these natures, which cannot be defined apart from the form, the zoologist can come to discover the definition of the form of a particular animal. In other words, all the parts together point at the form because the material whole is the form. This implies that the science that Aristotle presents in *Parts of Animals* is inquiry rather than a completed science. Let us now turn to the science of zoology, and I will argue next that Aristotle's theoretical principles developed in the first book of the *Parts of Animals* are consistent with the conclusion we just derived from our investigation of *Metaphysics* ZH.

CHAPTER III: THE PHYSICAL SOLUTION

3.1. Introduction

The previous chapter showed why Aristotle came to the conclusion that a sensible *ousia* is form and defined by one, final differentia (Z.12). This definition lacks parts and expresses the *ousia* as one thing. But we also came to learn that the composite is an *ousia*, at least derivatively, insofar as it is one thing (H.6). This is because the form and the proximate material have the same essence in a way (1045a33). They are one insofar as the potency of the proximate material is the same as the actuality of the form, e.g., a bird's proximate material has the capacity for flying and this capacity for flying is the form. So, this interpretation of *Metaphysics* ZH leads us to conclude that a zoologist would define an animal by one, final differentia that explains why the material parts belong together. For example, on my view, a zoologist will define a particular kind of bird by its capacity for flying in a particular way, and this particular way of flying will explain why its material is as such. But the zoologist is also interested in grasping the nature each of the individual parts. For example, the zoologist wants to grasp the nature of a bird's feathers, wings, feet, beak, etc. But if these individual parts all work together for one end, then by grasping the nature of the different parts, the zoologist will eventually be led to the definition of the form, the form defined by one, final differentia.

When we turn to the first book of *Parts of Animals*, this picture seems to be inapplicable or to have been rejected at least in part. Aristotle claims in *Parts of Animals* I.3 that no animal is defined by a single differentia but rather by many differentiae

(644a5-8, cf. 643b10-11). This method of division is often called “multiple differentiation.” I will argue in this chapter that this claim at 644a5-8 is consistent with the view that the form of an animal is defined by one, final differentia. I will argue this view primarily on two grounds. First, physics, of which zoology is a part, requires that the scientist study both the form and the material (*Physics* II.2 194a12-27). As we have seen, this differs from the way metaphysics studies the same thing (see 1.10). The very next passages in the *Physics* (194a27-b10) reinforces this view insofar as it states that physics should know both the end, the final cause, and the things that are for the sake of this end, the material (194a27-b9). The first chapter of the *Parts of Animals* reaches the same conclusion (642a1-2).¹⁸⁴ Second, in *Parts of Animals*, Aristotle presents the science as an inquiry into finding the middle term of a demonstration, which is the essence of a particular animal, e.g., human being, lion, ox, etc. This implies that the science is not yet complete, so we may not expect Aristotle to find the essence of many particular animals. I will argue that there is enough evidence to support the view that Aristotle is seeking the essence and the one, final differentia of an animal through these many differentiae. Aristotle begins his inquiry into the nature of animal by assuming that the zoologist seeks out the definition of each animal through a plurality of attributes (639a15-19). Aristotle then determines that the relevant attributes are the parts of animals (640b17-27). Each part has its own nature, expressed by a differentia, and the many differentiae are used to seek the definition of the form of a particular kind of animal (643b9-644a11). We see that this idea is backed up by the arguments found both in *Metaphysics* Z.17, where the being of the material just is the being of the form, and *Metaphysics* H.6, where form and

¹⁸⁴ Aristotle comes to the conclusion that two causes are present in an animal, for the sake of which and the cause from necessity (642a1-2). Aristotle equates the cause from necessity with the material at *Physics* II.9 200a30-32.

material are equated in the individual because they have the same essence. Simply put, the essence of all the material together just is the essence and the form. So, the nature of each individual part will point to this essence in being defined in respect to this essence. Thus, according to my interpretation, Aristotle assumes in *Parts of Animals* the conclusions of both *Metaphysics* Z.12 and H.6, which, I will argue below, makes possible the inquiry for knowledge (ἐπιστήμη) of zoological facts, i.e., finding the cause and explaining why certain attributes belong to this or that kind of animal. Multiple differentiation, then, is part of Aristotle's proposed method for finding the middle term, which here just is the essence and form of a particular kind of animal.

This interpretation of *Parts of Animals* and zoology as seeking the definition of a particular animal will also resolve another problem found in the literature concerning Aristotle's zoology and, in particular, the science found in the *Parts of Animals*. My view of Aristotle's presentation of science in *Parts of Animals*, following Aristotle's view of inquiry developed in the second book of the *Posterior Analytics*, entails that Aristotle uses the structure or form of a demonstration to find the middle term that explains why certain facts hold. This implies that Aristotle's aim is to arrive at demonstrative knowledge (ἐπιστήμη ἀπλῶς) of zoological facts. The problem is that it is hard to find a passage that presents a demonstration not only in Aristotle's scientific writings, but in particular, the *Parts of Animals*. This is an old problem in Aristotle scholarship, but it has resurfaced in the contemporary literature largely due to the work of G. E. L. Owen and Jonathan Barnes. Barnes' article, "Aristotle's Theory of Demonstration," makes clear the main assumption that allows the problem to arise, i.e., the discrepancy between

Aristotle's theory of science in the *Posterior Analytics* and his actual scientific writings.

He states his views on this issue as follows:

The problem only arises if it is assumed that the theory presented in the *Posterior Analytics* was intended by Aristotle to give an account of the sort of activities which his treatises report... But the assumption is false: the theory of demonstrative science was never meant to guide or formalise scientific research: it is concerned exclusively with the teaching of facts already won; it does not describe how scientists do, or ought to do, *acquire* knowledge: it offers a formal model of how teachers should *present and impart* knowledge.¹⁸⁵

Barnes denies that Aristotle uses the “theory of scientific demonstration” in his formal science because he supposes that Aristotle would use that theory to demonstrate *conclusions*. We do not find Aristotle doing this in the biological works, but we do find him seeking middle terms. Aristotle addresses this seeking in the second book of the *Posterior Analytics*. Barnes ignores the first line of this text: “The things we seek (τὰ ζητούμενα) are equal in number to those we understand (ἐπιστήμη)” (89b23).¹⁸⁶ I will argue in section 3.3 that this method of seeking uses the facts and the structure of a demonstration to find the middle term. Facts serve as the conclusions of demonstrations. They come to be known through other means, namely, *historia*. *Historia* for Aristotle is an empirical method of establishing facts of a thing, e.g., that a certain kind of animal has feathers, which can be demonstrated by a middle term. Once the fact is established, the inquirer has both extreme terms of the syllogism and can, from there, seek the middle term. After finding the middle term, the inquirer has a demonstration. But what Aristotle presents in *Parts of Animals* is the seeking, not the teaching of facts already won and grasped by the scientist. If Aristotle is seeking a middle term and the text presents the

¹⁸⁵ See Jonathan Barnes, “Aristotle’s Theory of Demonstration”, in *Articles on Aristotle: Vol. I Science*, p. 77.

¹⁸⁶ Translation by Jonathan Barnes, *Aristotle’s Posterior Analytics*, second edition, Oxford: Clarendon Press, 1993, p. 48.

finding of them, it follows that demonstrations can be constructed from the text. I will present the theoretical grounds to support this last claim in this chapter as well as Chapter 4. I will give actual reconstructed demonstrations from various passages in *Parts of Animals* in Chapter 5.

But this argument by itself will not be sufficient to prove my about the multiple differentiae being explained by one, final differentia. It is consistent with the Balme-Lennox-Gottself-Charles view that demonstrations can be constructed from the zoological texts. None of these thinkers, other than Charles, though, believes that there is any philosophical problem in Aristotle's using different middle terms to demonstrate the various parts that belong to the same kind of animal, e.g., sparrow or human being. I will distinguish my view of Aristotle's practice of science from these scholars in the next paragraph. There is a deeper issue to tackle first that challenges the thesis that demonstrations can be constructed from Aristotle's biological texts. G. E. R. Lloyd has challenged the Balme-Lennox-Gottself-Charles view of constructing demonstrations from the biological texts in his article "The Theories and Practices of Demonstration". Lloyd claims that most of the scholars engaged in the debate about whether demonstrations can be constructed from his scientific texts assume that there is only one theory of demonstration and any practice of science should conform to that single theory.¹⁸⁷ Lloyd argues, though, that there are actually many theories and practices of demonstration, for example, most importantly for this project, demonstration in zoology weakens the conditions presented in the *Posterior Analytics*. Lloyd is referring to the passage at *PA* I.1 639b30-640a9 where Aristotle claims that the kind of necessity present in a demonstration in physics is distinct from the kind of necessity found in a

¹⁸⁷ See G. E. R. Lloyd, "The Theories and Practices of Demonstration", *Aristotelian Explorations*, p. 9.

demonstration in a theoretical science. I will argue that Lloyd is not correct in assuming that such necessity cannot be squared with the theory of demonstration presented in the first four chapters of the *Posterior Analytics* I (see section 3.5).

Now, the Balme-Lennox-Gottself view of the zoology is that Aristotle recognizes in his empirical study into the nature of animals that no one differentia of an animal can demonstrate the plurality of parts that belong to it. So, the zoologist must pursue many lines of differentiation at a time, each line being a possible middle term that demonstrates other parts belonging. This leads us back into the main problem of this dissertation. The answer I give why Aristotle is dividing by many lines of differentiation differs from this view. I have already sketched an answer to this above, but let me expand upon this in respect to the first book of *Parts of Animals*. The many lines of differentiation divide the kinds of attributes that belong to that kind of animal. The final differentia of any line of differentiation picks out a unique, determinate feature of a thing. Under the assumptions of dichotomy, which Aristotle critiques in *Parts of Animals* I.2-3, this would imply that the final difference just is one thing and the only relevant difference of a species (εἶδος) (PA I.3 643b36, cf. 644a7-8). Dichotomy, according to Balme, is when the divider uses only one line of differentiation to mark off that thing as unique. But if each animal has many parts that belong to it uniquely, each part would have its own being and be a different thing instead of all the parts being the material for one thing, i.e., the form of the animal. Yet, Aristotle is still assuming that both the form and the *ousia* are one thing and indivisible within this very critique of dichotomy (643a1, 643a16). Since division aids in finding definitions, the unity that is appropriate here is one in formula. Multiple differentiation seeks this formula by locating various lines of division that belong to the

same thing. Since it is also the case that the essence of the form is the same as the essence of the material of an *ousia* (H.6), then seeking out the many differentiae that make up the material of an animal just is seeking the middle term and the form and essence. On my understanding of the *Posterior Analytics*, there is an intimate connection between the nature of scientific inquiry, demonstrative science, and there being a solution to the problem of one or many differentiae.¹⁸⁸ My claim is that the many differentiae, since altogether they are identical with the form, are used to seek out the definition of the form. On my view, this is the reason why Aristotle rejects dichotomy. Dichotomy is not helpful either in seeking out the definition of the form or even marking off what kinds are unique and different from each other. But neither the critique nor the positive methodology posited in *Parts of Animals* I.2-3, as I read it, is possible without the assumption that the form is still defined by one, final differentia. The many differentiae need to belong to the same thing (644a8-10), and this is the form. The form, according to Aristotle, is that which will explain why each of the parts belongs to the same kind of animal. The form will explain that each part belongs for the sake of the end (639b12-21). The end for any animal is its essence and the *ousia* of the animal (641a25).

But the unity present to the object and to the definition in the inquiry of zoology is twofold. On the one hand, as I have already stressed, the zoologist assumes that an animal is defined by one fundamental feature of the thing which can be expressed simply—the one, final differentia. On the other hand, the zoologist is also studying the

¹⁸⁸ I should clarify briefly what I mean here. I do not mean that the scientific logic of the *Posterior Analytics* was designed to solve the problem of one or many differentiae. Rather, Aristotle presents in what way an *ousia* can be known in the *Posterior Analytics*, and one assumption that seems present in this text is that the middle term is the essence of the thing and this essence is one. See, for example, *Posterior Analytics* II.6 92a28-33. Charles develops the same kind of claim in his work, *Aristotle on Meaning and Essence*. See especially p. 291.

material of this same being. But the zoologist does not study the material as one thing, as the conclusion of *Metaphysics* H.6 that form and material are one would suggest. Instead, the zoologist studies the material parts separately trying to find how the various parts connect to the end and form (εἶδος) of that kind of animal. But, in my view, this is a different way to present the same kind of unity of the composite thing as argued in *Metaphysics* H.6. The animal is one because all of the parts are for the same end, and the definition of the composite animal is one because all parts are explained through the same feature. This one feature, the form and essence of the animal, is the object of the inquiry of zoology, for once the zoologist discovers it demonstrative science is possible. On my interpretation, the various parts will be demonstrated to belong because the formula of the part will include the formula of the essence in it. In other words, the formula of the part belongs *per se* in the second sense as discussed in the *Posterior Analytics* (I.4 73a37-38). The part cannot be understood apart from the kind to which it belongs. But this claim should not be surprising and makes sense in terms of Aristotle's conception of form and material. Aristotle shows in the *Metaphysics* that material cannot be defined or at least that it cannot be defined apart from form (Z.10 1035b3-31). He argues that form is the primary object of definition in the *Physics* (II.1 193a39-b3). Both arguments show the same thing: the part does not have a formula or being apart from the whole and the form of the thing.

What we are seeing is two different views on the unity of the animal. The first kind of unity, argued in the *Metaphysics*, is that all aspects of an animal are reducible to form, and form is one. The second kind of unity is where the unity of the composite whole is taken apart to see how the various parts fit together and belong due to the form,

and form is assumed to be one. The two views are really the same, but the way in which each approaches the same object differs. The definition of the particular animals Aristotle seeks in the zoology is of the composite whole, since the zoologist, as a physicist, studies both form and material.

I will argue this interpretation by showing that the first book of *Parts of Animals* is primarily concerned with arguing how the zoologist ought to proceed in seeking the definition of an animal. Aristotle raises this issue in an aporia, what I will call the first aporia of *Parts of Animals* (639a15-b5). The aporia arises because there is more than one way to seek the definition of an animal; (1) generically, by finding what is common over many animals, or (2) specifically, by finding what is unique to each species. Each method has its advantages and disadvantages, so Aristotle cannot proceed with the science of zoology until he determines the way to seek the definition of an animal. I will show how the various arguments in the first four chapters of *Parts of Animals* aim to solve the aporia. These arguments also serve to establish the theoretical principles of the science, but all of these principles are not only consistent with my interpretation of the central books of the *Metaphysics*, they also assume the unity of an *ousia* and make clear how to study a sensible *ousia* according to Aristotle's physics. How physics studies its objects is the natural place to begin this discussion. We will see that it coincides with the study the composite and studying in respect to coming to be rather than studying its being.

3.2 Why the Science of Physics Studies the Composite: *Metaphysics E.1 and Physics II.2*

The previous chapter blocked Balme's assertion that, since nature is defined like the snub, the form of an animal cannot be defined apart from its material. But now we are faced with the opposite problem. Many interpreters of Aristotle's zoology take the definition of the various parts together just to be the form.¹⁸⁹ But Aristotle asserts in *Parts of Animals* that the parts are the proper material of an animal (I.1 640b19-22). One option is Balme's path: the form and material are one when actualized, so studying the material is studying the form. But the argument Aristotle makes in *Metaphysics H.6* assumes that there is a definable essence that is intelligible apart from the material which also just is the cause of the material being one with the form. Furth's solution that the unity of a definition of an *ousia* is the genus, as we saw in the first and second chapter fares no better. Aristotle denies that the kind of unity that belongs to a genus is the same as that which belongs to an *ousia* (Z.13-16). I will argue that by turning to Aristotle's conception of how physics studies an *ousia*, we can clarify how it is possible for Aristotle to maintain that the parts of an animal are its proper material and by studying these same parts the zoologist is also seeking the nature of the form.

Aristotle asserts that the science of physics requires that the form be studied along with the material (*Physics II.2* 194a21-23). The material referred to in this passage at *Physics II.2* seems to be the parts of the thing, e.g., the bricks and wood of a house. But the first book of *Parts of Animals* seems to equate the study of the parts of an animal with the inquiry into finding its form. The passage that raises the first aporia discusses

¹⁸⁹ See Balme, "Aristotle's biology was not essentialist", p. 295, Furth, *Form, Substance, and Psyche*, pp. , Lennox, *On the Parts of Animals I-IV*, p. 166, Pellegrin, *Aristotle's Classification of Animals*, p. 32, and Gotthelf, "Notes towards a Study of Substance", p. 48-50.

defining an animal by establishing what attributes belong to a kind (γένος) (I.1 639a19). These attributes just are the parts of an animal (I.5 645b1-6). Further, Aristotle's critique of dichotomy and his reform of division seem to imply that zoology searches for the definition of the parts of the animal as well (e.g., I.3 644a5-7). Division hunts out terms predicated in the definition of a thing (*APo.* II.13 96a22-3), and definition is always of the essence (*APo.* II.3 90b31). Since the essence is the form, it would seem to follow that the form is the parts, which are the many differentiae found by multiple differentiation. All of this would seem to support Balme's view. I must now show that, first, the science of physics presupposes that the form of an animal can be defined separately, even though the science of physics does not study the form as separate, and, second, the search for the many differentiae is also just the search for the definition of the form. I will begin my argument with a look at the passage in *Metaphysics* E.1 that claims that nature is defined like the snub. I will then show that this passage is consistent with the claim at *Physics* II.1 that the form is defined separately from its material. Finally, I will use various arguments and conclusions reached in the second book of the *Physics* to show that the search for the formulae of the various parts of an animal, which I take to be the many differentiae, is the same as the inquiry into what the form is. The arguments of this section will then help us see what metaphysical principles Aristotle is assuming for the science of zoology to be possible.

I will begin by quoting the passage at *Metaphysics* E.1 1025b28-1026a7:

We must not fail to notice how the essence and the formula of an object of physics exists (ἐστίν), for inquiry without this leads nowhere. Now of things defined and of the whatness of things, some are considered in the manner in which snubness exists, others in the manner in which concavity exists. These differ by the fact that "snubness" is *understood* with matter (for a snub is a concave nose) but "concavity" without sensible matter. If, then, all physical

things are named in a manner like the snub (as for example a nose, an eye, a face, flesh, bone, and in general an animal, and also a leaf, a root, a bark, and in general a plant; for what is signified by the formula of each of these is not without motion but always has matter), it is clear how we must seek and define the whatness in physical things and why it belongs to the physicist to investigate even some part of the soul, namely, that which does not exist without matter. From what has been said, then, it is evident that physics is a theoretical science.¹⁹⁰

Balme reads this passage to support his claim that, since an animal is defined like the snub, there can be no formula (λόγος) of an animal that does not include its material.¹⁹¹

But the obvious problem is that this passage is discussing the science of physics and the way in which it studies natural things, since the conclusion is that physics is a theoretical science.¹⁹² On the other hand, this passage would then seem to assert that the form of an animal in the science of physics cannot be defined apart from its material, which is the view of Balme. There are two things that speak against such an interpretation. First, Aristotle says (as Apostle stresses in italics in his translation) that the snub cannot be understood (συνειλημμένον) apart from its material. I will argue why this is so in respect to the science of physics below. One piece is already before us from the previous chapter. The form of an animal is an actuality and always the actuality of a particular material. If we are to come to know the form and the actuality, which does not exist apart from the material, it is not clear how we would grasp this actuality apart from grasping at least some aspects of the nature of the material. But this does not entail that the form includes material in its definition, as I showed in respect to the argument at Z.11 1036b26-32 (see 2.2.2), but rather our seeking the definition is through grasping the nature of the material parts. Second, Aristotle is asking about the being (ἐστί) of a thing

¹⁹⁰ Translation by Hippocrates G. Apostle, *Aristotle's Metaphysics*, p. 103. The italics are Apostle's.

¹⁹¹ See especially his "Note on the *aporia* of *Metaphysics Z*", in *Philosophical Issues in Aristotle's Biology*, p. 303.

¹⁹² This is yet another sign that Balme does not clearly distinguish between the way in which metaphysics studies a thing from the way in which physics studies the same object.

(or how it exists in the world) and not the way in which the formula can be expressed. As I have already argued, form is intelligible in formula by itself (see 2.2.2). Now, the kind of being the physicist grasps is that of a thing in respect to its ability to move ($\delta\upsilon\nu\alpha\tau\acute{o}\nu\ \kappa\iota\nu\epsilon\acute{\iota}\sigma\theta\alpha\iota$) (1025b27). Motion requires material (*Physics* I.7 190b9-10). This was resolved in the last chapter by seeing that the kind of form that belongs to an animal presupposes the material, for form is the principle that holds the material parts together. But what of this claim when Aristotle turns to zoology? We will soon see that the physicist will still need to assume that the form of an animal has a formula that can be expressed by itself, yet, qua physicist, he does not study this form separate from the material. I will now turn primarily to the second book of the *Physics* to show that the inquiry into the nature of the form of an animal is the same thing as inquiring into the nature of its proximate material.

The first step of the argument has already been made. Aristotle argues that any thing that comes to be requires material—an underlying subject that moves from a privation to having a certain form (*Physics* I.7 190a31-b13). Further, since the form is the actuality of the thing, and the actuality is of a determinate material, studying the material can lead to an understanding of what the form is. Although this is relevant to both artifacts and natural objects, it is most pertinent to sensible *ousia*. Aristotle, then, begins the second book of the *Physics* asking which is nature ($\phi\acute{\upsilon}\sigma\iota\varsigma$), form or material? He answers by the end of the first chapter that form is more nature than material on the grounds that form is actuality (193b6-8), form is the cause of motion that generates a natural being (193b8-12), and finally form is the end of the motion as well (193b12-18). Aristotle claims that form is the formula of the thing (193a31), so the formula of a natural

thing is more nature than its material. But Aristotle also argues that this formula is prior in being to the material parts (193a36-b3). The formula of the form and the essence, then, must be prior to and not contain any material of the thing. But if form is more nature than the material, then Aristotle implies that both form and material are nature. So, Aristotle raises the question which one does the physicist study? Aristotle attempts to answer this question in *Physics* II.2 by turning to the fact that form is the end. Let us turn to this chapter and see the argument of how physics can be one science studying the composite being.

Physics II.2 begins by claiming that different sciences can study the same thing, yet they study that thing in different ways. Mathematics studies physical bodies as surfaces, solids, points, etc., and not as things that come to be. But it is also the case that science studies a genus, and a genus has a nature and a “what it is” (τί ἐστίν) or essence. Aristotle had argued in the previous chapter that both form and material have some claim to be a thing’s nature. Thus, the following question arises for Aristotle under his own assumptions:

Since there are two natures with which of them should the physicist be concerned? Or should he be concerned with that which has both natures? Of course, if with both natures, then also with each of the two natures. So should the same science be concerned with both natures, or one science with one and another with the other (194a16-18)?¹⁹³

Aristotle first solves this problem by appealing to his assumption that art (τέχνη) imitates nature. We will see this solution is not fully successful. Now, nature should study both form and material because art does as well, at least up to a point. The builder must know some things about the material of the building to build. But this runs into an obvious

¹⁹³ Translation by Hippocrates G. Apostle. All other translations of the *Physics* will be by Apostle. See Apostle, *Aristotle’s Physics*, Grinnell, Iowa: The Peripatetic Press, 1980, p. 28.

problem. The artisan does not know everything there is to know of the material but only what is relevant of the material in respect to the final product. For example, someone who makes a bed is not concerned with knowing wood as wood but whether wood is sturdy enough and can be molded in such a way as to make up the various parts of the bed. This raises a serious problem. If the animal is to be an *ousia*, yet its material parts are in one sense not part of the nature of that animal, just as wood as wood is not part of the nature of the bed, then form and material cannot be one as *Metaphysics* H.6 concludes. James Lennox recognizes this problem in his paper “Material and Formal Natures in Aristotle’s *De Partibus Animalium*”. In this paper, Lennox shows that Aristotle, at least in his practice of zoology, accepts that certain material aspects of an animal place constraints on the actions of a formal nature.¹⁹⁴ These constraints either arise out of material that Lennox takes to be explanatorily primitive, e.g., the blood of an animal, or out of the material that is demanded by hypothetical necessity, the necessity in respect of an end. If material does place such constraints on the form, this would undermine my thesis that the claims in the central books of the *Metaphysics* are consistent with both Aristotle’s theory and practice of zoology. But there is a problem with Lennox’s interpretation. I will first show that Aristotle’s distinction between form and material in physics and in the zoology are consistent with his claim that form and material are one in a way in *Metaphysics* H.6. This will help expose a weakness with Lennox’s view. We will have to wait until chapter 5 to see whether Aristotle’s practice of zoology is consistent with his theoretical commitments. Lennox’s claim coincides with the present problem at hand: is the physicist concerned with both natures, and, if so,

¹⁹⁴ See Lennox, “Material and Formal Natures in Aristotle’s *De Partibus Animalium*”, in *Aristotle’s Philosophy of Biology*, Cambridge: Cambridge University Press, 2001, p. 183 and p. 196.

can he study them both under one science? Aristotle answers this in the very next passage in *Physics* II.2. Let us turn to this passage see if it supports Lennox's thesis.

The next passage in *Physics* II.2 is as follows:

Moreover, it belongs to the same science to be concerned with the final cause or the end and also with whatever is needed for the sake of the final cause or the end. But nature is [also] an end and a final cause; for if, in that which is in continuous motion, there is some end of that motion, this [end] is the last and the final cause. And it is in view of this that the poet was carried away when he made the ridiculous statement "he has an end [death], for the sake of which he was born". For not every last thing tends to be an end, but only the best, seeing that in the case of the arts, too, some of them just make the matter but others make it serviceable and that we use things as if they exist all for our own sake (since in a certain sense, we too are an end, for "final cause" has two senses, as we stated in "*On Philosophy*"). Indeed, there are two arts which rule over matter and have knowledge of it – the art which is concerned with the use of it and the art which directs the production of it. Thus the art which uses matter is also in a sense directive, but as directive, it differs from the other insofar as it knows the form, while the art which directs the production knows the matter; for the steersman knows what kind of form the rudder should have and orders its production, but the engineer knows from what kind of wood it should be produced and how it should move. Now in objects produced according to art, it is we who produce the matter for the sake of some function (τοῦ ἔργου ἕνεκα), but in natural objects it is there all along. Again, matter is relative to some thing, for distinct forms require distinct matter (194a27-b9).

The passage claims that there is only one science that studies both natures, but physics can only be one science if the material nature is subordinate to and for the sake of the form. This passage, then, not only confirms my view that physics studies the composite and its coming to be but also my claim that the final cause is what accounts for the unity of a sensible *ousia*. But how does this passage address the theoretical problem raised by Lennox that material can be its own principle in physics often which can place constraints on the formal nature? We can see that this passage acknowledges the problem. There are two arts that govern the material in any art: the art that uses the material for some end and the art which produces the material. It also makes the same distinction that I made above.

The former artisan only knows the material insofar as it can be used for an end. The latter artisan knows the material as the material. In respect to art, the nature of the material would seem to place constraints on the end and on the form. But the passage above does not support this view. Aristotle stresses at the end that it is we who produce the material for the sake of the function (ἔργον), or as I will translate, “work”. Although the material has a distinct nature from the artifact, the artisan only picks the kind of material that is appropriate for the work of the artifact. The same point is made in the last chapter of Book II of the *Physics* where Aristotle argues that, for example, the saw cannot be made out of any material, but the material must be hard, like iron, to perform its work (*Physics* II.9 200a10-13). Aristotle, in establishing that form demands a certain kind of material, draws the conclusion that material belongs to an object due to hypothetical necessity (II.9 200a14-15). Thus, the kind of material that belongs to an object, be it an artifact or an animal, is that which is necessitated by the form. The argument in the above passage (194a27-b9) makes a similar kind of argument. By knowing the form, one can know both the formal nature and the kind of material that needs to be present. But knowing the kind of material does not exhaust knowing the nature of the material in itself or in its own particular nature. Thus, Lennox’s objection cannot be countered by a mere appeal to hypothetical necessity.

On the other hand, the theoretical point in the above passage is that there can be one science of the composite. I read this to imply that knowing the form of a thing with a nature is sufficient to know the composite whole. This is consistent with the interpretation of *Metaphysics* H.6 that the form is the composite whole in a way, insofar as the material is of the same essence. According to Lennox’s interpretation, this does

not hold in the practice of zoology. The material has its own independent nature that is primitive. But something in the above passage speaks against this interpretation as well as certain passages in *Parts of Animals*. First, Aristotle is acknowledging in the above passage that artifacts are not known through one science completely, for there are two ways of knowing the material. But Aristotle does not draw the same conclusion about animals, a thing that exist by nature. Aristotle states the opposite claim about natural objects: “Now in the objects produced according to art, it is we who produce the matter for the sake of some function, but in natural objects it is there along” (194b8-9). Unlike artifacts, in a natural object, such as an animal, there is no other cause for why this material belongs to this animal other than the nature of the animal itself. There is no knowing the material as material apart from the form in an animal or anything else that is by nature. In a way, Lennox’s view is correct. The material cause is primitive, but not because it is its own nature independent of the object, but for the exact opposite reason. The material present to an animal already has the potential to be that kind of animal (cf. *PA* I.1 640a23). This is precisely the claim that Aristotle made in *Metaphysics* H.4 that the material cause is the menstrual fluid, which is just blood, and this material is proper to the animal (1044a34-b3). Further, *Metaphysics* H.5 confirmed that this proper material only has one proper potential in respect to one form (1044b29-1045a6). So, the material cannot be explained to belong to an animal other than by the fact that it already has the nature to be that animal potentially. For the blooded animal, this material just is the blood, precisely, the specific kind of blood that makes up that kind of animal. But this is an explanation through the form insofar as Aristotle understands being blooded as an

aspect of the animal's essence. Aristotle states this view several times in *Parts of Animals* (II.3 650b10-12, II.4 651a13-14, III.4 665b10-12).

On theoretical grounds, Lennox's claim does not hold up. But there is still the question whether Aristotle remains consistent with this theoretical claim in his practice of zoology. I will address this explicitly in chapter 5. But the above passage sheds much light on the problem of one or many differentiae. First, in respect to studying something by nature, there is only one science that studies the composite, since the material is for the sake of the end and already has that potential from the beginning for that end. Second, it confirms the view that there must be one end, for it is the one end that makes possible the fact that there is only one science. If there is only one end of an animal, it would seem appropriate that the animal would be defined in terms of this one end. One, final differentia would then be an appropriate definition of an animal. Third, this one end would explain why the various parts of an animal belong to the composite animal. If the parts are potential *ousiai*, as *Metaphysics* Z.16 concludes (1040b5-10), it would be reasonable that each part is also a unity of a sort, and the formula of such a part would include one, final differentiae plus the nature of the kind to which it belongs, which I interpret to be the essence of that animal. This view needs to be confirmed by the first book of *Parts of Animals*, but the theoretical commitments already point to such a conclusion. Finally, this above passage from *Physics* II.2 confirms the view that physics studies an object in a distinct way from the science of metaphysics. It is also the case that this chapter reaches this conclusion immediately after this passage:

To what extent should the physicist understand the form or the whatness? Up to a point, just as the doctor understands sinews and the smith understands bronze, for

each of them [sinews and bronze] is for the sake of something, and the physicist is concerned with what is separable in kind but exists in matter; for both man and the Sun beget man. As for a separate form, how it exists and what it is, this is a task to be settled by first philosophy (194b10-15).

Of course, one could object that Aristotle only distinguishes the study of nature from that of separable form in this passage, but Aristotle claims that for us to understand separable *ousia*, we must first grasp sensible *ousia* (Z.2 1028b28-32). As we saw in the previous chapter, *Metaphysics* ZH is a study into the being of sensible *ousia*. This study concludes that form is the being of *ousia* and the cause of the composite *ousia* being one. Physics, on the other hand, studies both the material as distinct from the form and the way in which the material conforms to the end. Physics, then, treats the parts and the material distinct from the form. But this view does not conflict with the conclusion in *Metaphysics* H.6 because this argument only concludes that form and material are one in a way ($\pi\omega\varsigma$) (1045b21). This would imply that in another way they are distinct. The science of physics takes advantage of this “in a way” and studies form and material as distinct and breaks up the material into parts so that the physicist and zoologist can grasp how the nature of each part and the material of an animal have their being in respect of the form. I will now show that Aristotle’s method of finding the middle term in *Posterior Analytics* II.8 conforms to the view that form and material are distinct in one way, and can be studied separately, yet in another way that being of the material just is the being of the form. A close look at this chapter will further my argument that the many differentiae

are the material and are used to seek out of the nature of the form and its definition within the science of zoology.

3.3 Finding the Middle Term and the Essence: *Posterior Analytics* II.8 and Multiple Differentiation

The previous section showed that physics also studies the nature of the material along with the form. Aristotle argues that the proper material of an animal just is the parts (*PA* I.1 640b17-27). I will present this argument in 3.5. We can see now that a certain consequence follows. If each part has its own formula, and this formula expresses the proper work of the part, and each part has only one proper work, then each part will have in its formula a single differentia. I will argue in this section, following St. Thomas Aquinas, that multiple differentiation as presented in *Parts of Animals* I.2-3 is part of the method proposed to find the middle term and the essence of a sensible *ousia*.¹⁹⁵ I will develop this claim in respect to the argument developed in *Posterior Analytics* II.8, which proposes a method of finding the middle term and the “what is” (τί ἐστίν) of a thing that resolves various aporiai raised in the previous chapter of the *Posterior Analytics* (II.7). Although *Posterior Analytics* II.8 does not argue for multiple differentiation, I will argue that it presents a methodology to seek out the middle term and “what is” of a thing that is consistent with Aristotle’s use of multiple differentiation in his zoology. Such an interpretation of multiple differentiation alleviates the discrepancy between the way in which metaphysics and physics define the same thing: the former defines the essence by itself and the latter seeks the definition of this essence through the material parts. It is, in

¹⁹⁵ For the various passages where Aquinas makes this claim, see Joseph Owens, “Our Knowledge of Nature”, in *Proceedings of the American Catholic Philosophical Association*, 1955 (29), p. 75. In this same article, Owens also discusses that Aquinas held the view that human beings could not grasp the particular essence of any animal. I will address this issue in the final part of the fifth chapter.

my view, the same essence in each science. What differs is the way the scientist in each case studies this object. The many differentiae sought by the zoologist are those of which the essence of an animal is the cause (τὸ αἰτιον). The way I apply the argument of *Posterior Analytics* II.8 to the inquiry of zoology is that the many differentiae of a kind of animal are understood as predicated of the subject, here, either of the species (εἶδος) or the genus (γένος) of animal, and predicated of this subject *per se* in the second sense through the essence of the subject (*APo.* I.4 73a37-b1). *Per se* in the second sense is when the feature or attribute cannot be defined apart from its genus, e.g., odd or even cannot be defined apart from number or beak and feather apart from that nature of a bird. (Whenever I use the term attribute, I mean that which is predicated of a kind *per se* in the second sense.) In this sense, the many differentiae are also understood as conclusions of a demonstration, e.g., bird is beaked or bird is feathered. The zoologist seeking the middle term and the definition then uses the logical structure of a demonstration to find what middle will account for why these various attributes belong to this kind. It assumes the same logical structure of a demonstration as it is spelled out in *Posterior Analytics* I.1-6. In my view, *Parts of Animals* I.2-3 propose multiple differentiation as part of the method to help find the middle term and the essence of an animal. The method begins by seeking out a genus or form by seeing what counter-predicates can be grouped together. Counter-predication occurs when one can show that two predicates are co-extensive, e.g., all feathered things are beaked, and all beaked things are feathered. Aristotle seeks out the counter-predications amongst animals in his *History of Animals* to mark off genera. But the genera can exist at various levels, e.g., a genus of bird is one generic level but being lunged is another level. The latter predicate belongs to kinds of animals other than

birds. So, the formula of any particular species of animal will seem to be composed of numerous genera and explanations for why its parts belong will admit to various levels. I will take this issue up in the next chapter. Now, the initial assumption is that the counter-predicates belong to this genus *per se*.¹⁹⁶ This is what Aristotle calls establishing the fact (τὸ ὅτι) or knowing the that, and these facts serve as conclusions of demonstrations (*APo.* II.8 93a36-b3). Once the fact is established, the zoologist knows that the genus exists or has being. It is only at this point that the zoologist is in a position to inquire into the “what it is” and essence that explains these predications. I will develop this interpretation more concretely in respect to *Parts of Animals* I.2-3 later in section 3.6, but, for now, I will present this methodology of seeking the middle term found in *Posterior Analytics* II.8. I will begin with the problem that *APo.* II.8 states to resolve: how can one prove what the “what it is” (τί ἐστὶ) of a thing is? Since this problem is also raised in the very beginning of the second book, we must consider the intervening chapters before we turn to how *Posterior Analytics* II.8 solves this problem.

Aristotle begins the second book of the *Posterior Analytics* with the claim that the things sought are the same in number to the things we understand (89b23). These are the fact (τὸ ὅτι), the reason why (τὸ διότι), if it is (εἰ ἔστι), and what it is (τί ἐστὶ) (89b24). In the second chapter, Aristotle argues that the reason why is the same as the what it is of a thing (90a15). Both of these are middle terms that are explanatory and the cause (τὸ αἴτιον) of why an attribute belongs to a thing.¹⁹⁷ The problem is how we seek out and

¹⁹⁶ I say “initial assumption” insofar as the counter-predicates are grasped empirically, and it is always possible that one or several of the terms is not actually a *per se* attribute of that kind.

¹⁹⁷ There is some debate about whether “τὸ αἴτιον” should be translated as explanation or cause. The former seems to be epistemic and the latter metaphysical. But if my interpretation of the central books of the *Metaphysics* is accepted, then it would follow that the metaphysical aspect of “τὸ αἴτιον” is prior to any

find the what is. It would seem to be that we can only claim that something is so necessarily if it can be demonstrated. Thus, if we could demonstrate the what is of a thing, then we could have knowledge simpliciter (ἐπιστήμη ἀπλῶς) that this is the what is of a thing. On the other hand, the what is of a thing is its definition, and demonstration and definition grasp different things (90b18-28). This is one reason why there is no demonstration of a definition. Aristotle argues several other reasons as well, but then he focuses his attention on whether there are other ways to come to know and find the what is of a thing.

He first investigates in *Posterior Analytics* II.4 whether one can grasp the definition through a syllogism that is not a demonstration, for demonstration is just one kind of syllogism. For example, assume that what it is to be A is C. If A is also B and B belongs to C, then there is a syllogism that proves C is the what it is of A. The obvious problem is that how did we come to know that A is B and B is C? The method of syllogism would seem to presuppose a prior definition which is not proved to hold, i.e. A is B. But there is also another problem that David Charles raises in his work *Aristotle on Meaning and Essence*.¹⁹⁸ The problem is that the syllogism cannot tell us which middle is the what it is and prior to and explanatory of the other terms. These latter features hold of every demonstration (*APo.* I.2 71b20-22). The reason this problem arises is because the terms of the above syllogism convert. B is also A, and A is C. Since these are universal, affirmative claims, we can also arrive at the conclusion that C is the what it is of B or, convert and rearrange (e.g., C is B, B is A), and we arrive at the conclusion that A is the what it is of C. Thus, the method of syllogism cannot pick out the unique thing

epistemic claim. I simply use “explanatory” and “cause” as synonyms in respect to discussing Aristotle’s theory of demonstration and science.

¹⁹⁸ See 7.2 and 7.3 of his work, pp. 180-191.

that just is the what it is of a thing. Demonstration can do so insofar as the premises are known to be prior to and explanatory basic of the conclusion. But, of course, demonstration proceeds and can be explanatorily basic by assuming the definition of a thing to prove what belongs to that kind, not by demonstrating that definition. Once again, we would need to know the definition before knowing any facts, but Aristotle is asking how do we seek the definition.

Aristotle then argues in *Posterior Analytics* II.5 that division fares no better in respect to finding the what it is of a thing. The problem with division is that it does not carry with it any necessity that what is found by dividing just is the what it is. Division proceeds by both assumption and stipulation. For example, say that the what it is that is being sought is human being. The divider then assumes that a thing is either an animal or not. The one defining via division would then say human being is an animal. But this is just the stipulation of the definer. There is no guarantee that the divider will find the terms in the right order, or exhaust all of what is in the what it is, or stipulate what is most relevant for defining that thing. Even worse, Aristotle in the next chapter states that this method cannot insure that the definition found via division (or via syllogism for that matter) is one. For, someone might divide animal into footed and footless, and then footed into winged and wingless and this into something else, such as tame and wild. But Aristotle asks what unifies all these divisions into one definition, e.g., the tame, wingless, two-footed animal (92a31)? Aristotle is obviously assuming that a definition must be a unity. Why this is so is in one sense clear. If the definition does not form a unity, it will have parts that are separate. One could then ask what is the reason these two parts express the same thing, e.g., why do two-footed and animal express the essence of human

being? The reason that explains why these parts are one would then be the cause of why the two things belong to the same thing, which would really be the definition and the what is of the thing. Thus, logically speaking, the parts of any definition must be one in some way if the thing is also one.

But Aristotle does not end here with the problems of trying to seek the what it is of a thing. In *Posterior Analytics* II.7, he raises the problem that follows from the fact that demonstration and definition concern different things (92b9-11). Definition grasps the what it is of a thing. Demonstration proves that some fact ($\tau\omicron\ \acute{\omicron}\tau\iota$) is the case (92b14) and through a middle term. The fact is an answer to the “if it is” ($\epsilon\iota\ \acute{\omicron}\sigma\tau\iota$) question. This latter question must be answered prior to finding the definition and the what it is of a thing, for to search for a definition of that which is not known to be could only be searching for the definition of a name and not the thing (92b4-7). But a demonstration has for its middle term the what it is of a thing. Thus, we run into a circle. To know the definition we need to grasp that it is ($\tau\omicron\ \acute{\omicron}\tau\iota$), e.g., that A is C, but to grasp that this is, A is C, we need to grasp the definition of A to prove that A is C is the case. *Posterior Analytics* II.8 resolves how one can find the middle term and the what is so that one can know with necessity that this definition holds of a thing and how to do so in a non-circular manner. Let us now see how *Posterior Analytics* II.8 resolves the problem.

I take it that Aristotle begins this argument at 93a15 and it ends at 93b7; he offers an additional example to illustrate the argument at 93b7-14. The conclusion is actually stated after the example at 93b15-20. This passage is as follows:

We have now said how what something is is taken and becomes familiar. Although there are no deductions and no demonstrations of what something is, nevertheless what something is is made plain through deductions and through demonstrations. Hence without a demonstration you cannot get to know what

something is (in cases where the explanation is something else), and yet there are no demonstrations of what something is (as we said we went through the puzzles).¹⁹⁹

How, then, does a demonstration “make clear” the what it is of a thing without demonstrating it? Aristotle states the following:

When we know incidentally that something exists (ὅτι ἔστιν), necessarily we have no grasp on what it is (πρὸς τὸ τί ἐστιν); for we do not even know that it exists, and to seek what something is without grasping that it exists is to seek nothing. But when we grasp something of the object, the business is easier. Hence in so far as we grasp that it exists, to that extent we also have some grasp on what it is (93a24-29).

This passage states that one must first grasp something of the thing (ὅτι ἔστιν) (93a28).

But what does this mean “to grasp something of the thing”? He explicates it as follows:

οὕτως ἔχομεν καὶ πρὸς τὸ τί ἐστιν (93a28-9). One way to translate this is this: “we grasp thus also something related to what it is.” The “πρὸς” makes it clear that we are relating something to the what it is by grasping something of the thing. What are we grasping? Aristotle answers this by an example in the next passage. It states:

When we grasp something of what a thing is, suppose first that it is like this. Eclipse A, moon C, screening by the earth B. To ask whether it is eclipsed or not is to seek whether B is or not. This is no different from seeking whether there is an account of the eclipse (εἰ ἔστι λόγος αὐτοῦ); and if there is, we say that it is eclipsed (93a30-33).

We see from this passage that finding out something of the thing is answering an if it is (εἰ ἔστι) question. The answer to such a question is a statement of fact (τὸ ὅτι). Here, the fact we come to learn is that the moon is eclipsed. This is a conclusion of a demonstration. What kind of demonstration is this? It is of the understanding of the fact, as discussed in *Posterior Analytics* I.13, where the middle term is neither explanatory nor

¹⁹⁹ Translation by Jonathan Barnes, *Posterior Analytics*, pp. 57-58. All subsequent translations of the *Posterior Analytics* are by Barnes.

prior in being to the conclusion (78a23-29). All demonstrations in the proper sense have a middle term that is explanatory and the cause of the conclusion as well as being prior in being to the conclusion. But this example does not actually prove to be that helpful to make the argument clear. The problem is that we have come to grasp the middle term too quickly. What establishes the fact that the moon is eclipsed here is the same thing that explains why the moon is eclipsed. Screening by the earth is really the explanatory middle term. It is the cause of there being an eclipse. Aristotle does not always expect the inquirer to find the middle term so quickly through this method of grasping something of the thing. So, there is yet another example that contrasts with the above example. The passage is as follows:

When we discover it, we know at the same time the fact and the reason why – if we proceed through middle terms. Otherwise we know the fact and not the reason why: moon C, eclipse A, not being able to produce a shadow during full moon although nothing visible is between us and it B. If B, not being able to produce a shadow during full moon although nothing visible is between us and it, holds of C, and A, being eclipsed holds of B, then it is plain *that* it is eclipsed but not yet *why*; and we know *that* there is an eclipse but we do not know *what* it is (93a35-b3).

This example shows that establishing a fact about a thing does not necessarily lead directly to the middle term. On the other hand, knowing the fact that an eclipse is when the moon is not able to produce a shadow although nothing is visible between us and it will help us in the inquiry to what an eclipse is. Whatever an eclipse is, it must be the cause of this fact. So, both of Aristotle's examples show that we seeking the middle term through the facts that obtain of a thing and that middle term explains these same facts (τὸ ὅτι) about this thing, here, an eclipse.

Aristotle states this conclusion as follows:

When it is plain that A holds of C, then to seek why it holds is to seek what B is – whether screening or rotation of the moon or extinction. And this is the account of one extreme, i.e. in this case of A; for an eclipse is a screening by the earth (93b3-7).

The first step here is that one begins with a fact: A holds of C. This is in the form of a conclusion of a demonstration. The conclusion connects the two extreme terms of the demonstration. The middle term connects them together to show that A holds of C universally, necessarily, and *per se*. We will find the middle term when we realize what term will make such a connection. Thus, the very structure of a demonstration is exploited to help find the middle term. One can seek to find what term makes the connection by knowing what kind of connection a demonstration makes logically and by knowing that a certain conclusion holds, i.e., knowing something of the thing. Thus, the what is is not grasped by a demonstration but is made clear by it. Further, the more facts one knows of a thing, the more likely it is that one will hit upon the middle term properly, for it will be the sole term that explains why all the facts of that thing hold.

Now we have arrived at the conclusion of *Posterior Analytics* II.8, we must now begin to see how Aristotle puts this theory of inquiry to work in determining the theoretical principles of zoology. The next section (3.4) will show that Aristotle is raising the question of how one should seek the definition of an animal. Since the middle term is the definition of the thing, such a question suggests that Aristotle is presenting the science of zoology as an inquiry into the middle term of a syllogism. As we proceed through *Parts of Animals* I.1-4, we will see that all of the relevant features of inquiry discussed above are under discussion. In section 3.4, I will turn to the first aporia of *Parts of Animals* found in I.1 and argue that the problem raised in the passage concerns the proper way to pursue the definition of an animal. In section 3.5, I will show that

much of the rest of *Parts of Animals* I.1 Aristotle is arguing how zoological knowledge is demonstrative. Section 3.6 will look closely at what is called Aristotle's rejection of dichotomy and how this rejection conforms to the claim that an animal is defined by one, final differentia. I will conclude this chapter in section 3.7 with how I interpret Aristotle to resolve the first aporia and how this solution is consistent with the metaphysical claim that an animal is defined by one, final differentia.

3.4 The First Aporia of *Parts of Animals* (639a15-b5)

I will begin my argument that *Parts of Animals* is an inquiry into finding the middle term and the definition of an animal with a close look at the first aporia (639a15-b5). This is a good place to begin such an argument for it raises the question of the appropriate way to define an *ousia* in zoology (639a15-19). The standard view in the literature is that science, for Aristotle, begins from the definitions and axioms concerning the thing.²⁰⁰ I will argue instead that Aristotle is presenting how science seeks the definition of an animal. This kind of inquiry will conform to the methodology presented in *Posterior Analytics* II.8. The first aporia, on my view, presents a problem in respect to this kind of methodology: there appear to be various levels of generality at which to inquiry into the definition of an animal. In other words, the middle term being sought may either be generic or specific to the nature of the animal. It seems possible either to study each animal species and its form (εἶδος) independently or to study them according

²⁰⁰ See, for example, Barnes, "Aristotle's Theory of Demonstration", in *Articles on Aristotle: Vol.III*, 1975, pp. 65-87, Allan Gotthelf, "First Principles in Aristotle's *Parts of Animals*", in *Philosophical Issues in Aristotle's Biology*, pp. 167-198, and G. E. R. Lloyd, "The Theories and Practices of Demonstration", in *Aristotelian Explorations*, 1996, pp. 7-37.

to something common, e.g. a genus (γένος). The first aporia is stated in the text as follows:

I mean, for example, should one take each *ousia* singly and define (διορίζειν) it independently, e.g. taking up one by one the nature of mankind, lion, ox, and any other animals as well; or should one first establish, according to something common, the attributes (συμβεβηκότα) common to all? For many of the same attributes are present in many different kinds (γένεσιν) of animals, e.g. sleep, respiration, growth, deterioration, death, and in addition any remaining affections and dispositions such as these. (I add this because at the moment it is permissible to speak unclearly and indefinitely about these things.) It is apparent that, especially when speaking one by one (κατὰ μέρος), we shall repeatedly say the same things about many kinds; for instance, each of the attributes just mentioned belongs to horses, dogs, and human beings. So if one speaks of their attributes one by one, it will be necessary to speak repeatedly about the same things—whenever, that is, the same things are present in different forms of animals, yet themselves have no difference (διαφοράν). Yet there are probably other (ἕτερα δ' ἴσως) attributes which turn out to have the same predicate, but to differ by a difference in form (τῇ κατ' εἶδος διαφορᾷ), e.g. the locomotion of animals; it is apparent that locomotion is not one in form, because flying, swimming, walking, and crawling differ. Accordingly, the following question about how one is to carry out an examination should not be overlooked—I mean the question of whether one should study things in common according to kind (κατὰ γένος) first, and then later their distinctive characteristics, or whether one should study them one by one (κατ' ἕκαστον) straight away (639a15-b5).²⁰¹

There is some debate on how to interpret this aporia in the literature. I will begin to develop my interpretation of this aporia by turning to the two main views of this aporia in contemporary scholarship. These are the views of Balme and Lennox.²⁰² I will develop both views and criticize each before turning to my own interpretation of the aporia. I will begin with Balme, since Lennox builds upon Balme's view of the aporia. Balme claims that this aporia does not concern method but rather scientific

²⁰¹ All translations of *Parts of Animals* in this rest of the dissertation are by James G. Lennox, *On the Parts of Animals I-IV*.

²⁰² Few scholars of the zoology have commented on this aporia extensively. For example, neither Furth nor Charles nor Pellegrin discuss it in their respective works on Aristotle's zoology.

explanation.²⁰³ Balme understands Aristotle to be raising the issue concerning the level of generality at which one explains why certain attributes belong to a certain species of animal. The zoologist could either explain the attribute belonging in respect to the level of the species, for example, the zoologist explains why stomachs belong to mankind, lion, ox, camels, etc, or explain the attribute belonging according to some generic nature, e.g., stomach as belonging to all blooded animals or even any animal. The first option leads to repetition of the explanation. The explanation for why a stomach belongs to an ox or an eagle or a trout would repeat the same explanation for why a stomach belongs many times. It may at first seem strange to us today why repetition of an explanation is really a problem at all. Balme responds to this by claiming that there seems to be a deeper problem behind the claim of repetition. Repetition suggests a failure to locate the proper level of cause and explanation of the attribute. For example, Aristotle displays this problem in *Posterior Analytics* I.5 in respect to explaining why equilateral, scalene, and isosceles triangle all have interior angles that add up to two right angles (74a25-32). The problem is that if a person explains why this attribute belongs to each kind of triangle separately, this person does not recognize the cause for this attribute belonging to each kind. It is the generic nature of triangle qua triangle that explains why any triangle has interior angles that add up to two right angles. Balme makes this point by focusing on *Posterior Analytics* II.14. This chapter argues that excerpts from the divisions of the genus animal are helpful in locating the proper level of explanation of an attribute (98a1-12). This method of excerpt and division not only helps determine whether there is a common cause for an attribute in many species, it also is helpful in showing when the explanation will be peculiar to a species. When one divides all animals into horned

²⁰³ See Balme, *De Partibus Animalium* I, pp. 72-73.

animals and those that lack horns, the zoologist can then ask what follows having horns? The answer seems to be having multiple stomachs and lack of upper incisor teeth (*PA* III.2 663b20-664a3, III.14 674a22-b17). But the camel also has multiple stomachs and lacks upper incisors but does not have horns. Aristotle, then, must explain these features of a camel distinctively from those animals with horns as he does so at *PA* II.14 674a30-b17. Balme, then, interprets the aporia to raise a problem only in respect to repetition of explanation of animals that have attributes with common explanations. But does Balme's interpretation make sense even on its own terms?

Balme's appeal to *Posterior Analytics* II.14 to support his interpretation presents several problems with his interpretation of this aporia. First, division is a kind of methodology. The method presented in *Posterior Analytics* II.14 presupposes division and uses it to find various levels of explanation in respect to a genus, here, animal. But more to the point, given the argument I constructed above in section 3.3, Aristotle's methodology in scientific inquiry presupposes the very structure of explanation that he develops in the first book of the *Posterior Analytics*, especially the first six chapters. Aristotle is speaking of seeking the explanation of the various attributes of animals, thus, he is concerned with what method is appropriate for finding the various explanations sought. Second, Balme does not argue that the aporia concerns how to define an animal but merely how to locate explanations of various attributes and at what level of generality these explanations will be legitimate scientific explanations. But Aristotle's view of scientific explanation is that it requires a certain kind of middle term that connects subject to an attribute universally, necessarily, and *per se*. This kind of middle term is an essence, and essence is what admits to definition (*APo.* II.3 90b3-4, cf. *Metaphysics* Z.4

1030a10-14, see also section 3.3). Given this view of explanation, the aporia seems to arise because the zoologist has not as of yet determined what level of generality is proper for a zoological demonstration, i.e., a scientific explanation of why these attributes belong to this kind of animal. It seems that the likely candidates are the nature of the species of an animal or the nature of the genus under which that species falls. But even the term “genus” can function at various levels of generality, so Aristotle would have to determine if there is a single generic level or several higher generic levels that are sufficient for scientific explanation. Thus, it appears that the aporia both concerns methodology, specifically in respect to the proper way to define an animal to explain its attributes, and definition, for the definition could be too generic and miss specific defining features or be too specific and not recognize that the feature belongs due to a wider nature.

James Lennox, on the other hand, sees the aporia to concern methodology, like Balme, and the proper way to define an animal, unlike Balme. He interprets the aporia to arise because of the tension between the metaphysical reality of the particular species, e.g., mankind, lion, ox, and the epistemic value of the universal. Lennox claims that this tension resembles the last aporia raised in *Metaphysics* B (1003a7-17) that if no universal is an *ousia*, then there could be no knowledge of the particulars, e.g., Socrates, since knowledge is of the universal.²⁰⁴ But the aporia in *Parts of Animals* seems to be between generic kinds and particular species, e.g., human being, lion, or ox. Appealing to the aporia in *Metaphysics* B seems to be of little help. But the tension Lennox claims in the aporia could still be present. Lennox suggests that *Parts of Animals* I.4 644a29-b7 helps resolve this issue. A look at this passage shows that it does no such thing:

²⁰⁴ See Lennox, *On the Parts of Animals I-IV*, p. 121.

On the one hand, in so far as what is indivisible in form is an *ousia*, it would be best, if one could, to study separately the things that are particular and undivided in form – just as one studies mankind, so too bird; for this kind has forms. But the study would be of any one of the indivisible birds, e.g., sparrow or crane or something of this sort. On the other hand, in so far as this will result in speaking many times about the same affection because it belongs in common to many things, in this respect speaking separately about each one is somewhat silly and tedious. Perhaps, then, the right course is this. In some cases—whenever kinds are spoken of by people in a clearly defined manner and have both a single common nature and forms in them not too distant—we should speak in common according to kinds, like bird and fish and any other there may be that, though unnamed, embraces, like a kind, the forms with it. But whenever they are *not* such as this, we should speak one by one, e.g. about mankind and any other such kind (644a29-b7).

This passage that Lennox cites merely asserts that both the particular species and the common genus can be studied (and latter portion of the passage is the stated solution to the first aporia). There seems to be no hint of there being any tension between the two answers. Further, the above passage assumes that both genus and species can be the locus of explanation. Science is of the universal, so each can be grasped by a universal. This should not be surprising given the interpretation of *Metaphysics* Z.13-16 I supported in the previous chapter. A particular *ousia*, e.g., something numerically one such as Socrates, is not a universal nor is the form of the particular a universal, yet the form can still be a universal in a way; the definition of the form is of the universal.²⁰⁵ So, there seems to be little reason to assume the aporia arises due to the tension between the metaphysical reality of the particular and the epistemic value of the universal.

But the passage Lennox cites (644a29-b7) gives insight into the nature of the aporia. It asserts that the nature of an *ousia* is that of an indivisible form. This would be so if the *ousia* has a single nature. Aristotle asserts this at 644b3. As such, the definition

²⁰⁵ See section 2.2.3. Following Halper, I argued that the definition of the essence and the form of a sensible *ousia* is, in a way, a universal, having a definition, yet there is another way that the form is also a particular, not being separate from a sensible object.

of such a form should be indivisible and one. Studying the generic nature of that form of animal, e.g., bird or fish, is not going to make clear the specific nature of sparrow or crane, trout or bass. But we do know that Aristotle assumes the definition of an *ousia* to be one. Thus, on these assumptions, it would be best to pursue the definition of each particular kind of *ousia* independently. On the other hand, the generic nature of bird or fish does account for why certain attributes belongs to these kinds of animals generically. So, if one were seeking the nature of sparrow and did not know that this species belonged to a wider generic kind, this scientist would not have a full scientific grasp of why certain attributes belong to this species. As noted early, this is a certain kind of ignorance that any scientist wants to avoid (*APo.* I.5 74a25-32). But these attributes, such as feathered, beaked, winged, two-footed, etc., will be parts that belong to any species of bird *per se*. Thus, knowing the nature of the generic kind is intrinsic to finding the indivisible form of the species. The solution is consistent with this view for it accepts that some animals have a single common nature that belongs to many species (644a3). But it is also the case that some species of animal do not fall under a wider genus other than the genus Animal, such as human being, ostrich, bat, etc. Looking for a wider genus in these cases would seem to be fruitless and not get the zoologist closer to grasping the indivisible form. These species and their attributes must be studied separately. But human being and ostrich do have attributes in common such as having a heart and having a stomach. We have now seemed to have articulated the aporia. Neither of the two starting points seems to be able to arrive at the definition required for scientific explanation.

Aristotle does not resolve this aporia until *Parts of Animals* I.4. My view is that the arguments development between the first aporia and the solution given in I.4 are

aimed to resolve this aporia. Aristotle needs to develop the general methodology of seeking the middle term and the essence of a thing in respect to the very nature of animals. In other words, he needs to show that the argument of *Posterior Analytics* II.8 apply to the objects of zoology. The middle term is a definition, so Aristotle must show in what way an animal can be defined. The middle term is also a cause (*APo.* II.2 90a7). So, Aristotle will also need to determine what kind of cause is most relevant in the science of zoology or whether several or all causes are relevant in zoology. He will also need to know what kind of predicates are relevant, i.e., what the cause causes to belong to the kind. This will determine what kinds of facts are pertinent to this science. I will address these issues in the next section.

3.5 The Primary Cause and the Proper Material in Zoology: *Parts of Animals* I.1 639b5-642b4

I will argue that the next four chapters of *Parts of Animals*, chapters 1-4 of the first book, present arguments that aim to resolve the first aporia. This at first might seem implausible considering both the diverse subject matters of these chapters and that the literature often sees little that unifies the first book of *Parts of Animals*. Balme claimed that the first book lacked continuity and was probably five separate papers put together.²⁰⁶ But if we focus our attention on the fact that the first aporia concerns not only definition but also scientific inquiry, we can see why these first four chapters of *Parts of Animals* cohere together to form a unified study of the principles of zoology. The first aporia raises a question about the kind of definition the zoologist should seek to

²⁰⁶ See Balme, *De Partibus Animalium I*, p. 69. The five papers are Ch. 1, Ch. 2-3, Ch. 4, and finally Ch. 5 consists of two papers: one an “exhortation to zoology” and another “an analysis of the relation between bodily parts.”

grasp why the various parts of animals belong to this or that kind of animal. I will show that, to resolve this aporia, Aristotle turns his method of inquiry, using the structure of a demonstration to find the middle term, developed in the second book of the *Posterior Analytics*. One step in resolving the first aporia will involve determining what kind of cause is primary in zoological demonstrations (*PA* I.1 639b12-21, 640a10-32). Aristotle accepts that all four causes can serve as middle terms (*APo.* II.11 94a20-23). Is one cause primary in zoology or do all four have equal explanatory weight? Another step in resolving the first aporia is knowing what facts are most relevant to zoology (*PA* I.1 640b4-641a33). The zoologist must collect the appropriate $\acute{\omicron}\tau\iota$ -predications that can be demonstrated to belong to that kind of animal. These $\acute{\omicron}\tau\iota$ -predications will be used to seek the middle term of each kind of animal. I will show that Aristotle argues that (1) the primary cause in zoology is the final cause, which is the form, and (2) the relevant facts are the various parts of an animal. Coming to this conclusion leads Aristotle closer to resolving the aporia, for the relevant facts will help determine what level of generality is appropriate for zoological explanations. Finally, not losing sight of the consistency between the metaphysical and physical definitions of an animal, I will also show that there is much along the way in proving these two points that supports the view that Aristotle is accepting the assumption that an animal is defined by one, final differentia in zoology. I will support this view by showing that the arguments in this part of *Parts of Animals* both assume the unity of the definition of an animal and that the material parts of an animal are demonstrated through this unity.

I will begin with the first issue: what is the primary cause in zoology? We should first note that the passage immediately after the first aporia (639b5-11) once again shows

that Aristotle is engaging in an inquiry into the nature of animals and their parts. He asks the question whether the zoologist should first study the phenomena and collect the facts before turning to state the cause and the reason why. At first, such a claim seems odd given that inquiry always proceeds from the facts towards the explanation and the cause according to Aristotle (*APo.* II.1 89b26-32, cf. II.8 93a17). But, in defense of Aristotle, he is turning to a new subject matter that is not clearly a well-defined science before his time. The Presocratics seemed to study nature under one rubric, and Plato, although he dedicates the third section of the *Timaeus* to zoology or aspects of what Aristotle would take to be primarily zoology (68e-92c), does not consider zoology or physics to be a science (ἐπιστημή) but a likely story (69b, cf. 29d). I will argue that Aristotle is showing how zoology can be a science. This is precisely what he will do in the next passage (639b12-21), which raises the question what is the primary cause of natural generation, efficient or final cause.

This last question should give us pause. First, the obvious choice for the cause and the middle term that accounts for why attributes belong to this kind *per se* is the formal cause. *Physics* II.3 tells us that the formal cause is the formula of the essence and the genera of the essence (ὁ λόγος ὁ τοῦ τί ἦν εἶναι καὶ τὰ τούτου γένη) (194b26-27). Second, in *Physics* II.1, form is the cause of generation as final cause (193b12-18). Third, Aristotle claims in *Physics* II.7 that three causes are often one, where the formal and final cause are one and the efficient cause is same in form (198a24-26). In the passage in *Parts of Animals* I.1, Aristotle only mentions two causes as being responsible for the coming to be of an animal: final and efficient cause. Two questions naturally arise: (1) why leave out formal cause? (2) why distinguish between final and efficient

when in the *Physics* Aristotle treats them as same in form? I claim that the answer to the first question is that the formal cause is used as a premise in the argument. Aristotle asks which of the two causes is really the formula (λόγος) of the thing (639b15-17). But this just adds more confusion in trying to answer the second question. Aristotle takes both final and efficient cause to be same in form. Both should admit to being the formula of the thing. I will argue below that this is still the case, but Aristotle still has grounds to hold that the final cause is primary in respect to the generation of an animal. Generation is the most basic motion of a natural *ousia* and so the way in which physics studies a being. Let us turn to the argument.

The passage is as follows:

And in addition to these questions, since we see more than one cause of natural generation, e.g. both the cause for the sake of which and the cause from which comes the origin of motion, we need also to determine, about these causes, which sort is naturally first and which second. Now it is apparent that first is the one we call for the sake of which; for this is an account (λόγος), and the account is an origin alike in things composed according to art and thing composed by nature. For once the doctor has defined health, and the builder has defined house, either by thought or perception, they provide accounts and the causes of each of the things they produce, and the reason why it must be produced this way. Yet that for the sake of which and the good are present more in the works of nature than in those of art (639b12-21).

The argument is based on the claim that art imitates nature. It assumes that the formula is an origin and that which will be the primary cause in generation. Now, in art, the artisan first states the formula (λόγος) and definition, for this will be an account of the end that the art aims to attain. Aristotle also assumes that the final cause is the formula, for in stating what the product is it also states the end result of that art. Finally, Aristotle assumes that the final cause and the good are present more in nature than in art. Since the final cause is primary in art, it is all the more so in nature, so the formula will be identical

to the end result in nature. This end result is primary in causing what is generated to come to be such a thing. It is now clear how this argument reaches its conclusion. But why can we not reach the same conclusion about the efficient cause, for it is also same in formula (*Physics* II.7 198a26)?

It is actually clear that the argument addresses this issue. The efficient cause is derivative of the formula in art. The artisan must first grasp the formula and the end and only then does she have the capability of producing the product. In nature, something similar is the case. Although the efficient cause is still the form, it follows from the nature of the thing. The form dictates in what way and what parts are necessary for generation. In other words, the efficient cause presupposes the formula. It is same in formula but not simply the formula. Nothing in the *Physics* passage contradicts this. Aristotle only equates the formal and final cause. They are strictly one in the thing (198a25). Now that Aristotle has determined that there is a primary cause of the generation of an animal, he would seem to have established that there can be a science of zoology.

We now see that Aristotle is assuming that an animal, as a natural *ousia* has a formula and this formula can serve as a middle term. But we also must ask this question: what belongs in the formula of an animal? Is the formula of the form by itself, as it is in *Metaphysics* Z.12, or is the formula of all the parts of the animal as we might expect in the science of physics studying the composite? This passage may not at first seem to answer this, but the stress that the efficient cause is derivative helps point towards an answer. The formula must make clear why the parts belong. So, in a way, the formula is of the form by itself, but, in another way, since we are seeking what parts belong, it may

also be the case that the material parts are included in the formula. There is really no conflict in holding both views. *Metaphysics* H.6 shows that the formula of the form just is the formula of the composite. The inquiry in *Parts of Animals* exploits this conclusion, but the focus in zoology is to grasp the nature of the parts and their formulae to see why they belong to the whole animal and the form. So, a formula belongs to the form and to the composite and also to each of the parts. But the science is only possible if there is a formula that accounts for why the parts belong, which must be the formula of the form. The form, strictly speaking, is the only object that admits to definition, for it is not predicated of something else (*Metaphysics* Z.4 1030a11-12). Any part of an animal requires that it be predicated of something else. Now, we will see that more arguments in *Parts of Animals* I.1 will support this view that definition is primarily of the form, though physics seeks the formula of the composite whole which includes the formula of the parts.

But there is a problem. This argument (639b12-21) showed that the final cause connects what attributes belong to the subject. The final cause also expresses the end (τέλος) of the thing. But the end is not present to the thing actually at the beginning of generation. It is present only at the end of generation when the animal is a mature adult and the proper organs have been formed. On the other hand, a demonstration is where a middle term connects the extreme terms necessarily. What kind of necessity is present in animals through the final cause that can also be present through a demonstration? This is the issue Aristotle turns to next (639b21-640a9). He makes clear that the concern here is demonstration: “the mode of demonstration and of necessity is different in natural science and the theoretical sciences” (640a1-2). But this claim has left commentators scratching

their heads. Aristotle normally considers natural science to be a theoretical science (*Met.* E.1 1025b18-1026a23, cf. *PA* I.1 641b11). Some commentators take the contrast to be between art and the theoretical sciences, which includes natural science.²⁰⁷ Others take the contrast to be between natural science and theoretical science.²⁰⁸ I follow Lennox in that the passage itself supports the latter of the two contrasts.²⁰⁹ Although zoology falls under physics and physics is considered to be a theoretical science by Aristotle, the contrast here does not need to be absolute. Aristotle is not dividing zoology off from theoretical science in general, but rather Aristotle's focus is on the kind of necessity present in the thing and in a demonstration. I take the passage only to emphasize the contrast between physics and other theoretical science in a certain way. The other theoretical sciences, both mathematics and metaphysics, do not concern themselves with things that come to be. Physics does. The significant issue here is how to construct a demonstration within a science that studies both that which comes to be and is governed by a final cause.

The problem has been stated above: that which connects the terms in a demonstration in zoology is not present to the thing until it has reached its end. Aristotle states the following about demonstration in zoology:

However, the mode of demonstration and of necessity is different in natural science and the theoretical sciences. (These sciences have been discussed elsewhere.) For the origin (ἀρχή) is, in the latter cases, what is, but in the former, what will be. So: 'Since health or mankind is such, it is necessary for *this* to be or come to be', instead of 'Since *this* is or has come about, *that* from necessity is or will be'. Nor is it possible to connect the necessity in such a demonstration into

²⁰⁷ See Düring, "Aristotle's Method in Biology", in *Aristote et les problèmes de méthode*, edited by S. Mansion, Paris: Louvain, 1961, p. 215; Pellegrin, *Aristotle's Classification of Animals*, 1986, pp. 131-33.

²⁰⁸ See Balme, *De Partibus Animalium I*, 1992, p. 84; Grene, "About the Division of the Sciences", in *Aristotle on Nature and Living Things*, 1985, pp. 9-13; Kullman, *Wissenschaft und Methode*, 1974, pp. 13-16.

²⁰⁹ See Lennox, *On the Parts of Animals I-IV*, pp. 128-29.

eternity, as if to say, ‘Since *this* is, therefore *that* is’. (These matters too have been determined elsewhere—in what sorts of things necessity is present, what sort of necessity converts, and owing to what cause) (640a1-9).

The parts of an animal can be present without entailing the end. For example, when there is a beak, feathers, and wings that belong to an animal, this does not imply that the animal also has the capacity for flying. A newborn bird lacks this capacity yet has these parts. The capacity is present to the bird potentially but not actually. This is different from the necessity present in mathematics. When there is a figure with interior angles that add up to two right angles, there is a triangle, and vice versa. So, whereas the necessity present in a mathematical demonstration is convertible, the necessity present in a demonstration in zoology is not convertible. The zoologist cannot state that since certain facts are present, the end must of necessity be present. G. E. R. Lloyd claims that this kind of necessity is not the kind present in a demonstration according to the first four chapters of the *Posterior Analytics*.²¹⁰ There seems to be a relaxation of the kind of necessity present in a demonstration according to this passage. Lloyd claims that nothing in the *Posterior Analytics* prepares us for such a relaxation. Lloyd also claims that this kind of demonstration proves its antecedents, what is present temporally or ontologically prior to the end (τέλος) being present. But there seems to be no reason to accept this last point. The antecedents of the end are not the cause of the end being present except as material. Material does not have either temporal or ontological priority for Aristotle. Although the material may seem to be temporally prior in the thing, e.g., the newborn bird, Aristotle makes clear in the next argument (640a10-32) that the producer of any animal is prior both (1) in time and (2) in formula and the potential to be that kind of thing is already

²¹⁰ See Lloyd, “The theories and practices of demonstration”, pp. 28-34.

present in the seed (640a23-26). The end is prior in both respects insofar as the end and formula of the father is prior in time to the offspring. Further, Lloyd's characterization of conditional necessity as proving the antecedents seems confused about what physics studies. Why the parts belong is due to the form and the end of the animal. What Aristotle is making clear about conditional necessity in this passage is this very point. We need to study the animal in respect to its completed state of being and not how the animal comes to be. The former explains the latter just because it is ontologically prior.

Lennox attempts a response to Lloyd's claim that zoology relaxes the kind of necessity present in a demonstration according to the *Posterior Analytics*. Lennox constructs his argument by appealing to *Physics* II.9 and showing that the structure of a demonstration in zoology is the same as that in geometry or any mathematical science.

Geometry: Because the straight is so and so, it is necessary that a triangle should
Have angles equal to two right angles.

Physics: If the end will be or is <so and so>, <it is conditionally necessary
that> that which comes before will be or is.²¹¹

But it is not clear this is sufficient to overcome Lloyd's objection. The necessity present in each demonstration above is different and that is the key point. Lloyd believes that conditional necessity is not acceptable according to what is laid down in the *Posterior Analytics*. Lloyd seems to be thinking of the conditions expressed in *APo.* I.6 and I.8 that demonstrations always hold and the middle term does not perish (74b32-75a1, 75b24-26). But both of these conditions hold in a demonstration in zoology. The middle term is a formula and a universal, which always holds and does not perish. If the end is present, then such parts are necessarily present for that end. But Lloyd may be thinking of Aristotle's claim that such necessity cannot be connected into eternity. But what does

²¹¹ See Lennox, *On the Parts of Animals I-IV*, p. 129.

Aristotle mean by this expression? The claim immediately after this expression seems to elucidate it: “Since *this* is, therefore *that* is” (640a6-7). Lennox interprets the “*this*” to refer to the material and the “*that*” to refer to the origin—the final cause and the form. In other words, to connect the predicate to the subject necessarily into eternity is only possible for the kind of necessity that is convertible, e.g. mathematical necessity. But it still is the case that the necessity is always present, if the end and origin is present. So, if certain material is present, say feathers, wings, beak, etc., this does not imply that this thing has the capacity for flying. The thing has not developed into such a thing yet. But if the end is present, then of necessity feathers, wings, beak and other attributes will belong to that thing. If this interpretation of the expression “to be connected into eternity” is correct, then what Aristotle is emphasizing is in exactly what way the conditional necessity present in zoology can be present in a demonstration. *Physics* II.9 is consistent with this interpretation and states it explicitly (200a26-27). So, Lennox is right in a way. Conditional necessity does not affect the logical structure or sacrifice the necessity present in a demonstration, but the two kinds of necessity need to be distinguished. Both begin from a principle (ἀρχή) that connects a subject to a predicate, as Lennox stresses, but one kind is convertible and the other is not. So, thus far, Aristotle has established the primary kind of connection present in a zoological demonstration and how this kind of connection has a distinct form of necessity.

The next passage in *Parts of Animals* I.1 (640a10-32) is also consistent with my interpretation of the previous arguments and is also consistent with my interpretation of *Metaphysics* ZH. It concerns whether the zoologist should consider the process or end as primary in its study. Aristotle concludes that the end is primary. He is, in part, arguing

against Empedocles' view that a living being has certain attributes because of the way they are formed in the process of generation. Aristotle shows that this view is mistaken on two grounds. First, coming to be is for the sake of *ousia* (640a18) and not the other way around. The end is primary, as the argument at 639b12-21 establishes. Second, the living being comes to be from that which already has the potential to be that kind of thing (640a23). The motions that occur in coming to be are already dictated by the form and the end of the animal. Finally, these arguments are consistent with the interpretation I defended of *Metaphysics* ZH. The conclusion Aristotle draws from these arguments shows this. The best kind of explanation in zoology is through the essence of the thing that demonstrates why certain parts belong to this kind of thing necessarily (640a33). So, Aristotle arrives at the conclusion that essence is the primary term in zoology independent of, but consistent with, the arguments of *Metaphysics* ZH.

But one could raise an objection against my interpretation. Aristotle also concludes that there are other forms of explanation that are acceptable in zoology. Aristotle allows for explanation through the good or what must hold in general (640a35-36). These kinds of explanations are prevalent in the rest of *Parts of Animals*. I will leave this question aside for now, but, in the next chapter (4.5), I will argue that why each of these explanations is acceptable in zoology is ultimately grounded by the fact that each must refer back to the essence of the animal. For example, what is good for an animal is ultimately good in respect to fulfilling its end either directly or indirectly. What is important so far is that Aristotle has shown that the logic of demonstration does apply to zoology because there is an essence by which the zoologist can demonstrate why certain features belong *per se* and necessarily. On my view, this implies that the kind of inquiry

spelled out in *Posterior Analytics* II, especially II.8, is possible in the science of zoology. This has taken us one step closer to resolving the first aporia of *Parts of Animals*, but since both a form (εἶδος) and a genus (γένος) have an essence, more work needs to be done to resolve the aporia. The next set of arguments take us another step in establishing how to inquire into the nature of animals and one step closer in resolving the aporia.

According to my reading of *Posterior Analytics* II.8, the scientist seeks a middle term by establishing the facts (τὸ ὅτι) about the thing. These facts serve as conclusions to demonstrations. So, once the fact is established, the extreme terms are known, both subject and predicate. We can, then, use them to find what connects these two extremes, for this middle term is the essence of the thing. Aristotle has made clear that the kind of connection relevant in zoology is the essential formula, and this will be a final cause. So, the middle term will connect subject to a predicate through an end and explain why the predicate is for the sake of this end. Aristotle now turns to what facts are most relevant in zoology in *Parts of Animals* (640b4-641a33). Aristotle will establish that the parts of an animal are the most relevant facts and in what way these parts are to be formulated, i.e., according to their work (ἔργον). At the end of these arguments (641a23-33), Aristotle will return to the question of inquiry, once again making clear how the logic of demonstration applies to zoological matters.

Aristotle begins this discussion of what facts are relevant with a quick discussion of his predecessors. According to Aristotle, his predecessors examined nature through its material principle(s) and its moving cause. They believed that even the principles of animals were reduced to such causes as material and efficient causes. Aristotle has already argued that efficient cause is not primary, but the focus of these arguments is

what aspects of an animal are its proper (οἰκεῖα) material. Aristotle does not use this terminology in this passage, but it is clear that he is speaking of the proper material of an animal. Aristotle is raising the same question he raised in *Metaphysics* H.4 about stating the proximate cause as material: whether it is more appropriate to speak of an animal being composed out of earth, air, fire and water or what is proper to it (1044b3-6)? Aristotle's answer is similar here as well: it is the parts of that animal, both its uniform and non-uniform parts rather than the basic elements.²¹² The argument here is once again grounded on the assumption that art imitates nature (640b19-28). It runs as follows:

But if human beings, animals, and their parts exist by nature, one should speak about flesh, bone, blood, and all the uniform parts. Likewise, too, about the non-uniform parts such as face, hand, and foot, one should say in virtue of what each of them is such as it is, and in respect of what sort of potential. For it is not enough to say from what things they are constituted, e.g. from fire or earth. It was just as if we were speaking about a bed or any other such thing; we would attempt to define its form rather than its matter, e.g. the bronze or the wood. And if we could not do this, we would at least attempt to define the matter of the composite; for a bed is a 'this-in-that' or 'this-such', so that we would have to mention its configuration as well, and what its visible character is. For nature in respect of shape is more important than the material nature (640b19-28).

Since art imitates nature, and no artifact's proper material is the elements, then all the more so with animals which are constituted by nature. The producer does not seek out earth or fire as parts of a bed, but wood or bronze. But even more so, the producer, say of a bed, seeks out a determinate shape of the material parts that will fit together to form a bed. It is necessary that the pieces be sturdy enough to support the mattress and the person or people sleeping on the bed, but this is what will come along with bronze or wood. So, the same follows for animals. They would be defined by their uniform and

²¹² The difference between these two passages is that Aristotle asserts in *Metaphysics* H.4 that the proper material is the blood or the menses of a woman. Aristotle does not argue this point in this chapter, at least explicitly. But there is another key difference. The claim in *Metaphysics* H.4 seems to locate one proper material instead of the many parts of an animal.

even more so from their non-uniform parts, for the former are material for the latter and the non-uniform parts are material for the whole.

But there is a problem raised by this argument. The problem will be rectified by the next passage in *Parts of Animals* (640b29-641a13), so I will turn to this problem second. But the argument above contains a qualification that will support my view that Aristotle is presenting a scientific inquiry rather than a completed science in *Parts of Animals*. The ideal in physics is to define the form (640b25), for this, in a way, just is the composite as well. In this case, the form implies the material parts. But the qualification says to seek the definition of the material of the composite, for a bed or an animal is a ‘this-in-that’ (640b27). This is exactly how inquiry proceeds. The scientist seeks out what facts can be established about the thing. In respect to an animal, these are its various parts. But if the parts cannot be defined in the fullest sense apart from the whole and the form, then seeking for the definition of these parts is just seeking the definition of the form. As many scholars have noted, there seems to be no complete definition of any animal in either the *Parts of Animals* or the rest of the biological writings.²¹³ Further, following Balme, most scholars have recognized that Aristotle’s use of division and differentiae in zoology is to seek causes.²¹⁴ But seeking a cause is also seeking a definitional feature of a thing, for Aristotle equates the “what it is” and the “why” at *Posterior Analytics* II.2 90a15-23. What the argument (640b19-28) establishes is that the most revealing facts about an animal are its material parts, both uniform and non-uniform. Aristotle will soon argue (641a15-25) that these parts are defined in respect to

²¹³ This problem is recognized by pretty much all scholars, but the clearest statement of it is by Pellegrin. See “Aristotle: A Zoology without Species”, in *Aristotle on Nature and Living Things*, p. 99.

²¹⁴ See Balme, “Aristotle’s Use of Division and Differentiae”, in *Philosophical Issues in Aristotle’s Biology*, pp. 69-89, esp. pp. 88-89.

the kind of *ousia* each animal is, i.e., the formula of a part has within it the nature of the genus or kind to which it belongs.²¹⁵ I will show that the best way to interpret this is that the parts of an animal are *per se* attributes of the form and the *ousia* in the second sense; the parts cannot be defined apart from the kind to which they belong. But this leads us to a question and back to the problem hinted at in the beginning of this paragraph. How do we seek out the formula of a part? Since art imitates nature, and art seems to formulate a part in respect to its configuration, will Aristotle suggest that the zoologist should define an animal part in respect to its configuration? This seems problematic. For, as Aristotle will soon point out, the configuration of a heart or even the whole body soon after death seems to be the same as prior to death, but the heart of a dead animal is not a heart at all (641a34-35). Let us turn to see now how Aristotle will define a part insofar as the part has a nature and a potential.

The passage runs as follows:

Now if it is by configuration and colour that each of the animals and their parts is what it is, Democritus might be speaking correctly; for he appears to assume this. Note that he says it is clear to everyone what sort of thing a human being is in respect of shape, since it is known by way of its figure and its colour. And yet though the configuration of a corpse has the same shape, it is nevertheless *not* a human being. And further, it is impossible for something in any condition whatsoever, such as bronze or wooden, to be a hand, except homonymously (like a doctor in a picture). For such a hand will not be able to do its work (ἔργον), just as stone flutes will not be able to do theirs and the doctor in the picture his. Likewise none of the parts of a corpse is any longer such—I mean, for example, any longer an eye or a hand (640b29-641a4).

²¹⁵ In the most proper sense, a part does not have a definition but only a formula. On the other hand, a part can have a definition derivatively, for a part has what Aristotle calls a secondary essence (Z.4 1030a23-24). A part has a what is and essence, but this essence is really predicated of something else, namely, the animal to which it belongs.

As stated above, configuration is not a sufficient way to characterize a part of an animal. What is most significant aspect of a part of an animal is what it does—its work (ἔργον).²¹⁶ This solves the problem as well. The work of a part is not present to a corpse but is present to a living animal that is functioning properly. So, the formula of a part will be of its work—what it does. But Aristotle takes the argument a step further. The same is also the case with the part of an artifact (641a5-13). In this passage (641a5-13), Aristotle argues that a craftsman gives the formula of a part in respect to what it is for the sake of, which explains the reason for its shape. So, art is like nature in that the parts of a thing are formulated by its work. Aristotle has now determined what facts are most relevant to study of an animal, the uniform and non-uniform parts, and in what way the zoologist needs to determine these facts, in respect to each part's work.

But all of this is significant for it allows Aristotle to show the way in which the facts are connected to the subject through the middle term. In other words, Aristotle can now combine the two results established thus far in *Parts of Animals* I.1. The next passage (641a15-25) states what has been established, but something new has been added: the soul or at least some part of the soul is the end and that which is the ultimate object of definition for the zoologist.

Clearly, one should state that the animal is of such a kind, noting about each of its parts what it is and what sort of thing it is, just as one speaks of the form of the bed. Suppose what one is thus speaking about is soul, or a part of soul, or is not without soul (at least when the soul has departed there is no longer an animal, nor do any of the parts remain the same, except in configuration, like those in myths

²¹⁶ This word, “ἔργον”, is traditionally translated as “function”. But this translation misses the key idea that is expressed in the Greek. “ἔργον” means “work” but also “tilled fields”, “farm”, “deed”, and “action” (LSJ). The problem is that “function” does not express the fact that what defines the thing is what it does. “Function” tends to imply a state or capacity of a thing. Although the ἔργον of a part of an animal is a capacity (δύναμις), any capacity for Aristotle is defined in respect to its act or being-at-work (ἐνέργεια). “Function” does not have the same connotation, but “work” does. Further, this passage makes clear that the part is really what it does, since a part that no longer works is not a part at all of an animal.

that are turned to stone)—if these things are so, then it will be up to the natural philosopher to speak and know about the soul; and if not all of it, about that very part in virtue of which the animal is such as it is (καθ' ὃ τοιοῦτο τὸ ζῷον). He will state both what the soul or that very part of it is, and speak about the attributes it has in virtue of the sort of substantial being it is (κατὰ τὴν τοιαύτην αὐτῆς οὐσίας), especially since nature of something is spoken of and is in two ways: as matter and as substantial being (οὐσίας) (641a15-25).

This passage uses language appropriate to the logic of demonstration. Aristotle speaks of the parts being “in virtue of” (κατά) the *ousia* of an animal (641a24). I read this “κατά” to signify *per se* in the second sense. This is because Aristotle is distinguishing between form and material here, where the *ousia* of the animal just is the form (εἶδος). Aristotle uses “εἶδος” in this passage and suggests that the form of an animal is the soul or some part of it (641a16-18). I read the attributes as being the material of the animal and belonging in virtue of the *ousia* or form in the second sense. This passage states what the completed science should look like, but the emphasis is still on inquiry. Aristotle is arguing that the zoologist needs to seek out the very part of the animal, namely, the soul, in virtue of (κατά) what kind of animal it is (641a23). I read this “κατά” as the “κατά” of definition or *per se* in the first sense, i.e., what belongs in the definition of a thing. The soul will explain why each of the material parts belongs.

Aristotle concludes the first chapter of *Parts of Animals* with the conclusion that there are two causes present in this science: final cause and the cause from necessity (642a1-2). This may seem to go against my thesis that final cause is the unity of the animal, for there are two causes present, and this suggests two distinct principles or things at work in an animal. In a way, this is true. The nature of the elements and the elemental components of any part of an animal have the necessary nature of that combination of elements. But this is not the necessity to which Aristotle refers (642a2-

5). The kind of necessity that is relevant to the science of zoology is conditional necessity. This does not ignore the necessary nature of the elements and their combination, but rather presupposes it, and the relevant necessity is in respect to the end. In other words, the reason these elements are present are in respect to the end of the animal and its work. Why, then, treat this as a separate cause? This is because physics studies both form and material, and lack of the knowledge of the material may imply lack of knowledge of the end and work of that kind of animal. So, inquiry into the nature of animals must explore both, for the coming to be of any animal implies that there is both form and material present to that animal, and knowing the material contributes to knowing the end. It is also the case that what belongs due to conditional necessity may carry other things along with it as well (642a32-33). So, the cause from necessity can be responsible for why some of the parts belong. Of course, the necessity is only present to any animal due to its end and nature—the form. Now that Aristotle has determined the nature of the middle term and what facts are relevant in zoology, he must now turn to how the zoologist marks off the relevant kinds in zoology that require definition. I will argue in the next section that Aristotle proposes multiple differentiation as opposed to dichotomy, seeking one line of differentiation, to do this very task.

3.6 A Reinterpretation of Aristotle's Critique of Dichotomy in *Parts of Animals* I.2-3: Preserving the Unity of the Definition of the Composite

In the previous section, I argued that the first chapter of *Parts of Animals* establishes both what kind of middle term is primary in the science of zoology and what facts are most relevant in this science. The science of zoology will demonstrate why the parts of a certain kind of animal belong by showing that these parts are for the sake of the

end of that kind of animal. But if I am arguing that *Parts of Animals* I.1-4 is resolving the first aporia, showing that zoology is a demonstrative science is not yet sufficient to resolve this aporia. The first aporia asks whether the zoologist should inquire after the nature and definition of each animal separately or first establish what attributes belong in common and then proceed to the particular. Aristotle needs a method that determines whether and when attributes can be properly grouped together and when the groupings of attributes are distinct from each other. Collection and division is such a method. *Parts of Animals* I.2-3 discusses both collection and division, where both chapters focus primarily on a critique of dichotomy. Aristotle argues that the practice of dichotomy is not capable of grasping the particular species. Dichotomy is a kind of division that pursues a single line of differentiation. Balme argued for this interpretation of dichotomy in his commentary and it is now the standard view in the literature.²¹⁷ But Balme also understands the conclusion of the critique to imply that no animal can be defined by a single differentia. The text seems to support Balme's view as well, because it states that no animal is grasped by a single differentia (644a5-8, cf. 643b10-13). I will argue below that this latter claim is in reference to the inquiry into the definition of an animal. But there is a deeper issue. According to Aristotle in the *Posterior Analytics*, division helps to seek out those terms predicated in the "what it is" (II.13 96a23). The "what it is" is the same thing as the essence. So, if division in zoology must seek out many lines of differentiae, the animal would be defined by many differentiae. The definition of an animal would be a composite and not a unity. I will argue below that this is not the case. If division in zoology seeks out the terms appropriate to define the composite, then

²¹⁷ For Balme's view of dichotomy and his interpretation of Aristotle's critique of it, see his *De Partibus Animalium I*, pp. 101-19.

seeking out many differentiae is consistent with the claim that the form is defined by one, final differentia. The latter differentia is the definition of the thing that explains why all the other differentiae belong to one and the same thing. Aristotle does not explicitly state this in his critique, but I will show certain passages support this interpretation (esp. 644a8-11). But I need to give a defense of this reinterpretation, for much of the literature accepts that Balme's view of Aristotle's critique of dichotomy implies that no form of an animal can be defined by a single differentia.

The defense in one sense is simple once we understand the context of the critique of dichotomy and that physics studies the composite and not just the form by itself. Balme's own characterization of division in his commentary on *Parts of Animals* is actually a good starting point for a presentation of my view why grasping the particular by many lines of differentiation is necessary but not sufficient in zoology. Balme states the following about division in zoology: "Aristotle's problem is to mark off each animal species: (i) so as to show its specific attributes, (ii) so as to distinguish it from every other species."²¹⁸ Division enables the one inquiring to mark off species as being distinct from each other according to the differences amongst their specific or *per se* attributes. Why the zoologist should proceed by many lines becomes obvious. The zoologist does not know ahead of time belong under which heading. If he proceeds by a single line of division, then he must decide whether the distinct feathers or distinct beak or distinct feet of a bird are the most defining feature that marks off one species of a bird from another as unique as well as from other kinds of animals, e.g., fish or mammals or human beings. The zoologist would need some separate reason before beginning his inquiry to hold one of the features as primary. On the other hand, by pursuing only one line of division for

²¹⁸ Balme, *De Partibus Animalium I*, p. 101.

any given species, it is possible for the zoologist to mark off the same species as different from itself or different species as the same as each other. Male and female parts of the same kind may differ in certain characteristics, so the zoologist may take them as distinct, or, conversely, two birds may have the same kind of hooked beak and be taken as the same species.²¹⁹ So, it seems best for the zoologist to begin marking off species through many lines of differentiation.

Now, even if the zoologist inquires into the nature of a species or kind starting from many lines of differentiation, there is nothing inconsistent with the view that one feature will define each animal. If a plurality of *per se* attributes belong to any given species, something must account for why all of these attributes belong to the same thing (*Met. Z.17* 1041a20-23). As we saw in the *Metaphysics*, since an animal is an *ousia*, the thing that makes all these *per se* attributes belong to the same thing must itself be one. If this thing is a plurality, the same question arises. Why does this plurality belong to one thing? The form must be assumed to be one thing for the zoologist to seek a definition of an animal at all. Pursuing many lines of differentiation allows the zoologist to group the animals properly according to natural kinds without sacrificing the unity of the kind, be it generic or specific. Aristotle objects to dichotomy in that it will sacrifice the unity of the kind by placing some animals that are same in kind in different kinds and different kinds in the same.

I will defend this interpretation below, but first I want to present Balme's view of these chapters. Before Balme's work on these chapters, there was disagreement on what dichotomy means for Aristotle. Some scholars took dichotomy to mean division in

²¹⁹ Aristotle raises these very objections at *PA I.3* 643a7-15. I will show below how my interpretation handles the claim in this passage.

general.²²⁰ Other scholars, such as A. L. Peck, excised passages that seemed inconsistent with claims made in the *Metaphysics* about division and the definition of form.²²¹ Balme resolved both of these problems through his interpretation. He argued that dichotomy in this passage simply means division by one differentia at a time.²²² Dichotomy is where the divider pursues one line of division to mark off a thing from all other things. On this view, division is still part of the basic methodology of marking off species and kinds from each other, for there is no reason why a scientist cannot mark off a thing pursuing many lines of division. Balme argues, though, that there was a reading of *Metaphysics* ZH that was consistent with the view that an animal is defined by many differentiae. Balme claimed that *Metaphysics* Z.12 was only an argument to show that a particular line of differentiation can be one with the genus.²²³ This brings the claims in the *Metaphysics* on essence in line with Aristotle's rejection of dichotomy in *Parts of Animals*.

As I argued in the previous chapter (2.2.2), this view of Z.12 cannot be maintained. The text of Z.12 clearly states that the final difference is the form (1038a19-20). On the other hand, Balme's view is not completely off the mark. Each line of differentiation that a zoologist pursues is itself something that is one in a way. Multiple differentiation will proceed via proper differentiation to insure this unity (643b17-26), as

²²⁰ I. Düring and G. E. R. Lloyd held such views before Balme's views were put forth. See Düring, *Aristotle's Parts of Animals: Critical and Literary Commentaries*, 1943, pp. 109ff.; Lloyd, "The Development of Aristotle's Theory of the Classification of Animals", *Phronesis*, VI, 1961, pp. 59ff.

²²¹ Peck excised several key passages. The most crucial are at 643b31-34, 643b36-644a2, and 644a3-4. The first two passages concern how to express a line of differentiation, e.g., either simple as the final differentia or complex as woven together. The last passage states that the difference reached at the end of any line of division is not the final differentia or the form. This obviously contradicts *Metaphysics* Z.12. In only the first passage do the manuscripts have any variances. The second passage (643b36-644a2) repeats part of the first passage excised (643b31-34). Peck must have excised the final passage (644a3-4) for philosophical reasons. Both Balme's interpretation and my interpretation can make sense why all three passages are present and fit with Aristotle's critique of dichotomy. See Peck's text and translation in the Loeb edition, Aristotle, *Parts of Animals*, Loeb Series Vol. XII, Cambridge, MA: Harvard University Press, 1961, esp. p. 90.

²²² See Balme, *De Partibus Animalium I*, 1992, p. 101.

²²³ See Balme, "The *aporia* of *Metaphysics* Z", p. 304.

I interpret it, of the part. The difference that Balme did not note between these two passages, *Metaphysics* Z.12 and *PA* I.2-3, is that the latter is part of a methodology for finding the middle term and definition of an animal but the former is merely an argument for how the parts of the definition are one. Physics needs to present the parts in the definition with the same kind of unity, since zoology is a branch of physics, and physics studies the form and the material.

As I interpret it, the unity of the definition of any animal in zoology is through the single cause and end that accounts for all the parts belonging to that kind of animal. This cause is the essence and *ousia* of the animal. I will defend this interpretation by showing how Aristotle assumes this kind of unity at various times in his critique of dichotomy. I will begin from the last argument (644a1-11) of the critique, where I will show that he appeals to this kind of unity as an assumption of the argument. I will then show that the other passages in Aristotle's critique of dichotomy can be read as consistent with my interpretation.

I will begin at the end of Aristotle's critique with the last argument to build my case that dichotomy is rejected because it will mark off a unified thing as different from itself. The passage is as follows:

That there cannot be many such differences is clear; for by proceeding continuously one arrives at the last difference, though not at the final difference and the form (εἶδος). This last difference is either split-footed alone, if one is dividing mankind, or the entire complex, e.g. if one were to combine footed, two-footed, and split-footed. And if mankind were split-footed alone, by proceeding in this way one might arrive at this single difference. But since mankind is not merely split-footed, it is a necessity that there be many differences that are not under a single division. There cannot, however, be many differences under a single dichotomous division—at least not of the same thing (τοῦ αὐτοῦ). Rather, one must end with one difference with one difference according to one such division. So it is impossible for those who divide in two to grasp any of the particular animals (644a1-11).

This passage is the primary source for those who believe that Aristotle has abandoned the view that an animal is defined by one, final differentia. The assumption by those who hold this view, e.g., Balme, Lennox, et. al., is that an animal is too complex to be defined by one line of proper differentiation.²²⁴ Aristotle states this claim at 643b28-30, but Balme takes 643b26-644a11 to be one continuous argument. I take the passage cited above to be the argument in this passage. The prior part of the passage (643b26-b36) shows that any way the differentia is presented, as simple or inter-woven, it will lead to the same conclusion as the argument at 644a1-11 gives: no animal can be defined by a single differentia. So, following Balme, if the argument at 644a1-11 is consistent with one, final differentia defining an animal, then so is the passage at 643b26-b36. Now, Aristotle has previously argued in *Parts of Animals* (643b17-23) that any line of differentiation needs to take the difference of a difference so that the final differentia is one with all previous differentiae. The argument above concludes that the animal cannot be defined or marked off by one, final differentia. So, on Balme's and Lennox's reading of the argument, the premises of the above argument are as follows:

Dichotomous division marks off an animal from all other animals.
 Dichotomous division ends with only one, final differentia.
No animal is defined by one, final differentia.
 Dichotomous division cannot mark off any animal.

The problem with this construal of the argument is that it ignores at least one premise: "There cannot, however, be many differences under a single dichotomous division—at least not of the same thing (τοῦ αὐτοῦ)" (644a9-10). Neither Balme nor Lennox

²²⁴ See, for example, Balme, "Aristotle's Use of Division and Differentiae", pp. 77-78.

comment on this line specifically or state why it is part of the argument in their commentaries.²²⁵

The usage of “same thing” (τοῦ αὐτοῦ) here becomes significant to the argument once we recognize the way in which Aristotle is using the term here. This is a technical word for Aristotle and its various senses are given in *Metaphysics* Δ.9. Things are said to be the same in virtue of itself (καθ’ αὐτά) as many ways as things are said to be one (1018a4-5). He goes on to say in this passage that one way of being one is being one *ousia* (1018a7). This usage of “*ousia*” at 1018a7 suggests that the reference is the particular *ousia*, e.g., Socrates or that man. But the essence of an animal is also assumed to be one *ousia*, and the formula of that essence is assumed to be one in the *Metaphysics* (Z.12 1037b25-27). Now, since science studies the universal, the assumption in this argument (644a1-11) is that each kind of *ousia* will be one and the same. The sameness would seem to refer to being one in formula. But if this is what Aristotle is assuming in this argument, then the argument seems paradoxical. The claim in the argument seems to be that dichotomous division fails because it seeks to mark off the same thing by a single line of differentiation instead of pursuing many lines of differentiae. It would seem my interpretation of the argument would only work if Aristotle was arguing for dichotomous division. But this paradoxical result only arises if we assume that Aristotle is seeking *just* the definition of the form by itself. Rather, if we assume that Aristotle is marking off the species of animal according to what belongs to the composite, there is no paradox. This latter view is also consistent with how Aristotle describes the science of physics—the physicist studies form with the material (641a23-33, cf. *Physics* II.2 194a12-15). But the

²²⁵ See Balme, *De Partibus Animalium I*, pp. 118-19; Lennox, *On the Parts of Animals I-IV*, p. 167.

argument is still assuming that the form is one, in particular, one in formula. How is this still possible on my view? If the zoologist can grasp all the relevant parts that mark off the composite as a unique species, then the form can be grasped as one, not just by division alone, but also by appealing to demonstration and using the structure of a demonstration to find the middle term and the cause for why the various parts of the composite belong to the whole. The problem with dichotomous division in zoology should now be clear. Each line of differentiation marks off the thing with a different differentia. There is no way to account for the fact that each differentia that marks off the same animal belongs to that very same animal. By starting off with the assumption that many differentiae can belong to the same thing, Aristotle avoids this problem in his view of division in zoology.

I will now give my construction of the argument at 644a1-11:

A particular kind of animal is an *ousia* and is one and the same thing.

A particular kind of animal is marked off by more than one differentia.

Dichotomous division can not mark off many differentiae of the same thing.

Dichotomous division cannot mark off a particular kind of animal that is one and the same thing.

What is assumed above is that the formula of a particular kind of animal is one and the same. This assumption along with the above construction of the argument makes it clear that there needs to be something which accounts for why all the many differentiae belong to the same thing or at least mark off the same thing. Division, of course, does not find what is one in formula by itself, but it seeks out the formula of a thing that has such a unity. So, the kind of division appropriate for seeking such a thing must not divide so as to neglect this unity. Dichotomous division, as the above argument proves, neglects this unity. It is on these grounds that I interpret this argument to reject dichotomous division.

Such an interpretation has a consequence that resolves an issue that has plagued scholars of the zoology. Aristotle is still emphasizing in *PA* I.2-3 that the definition of an animal is one, and not just by conjunction (643b18). Positing that there are many differentiae that belong in the definition of an animal leaves the problem of how the many differentiae are one or why they belong to the same thing. Lennox goes so far as to say that Aristotle nowhere explicitly addresses this problem.²²⁶ On my interpretation of the above argument, no such problem arises. Aristotle does not have a problem of why the many differentiae belong to the same thing, for this is a fundamental assumption of zoology. The work of the zoologist as a scientist is to show that the many differentiae belong to the same kind of animal. Therefore, there is no reason for Aristotle to address this problem explicitly. The more pertinent question is whether Aristotle still holds to this view and this assumption that all the differentiae belong due to one thing, the form, in his practice of zoology in the rest of *Parts of Animals*, and whether the form itself is still assumed to be one.²²⁷ I will turn to this issue in the final two chapters of the dissertation.

But nothing of what I have said implies that the parts of an animal are the differentiae. But the passage above (644a1-11) implies that. The example is the kind of two-footedness that belongs to human beings. This is clearly a part of a human being. But it could be the defining feature and the essence of a human being. This seems implied by *Metaphysics* Z.12, though this seems implausible. First, Aristotle often

²²⁶ Lennox, *On the Parts of Animals I-IV*, p. 166.

²²⁷ Most of the scholars of the zoology, such as Balme, Lennox, Gotthelf, and Pellegrin, take the position that Aristotle is comfortable with seeking different middle terms to prove what attributes belong to the same thing. David Charles holds that Aristotle's theory laid out in the first book of *Parts of Animals* commits him to the view that it must be the same middle term and this middle term must be a simple (non-complex) definition of the animal.

defines human beings as a rational animal (e.g., *NE* I.7 1098a7) or as a political animal (*Politics* I.2 1253a3). Second, in *Parts of Animals*, Aristotle claims that the nature and *ousia* of a human being is divine, which is to engage in reason and in thought (IV.10 686a26-28). Further, Aristotle demonstrates that human beings are two-footed by nature by the fact that a human being is a rational animal (IV.10 686a28-35). It seems that Aristotle's appeal here to two-footedness implies a part. But Aristotle does not always pick the most fitting examples. For example, he appeals to a house as an *ousia* in several arguments in *Metaphysics* Z (e.g., Z.7 1032b11-14, Z.8 1033b19-23, Z.17 1041b4-10), then denies that any artifact is an *ousia* in *Metaphysics* H.2 (1043a4-6). On the other hand, the primary object of division in the biological treatises is the various parts of animals.²²⁸ If division is primarily of the animal parts, and Aristotle accepts animal parts as the material of the animal (640b17-23), then my interpretation of multiple differentiation is compatible with his theoretical principles, and it fits with the distinctions Aristotle has made between form and material in the first chapter (e.g., 641a24-25). We will see, when we turn to the practice of zoology, that most of the divisions are applied to kinds of animal parts. I will explore this in the fifth chapter.

Scholars such as Balme and Lennox could object that I am ignoring that Aristotle explicitly states that division does not arrive at the final difference and the form (644a2). They read this line as rejecting that a single differentia defines an animal. But it does not need to be read this way. On my view, this claim still holds: pursuing many lines of differentiation implies, on my interpretation, dividing by the kinds of attributes that belong to that kind of animal. So, no single line of differentiation can be marked off as the final difference and the form through division alone. Rather, the zoologist will only

²²⁸ See Pellegrin, "Logical and Biological Difference: The Unity of Aristotle's Thought", pp. 335-36.

have found the form and definition of the animal when he grasps the middle term of a demonstration. This middle term will be that which demonstrates all the attributes belong to the same thing. Division will not find the definition and what is the form of an animal, at least not by itself.

There is yet another way for Balme and Lennox to reject my view of division. My interpretation of division seems to go against one of the rules posited by Aristotle in his critique of dichotomy at 643a27-30: divide by what is in the *ousia* and never by the proper attributes. There are two ways in which my view does not conflict with this rule. On the one hand, Aristotle later in Book I states that he will proceed by dividing the attributes (I.5 645b1-2). So, it seems that Aristotle violates his own rule. But this does not really need to be the case. For, if form and material are one in a way, there seems to be no difference in zoology if one divides by the attributes, for all of them together are, in a way, the form. If form is *ousia*, then dividing by the attributes in zoology is dividing by what is in the *ousia*, at least in a way. This does not lead us to the conclusion that an animal is defined by many differentiae. The definition is one in formula, so ultimately only the final differentia will be the definition. On this understanding, division is also still that which hunts down what is predicated in the formula (*APo.* II.13 96a23). The zoologist can only truly hunt down what is predicated in the formula of the essence by dividing and marking off the thing by its attributes, for only in this way will the zoologist be led towards the formula of the essence. On the other hand, since zoology is an inquiry, the scientist does not know beforehand which terms are the material parts and which term is the essence. Division does not need to distinguish between proper attribute

and essence in marking off animals, for that is precisely what the inquiry aims to determine. So, my interpretation does not violate this rule.

But many scholars question whether form and *ousia* are still identical in the zoology.²²⁹ The problem concerns what is included in the definition of an animal. Balme sees that Aristotle includes various aspects of an animal in the definition in the zoology, e.g., being lunged (*PA* III.6 669b8-12), yet these aspects are not identical to the essence. Gotthelf shows that Aristotle uses *ousia* and essence and what is in the formula of an *ousia* to refer to various generic levels, not just to refer to the level of species (εἶδος). This problem may be less puzzling if we remember that Aristotle treats both form and material as *ousia*. In *Metaphysics* H.1, Aristotle treats material as potentially *ousia* (1042a26-28). In *Physics* II.1, Aristotle says that material is *ousia* but form is more so (193b5-7, cf. 193a9-12). So, Aristotle can still hold the identity of form and *ousia* in physics as well as hold that the material is, in a way, *ousia*—as the potential of that animal. Form will be *ousia* if form is that which unifies all the attributes of an animal and makes them belong to one thing. What I want to show below is that the other passages in Aristotle's rejection of dichotomy are consistent with the view that the many differentiae are the material parts of an animal and that Aristotle still assumes that a unified form is what unites these parts and causes these parts to belong to one thing. I will follow Balme's view that there are eight distinct arguments. I have already addressed the consistency of my view with argument 8 (644a1-11) and argument 4 (643a27-31). By the end of the discussion, I will fill in the gaps to show how I see Aristotle's positive methodology of division working in zoology.

²²⁹ Balme argued that they are not in his "Aristotle's Biology was not Essentialist", pp. 294-95. Gotthelf raises the same question and explores in detail in Aristotle's practice of zoology. See his "Notes Towards a Study of Substance and Essence in Aristotle's *Parts of Animals ii-iv*", pp. 27-54.

The first argument runs as follows:

Some people attempt to grasp the particular by dividing the kind (γένος) into two differences. But this is in one respect not easy, and in another impossible. For of some things there will be only one difference, the others being superfluous (περίεργα), e.g. footed, two-footed, split-footed [footless]; this single difference is decisive. Otherwise, it will be necessary to say the same thing many times (642b5-9).

This argument has given the scholars some trouble. It is not clear the entire argument is present. Both Balme and Lennox read it as a shortened version of the last argument of Aristotle's rejection of dichotomy (643b26-644a11). This argument, as I discussed above, concludes that dichotomy is impossible on the grounds that no animal is marked off by one, final differentiae. If this is the best way to read this argument, then it is consistent with my interpretation of Aristotle's rejection of dichotomy.

I am hesitant of this interpretation of the argument. The argument seems to be a shortened version that division must proceed properly by taking the difference of a difference. On these assumptions, the final difference will be the only one that needs to be stated, for it will entail the previous differentiae. One reason for reading the argument this way is that the language is very similar to the passage in *Metaphysics* Z.12:

If this is so, then it is evident that the last differentia will be the *ousia* of the thing and its definition, if indeed one is not to state the same thing many times in the definition, for this would be redundant (περίεργον) (1038a18-21).

Aristotle emphasizes in both passages that by taking the difference of a difference mention of the previous differentiae will be redundant (περίεργον) and saying the same thing many times. The difference between the two passages is that Aristotle is arguing how a definition composed of genus and differentia can be one in *Metaphysics* Z.12 but this is not clearly so in passage at *PA* I.2 642b5-9. The argument in *Parts of Animals* merely speaks of the unity of one line of differentiation and this line's unity with some

genus. I read this argument to claim that each line of differentiation seeks out the nature of a kind of part belonging to that kind of particular species. This is what the example seems to indicate: footed, two-footed, split-footed. Each part will have a particular formula, so it will need to have its own unity. But this formula of the part will not be a definition for it will be said of something else, namely, the species or form of animal to which it belongs. In other words, the definition of the kind of animal will also be present in the formula of the part. But if this is the case, then division seeks out the parts that belong properly to the same thing. So, either way this argument is read, it is consistent with my interpretation of Aristotle's rejection of dichotomy.

The second argument runs as follows:

Further, one should avoid tearing each kind (γένος) apart, e.g. putting some of the birds in one division and some in the other, as the written divisions have done; there, some of the birds end up divided off with the water-dwellers, some in another kind. Now this similarity has an established name, 'bird', and another has 'fish'. Other similarities are nameless, e.g., the blooded and the bloodless; there is no one established name for either of these. If, then, nothing alike in kind should be torn apart, division into two is worthless. For people who divide in this manner necessarily separate and tear apart; some of the many-footed things are among the land-dwellers, while some are among the water-dwellers (642b10-19).

This passage assumes that each genus (γένος) is a unity. Aristotle shows that dichotomy tears apart the genus by marking off things assumed to be one in genus as being in many genera. What is the problem? A differentia can only fall under one genus or can only belong to two genera if one is subordinate to the other.²³⁰ If it is known that bird and fish are distinct genera, the differentiae they share in common belong to some higher genus. But bird and fish also have distinctive differentiae that are not held in common. Birds

²³⁰ See Balme, *De Partibus Animalium I*, p. 107.

have feathers, wings, beaks, and are two-footed. Fish have fins, gills, and are footless.²³¹ Therefore, bird and fish species must fall under their respective genus and never under both or another genus with a different nature. This reading of the argument is consistent with my view. The many differentiae that fall under the genus bird or fish mark off that genus, and each of the differentiae can be explained to belong to that genus through the generic nature. The zoologist then divides the generic features of the kind marked off to grasp the particular. But this need not imply that the definition of an animal just is the many differentiae that mark it off. Nothing prevents further differentiation of this generic nature to arrive at the essential nature of any species of bird or fish or any other kind of animal grouped by a lower genus than animal, and this essential nature can be shown to define this animal if it is the middle term that demonstrate all the features that mark off that kind.

Balme reads the next argument as covering lines 642b21-643a27. Although he sees three distinct arguments, each aims to show that dichotomous division cannot use privative differentiae. The assumption is that privations need to be used to mark off certain kinds of animals, e.g., fish or snakes, which are both footless (cf. 643b25). This generates a problem. Under dichotomous division, the zoologist cannot differentiate the footless animals into two kinds without violating the unity of that line of differentiation. There is no proper differentiation of a privative differentia. On these assumptions, something will be held in common, e.g., footless, by two forms of *ousia*, e.g., a particular

²³¹ It may seem odd that Aristotle accepts a privation as a kind of differentia appropriate to the kind fish. This is textually justified in several ways. First, later his rejection of dichotomy, Aristotle states that privations can be a differentia on his view (643b25). Second, in *History of Animals*, fish are marked off as gilled, finned (though some lack fins), footless swimmers (489b23-26). Finally, Aristotle proves that fish are footless at *PA* IV.13 695b19-24.

kind of fish and a particular kind of snake, that are different and other from each other.

This particular passage runs as follows:

Yet if it is impossible for some indivisible (ἄτομον) and unitary (ἓν) form (εἶδος) of *ousia* to belong (ὑπάρχειν) to animals that differ in form—rather, the form will always have a difference, as bird differs from mankind (for their two-footedness is other and different)—then even if they are blooded, either their blood is different, or blood should be reckoned as no part of their *ousia*. If this is how it is, one difference will belong to two animals. And if *this* is the case, it is clearly impossible for a privation to be a difference (643a1-7).

One assumption in this argument is that each animal is a particular kind of *ousia* that is indivisible (ἄτομον) and one (ἓν) (643a1-2). Since footlessness belongs to both fish and snakes, this differentia can be no part of the *ousia*. But Aristotle accepts that both fish and snakes are footless (*HA* I.5 489b23-26, *IA* 708a9-13). Dichotomous division, then, cannot grasp the particulars species that fall under the genus fish or snake for dichotomous division would treat fish and snakes under one genus instead of two. The real problem is that dichotomous division treats “footless” as one predicate when it is really many, e.g., the kind of footlessness that belongs to fish and the kind that belongs to snakes. Nothing in my interpretation conflicts with this view. Aristotle’s method of division in zoology can accommodate privative differentiae. The nature of the genus or species will explain why such a differentia belongs, and since the generic nature of fish and snake are different, the reason why being footless belongs to each will differ. The differentia “footless” will be different and other to each other in respect to which genus it belongs, just as two-footed in bird and human being are different and other, because the explanation for the being of that part will differ in each case. The other two arguments present further problems for dichotomous division in respect to privative differentiae.

These problems will be resolved on my understanding of the reforms of division by the same means as presented above.

There is another issue that is raised by this passage. How do the differentiae relate to the *ousia*? Is Aristotle using “belong” (ὑπάρχειν) to express the first sense of *per se* or in the second sense? If Aristotle uses “belong” to imply as in the first sense of *per se*, this supports the view that the essence will be defined by many differentiae. If Aristotle uses “belong” to mean as in the second sense, the essence will be a constituent of the definition of any of the parts. The evidence in *Parts of Animals*, as I will show in the fifth chapter, supports the second view. Aristotle gives a proof through the essence that two-footedness belongs to human beings (IV.10 686a25-b1) as well as appealing to the generic essence of a bird to prove that they are two-footed (IV.12 693b5-14). On the other hand, Aristotle claims several times that being blooded (ἔναιμα) is in the *ousia* or in the formula of the *ousia* (678a33-34, 693b5-6, 695b19-20). Given these passages, being blooded seems to be a genus (or differentia) in the definition of the essence of a particular animal. I will argue in the fourth chapter how Aristotle can distinguish between differentiae in the definition of the essence of an animal and the differentiae that belong to the animal through the essence, i.e., belong in the second sense of *per se*.

The fourth argument (643a27-31) really just presents a rule: the zoologist should divide by features that are in the *ousia*, not by the proper attributes. I have already discussed how my interpretation is consistent with this rule above. The next two passages, arguments 5 and 6, also discuss rules. The next rule is that the zoologist should divide by opposites (643a31-34). Opposites are different from each other and divide the genus non-incidentally. An incidental division would be, for example, dividing a genus

by swimmers and what is colored. If the genus is not divided incidentally, then the differentiae can mark off those species that fall under that genus. This insures that the species under a genus can be marked off properly. The final rule is that animals should be divided by functions common to soul and to body (643a35-b8). Aristotle's example is not to divide animals into walkers and flyers, for some animals admit to both. He also claims in the same argument that the zoologist should not divide a genus into wild and tame, for many animals admit to both. This rule, then, seems to prevent the zoologist from breaking up any species and marking off the same species under opposing differentiae. Once again, Aristotle is assuming the indivisibility of the species, so it is consistent with my view. These rules do not imply that a species is defined by many differentiae.

The final passage is important for it spells out Aristotle's positive method of division in zoology rather than a critique of dichotomy. The passage is as follows:

Speaking generally, this is a necessary result of dividing any sort of difference by a single division. Rather, one should try to take animals by kinds, following the lead of the many in demarcating a bird kind and a fish kind. Each of these has been defined by many differences, not according to dichotomy. For if one uses dichotomy, it is either altogether impossible to grasp something (since the same thing falls into many divisions and opposed things into the same division), or there will only be one difference, and this one, whether it is simple or the result of interweaving, will be the final form (643b9-16).

The first step is to locate animal genera that mark off a plurality of species that hold certain attributes in common. Aristotle's example here, as previously at 642b14, is bird and fish. These genera have been marked off by many differentiae. The zoologist, to grasp the particular, should begin division from such differentiae. It seems that Aristotle implies a previous step of collection, where the zoologist empirically investigates animals for features that can be counter-predicated. Counter-predication can be used to mark off

a genus by showing that certain features always belong together. For example, all feathered animals have wings of a certain sort, and all winged animals of a certain sort have feathers. When predicates can be shown to counter-predicate, the assumption is that there is some nature that accounts for why they belong to the same kind of thing. Once these differentiae have been shown to belong to a certain genus of animal, e.g., bird, the zoologist can then divide these differentiae to grasp the particular species of animals under that genus. This is the second step. Dichotomy fails, as the passage states, for it will either make the same animal different or different animals the same, or if it marks off a species properly, the last differentia must be the form of the thing. But a certain kind of bird could have a distinct beak, a distinct kind of feather, and distinct kind of wing. No single feature marks off the bird as distinct because each of them does. So, Aristotle's view of division is that it will not determine the form of any particular animal but merely mark off these distinct species through the relevant differentiae. But if the zoologist has properly determined that these differentiae belong to a given species, he can then seek the form and the definition of that species of animal by assuming the differentiae as conclusions to demonstrations. Counter-predication, then, is one way of establishing a fact. Once the facts have been established of a kind, the zoologist can divide to seek the definition of a particular species. Division will not be sufficient, so the zoologist will need to appeal to structure of a demonstration to seek the middle term. This is how the arguments in *Parts of Animals* I.1 and I.2-3 form a coherent whole. Both collection and division and the structure of a demonstration are used to seek the definition of a particular species. Now, the definition of the animal will be the middle term that explains why all

these various differentiae belong. Aristotle's practice of zoology will make clear that these differentiae are the various parts of an animal that belong *per se*.

I have already looked at the final argument (643b26-644a11). But this argument with the previous argument (643b9-16) takes one more step toward solving the first aporia. The first chapter of *Parts of Animals*, as I argued in the previous section (3.5), established what kind of cause is most relevant in zoology, the final cause, and what are the relevant facts, the animal parts. But this just implies that a definition of an animal can be sought. The first aporia asks in what way the zoologist should seek the definition. Should the zoologist proceed with each species singly or first try to establish something common? *Parts of Animals* I.2-3 sheds some light on how to answer this. It will depend on the kind of animal. Aristotle states twice that bird and fish have been marked off properly as genera by the many (642b14, 643b12-13). These kinds of animals have attributes in common, so to define each singly as, e.g., sparrow or eagle, would ignore why these attributes belong to the species that fall under these kinds. On the other hand, human being seems to have distinct features that are not shared in common, e.g., its two-footedness is different and other than the other things that are two-footed (643a3). If an animal has distinct attributes, the cause for why these attributes belong will be distinct. It seems likely that it will be the essential nature of the thing. So, Aristotle's critique of dichotomy adds a positive step in solving the aporia. There seems to be at least two ways to proceed to find a definition of an animal properly: singly and by what is held in common. Why there are these two distinct ways is due to the nature of the animal, some animals have a plurality of parts they do share in common with a kind, and some animals simply have distinct attributes. But Aristotle still needs to ask if there are various generic

levels that must be sought out to define an animal, for all animals seem to share at least some attributes in common (639a19-21). This is where Aristotle picks up the argument in the next chapter.

3.7 The Solution to the First Aporia: The Possibility of Zoology as a Science

The first aporia of *Parts of Animals*, as I argued in section 3.4, is about the proper way to define an animal in zoology. For zoology to be a science, there must be an object that admits to definition. This is the animal kind—primarily the animal species, e.g., human being, ox, lion, etc, but it can also be the genus, e.g., bird or fish, in a way. Although the *Metaphysics* argued that the genus is not the proper object of definition, for it is not an *ousia*, certain animal genera serve as the final cause for why various attributes belong and the specific natures of animals that fall under these genera have the nature of the genus in their definitions. Now, once the definition is found, it can be used to demonstrate why the various attributes belong to the thing universally, necessarily, and *per se*. The aporia arises because there seem to be two distinct ways to define an animal, taking up an animal species singly or locating common attributes and establishing a genus. We can now turn to see how Aristotle resolves this aporia. But one issue is left open. There seems to be multiple generic levels of explanation. Aristotle is asking which, if any, of these generic levels are appropriate to establish in order to find the definition of an animal. *Parts of Animals* I.4 raises this issue and begins as follows:

One might be puzzled (ἀπορήσειε) why people have not named one kind (γένος) that embraces both the water-dwelling and flying animals, comprehending both at once by one higher name. For there are some affections common both to these and to all other animals. Nevertheless, they are correctly defined (διώρισται) in this way. For those animals that differ by degree and the more and the less have

been brought together under one kind, while those that are analogous have been kept apart. I mean, for example, that bird differs from bird by the more and by degree (for one has long feathers, another short feathers), while fish differs from bird by analogy (for what is feather in one is scale in the other). But to do this in every case is not easy; for most animals have the same affections by analogy (644a12-23).

Given the language of the passage, using “ἀπορήσεις”—a verbal form of the noun “aporia”, Aristotle seems to be raising another aporia. Balme makes no mention of this passage raising an aporia.²³² Lennox, though, sees the aporia as why people have named certain genera but have failed to name others.²³³ The problem is that fish and birds, according to Lennox’s view, have analogous likenesses, so the question is should these likenesses be grouped and given a name to mark off a higher genus that encompasses both. But this is not what the passage states, at least it does not state anything about analogous likenesses to raise the aporia, but it does appeal to such a distinction to solve it. Instead, Aristotle is asserting that birds and fish have affections in common, not just with each other but also with all other animals (644a15-16). There is no indication in the text that these affections are merely analogous likenesses. Further, if the likenesses of the affections were just analogous, there would seem to be no reason to raise a problem. Aristotle accepts that analogous things are in different genera, as the solution states (644a19). It would seem that Aristotle is accepting that there are genera above the level of bird and fish. The genera at the level of bird and fish have already been acknowledged by Aristotle in his critique of dichotomy. These genera are often called in the literature the “extensive genera”.²³⁴ What are Aristotle’s reasons for accepting genera above the

²³² See Balme, *De Partibus Animalium*, p. 120.

²³³ See Lennox, *On the Parts of Animals I-IV*, pp. 167-68.

²³⁴ See, for example, Lennox, *On the Parts of Animals I-IV*, pp. 168-69. This view is widely accepted, though Pellegrin does not find it convincing. He finds some evidence that the term extensive genera is used at various generic levels as well. For Pellegrin, Aristotle uses “extensive genus” to signify a class that has

level of the extensive genera? First, animal is clearly a genus. But this genus does little work in the zoology except mark off the object of study from other things. Second, if bird and fish have common affections with each other distinct from other kinds of animals, there would seem to be a genus above it that would also fall below animal. For example, according to Aristotle, bird and fish both have hearts, but there are bloodless creatures that lack hearts but have something analogous (*PA* IV.5 681b29-31). Finally, the use of “nevertheless” (ἀλλ’ ὅμως) is further evidence that Aristotle accepts higher genera above the genus bird and fish, for there would be little reason to use such a term that implies what was stated before still holds. What, then, is the aporia?

The solution can help us interpret the aporia. Aristotle begins his solution with the claim that these genera, e.g., bird and fish, are, nevertheless, defined (διώρισται) correctly in this way (644a16-17). Aristotle uses the same term, “define” (διορίζειν), in the first aporia passage (639a17). Further, Aristotle states in the first aporia that there are affections in common that belong to animals found in many different genera (639a18-21). It would seem that Aristotle is returning to the first horn of the first aporia and is asking what is the proper level of generality from which to begin to seek out the definition an animal. For example, the zoologist could begin from the genus bird and fish, which have been marked off by common attributes and a name, or the zoologist could begin from a higher genera, such as blooded or bloodless, which have not been named (642b15-16). The aporia arises because, for any single animal, there are various levels of nested genera under which that kind of animal falls. This follows from the fact that animals have

nested classes below it, e.g., the various kinds of birds are nested within the genus bird. See Pellegrin, “Logical and Biological Difference: The Unity of Aristotle’s Thought”, in *Philosophical Problems in Aristotle’s Biology*, pp. 327-28.

affections in common above the extensive genera such as bird and fish. Hence, these affections require a common cause, and that is the nature of the genus to which they belong. But the genera such as fish and bird have been marked off and accepted as an appropriate level from which to seek a definition (*PA* I.2 642b13-14, I.3 643b11-12). For example, bird has been marked off as having features in common, such as the fact that all birds have feathers, wings, beak, and two-feet. The same reasoning could be applied to higher genera, for example, all blooded animals have a heart, at least one stomach, a liver, and blood vessels. But these predicates vary so widely amongst the extensive genera that little can be gained by operating at such a generic level. The *aporia*, then, as I read it, concerns how one marks off an appropriate generic level amongst animals from which the zoologist can proceed and define an animal adequately.

Aristotle's solution is that those animals that differ by the more and the less have been grouped properly to seek out the definition of the kinds that fall under such genera, whereas those animals that have analogous features have been grouped apart. That is, the extensive genera are appropriate genera for seeking the definition whereas higher genera are not. This seems to ignore the claims just made that bird and fish do have affections in common both with each other and all other animals. The example in the passage may be helpful at this point to clarify why this solution is appropriate. Aristotle appeals to the feather of a bird, which could be short or long, and the scale of a fish, which is only analogous to a feather. Both parts are coverings for the body. They both also contribute to the end of the animal. The parts most likely to contribute to the end of the animal are the external non-uniform parts. These kinds of parts are also likely to be analogous across extensive kinds, e.g., wing is to bird as fin is to fish or four-footed is to mammal.

These same parts also differ by the more and the less within the extensive genus. For example, fish have either 4 fins or 2 fins or some have no fins. Aristotle seems to be appealing to the theoretical principles established in the first chapter. This chapter determined that an animal is defined in respect to its end or final cause (639b12-21) and the parts belong for the sake of this end (640b17-28). There seems to be no good reason for Aristotle to ignore these theoretical claims here.²³⁵ We will also see that he appeals to them more directly in his solution to the first aporia (644b1-7). The solution, then, on my view, implies that the affections in common above the extensive generic level, although not analogous, do not mark off the nature that defines the animal in question. Although the common affections that belong beyond the extensive generic level do form natural kinds on my view, these groupings will not be able to pick the proper *per se* attributes or relevant facts of an animal that enable the zoologist to find the middle term and the definition of that animal. The attributes that belong due to the nature of higher genera extend further than the attributes that belong due to the nature of an extensive genus or the nature of a particular species. On the other hand, the generic nature of a bird or fish is defined in relation to the end of a particular kind of animal that falls in that genus. Aristotle defines bird as animals with the capacity for flying (*PA* IV.12 693b12) and fish as animals with the capacity for swimming (*PA* IV.13 695b20). The attributes that belong according to this kind of genus do help the zoologist seek out the middle term and definition of the particular animal species. Another good reason for accepting this view of the aporia here (644a12-23) and its solution is that, as I will show below, it is presupposed in the solution of the first aporia.

²³⁵ For example, Lennox does. He reads the passage as implying no theoretical principles have yet been established to distinguish which parts are analogous rather than admitting to the more and the less. See Lennox, *On the Parts of Animals I-IV*, p. 168.

My view also incorporates the claim that an extensive genus is marked off by affections that differ by the more and the less. Animals that have affections that are analogous to the kind in question differ in genus. The problem with holding this view is that Aristotle gives us little or nothing to determine whether affections differ by a more or less or by an analogy. Lennox informs us in his commentary that Aristotle does not decide this question here.²³⁶ It seems to me that the determination can only be made from knowing the nature of the object or objects in question. Empirically, a scientist may group together affections that actually differ by analogy believing that they differ by a more or less or vice versa. But the scientist cannot determine if this grouping is appropriate apart from grasping the nature of the object in question. For, the nature of the object can demonstrate what affections belong to it *per se*. Only affections that belong to a genus *per se* will differ by a more or less in the most technical sense. So, given the empirical nature of science for Aristotle, he cannot determine what will count as affections differing by a more or less or by an analogy prior to inquiry. The ultimate way to make this distinction is only through inquiry—by finding the middle term and the nature of that genus or species. On the other hand, the theoretical assumptions established in the first chapter can aid the inquiry into discovering which parts are those that differ by a more and less and which parts differ by analogy. It will depend largely on what work defines the part and how that work relates back to the end of the animal. But this is really just the same thing as saying that one needs to find the nature of the genus or species to determine when parts differ in what way.

Aristotle is now ready to solve the first aporia. His solution is as follows:

²³⁶ See Lennox, *ibid.*

Perhaps, then, the right course is this. In some cases—whenever kinds are spoken of by people in a clearly defined manner and have both a single common nature (μία φύσιν κοινήν) and forms in them not too distant—we should speak in common according to kinds, like bird and fish and any other there may be that, though it is unnamed, embraces, like a kind, the forms within it. But whenever they are *not* such as this, we should speak one by one, e.g. about mankind and any other such kind (644b1-7).

The solution to the aporia is that the method appropriate for defining an animal will depend upon what kind of animal it is. If the animal has a common nature with other animals, such as a bird or fish, then the zoologist should establish this common genus first and then proceed to define the particular species. This makes sense on theoretical grounds. A differentia cannot belong to two different genera unless one genus is subordinate to the other. Fish and bird may be subordinate to the genus blooded animal and definitely to the genus animal, but neither level of generality has both a common nature and forms underneath it not too distant, i.e., differing by the more and the less. The higher genera simply have a common nature. On the other hand, birds have attributes in common marked off by differentiae that belong in respect to a common nature. These differentiae are further differentiated by opposites in degree, e.g., short or long or hooked or straight. So, the forms under this genus, e.g., eagle, sparrow, etc., differ by the more and the less. I interpret the common nature to be the end of that animal, e.g., the capacity of flying for bird or capacity of swimming for fish. This is consistent with both his theoretical claims established in the first chapter (641a25-29) and his practice of zoology in the fourth book (IV.12 693b12, IV.13 695b20).

Now, if the animal does not have such a common nature by which it is grouped and marked off from other things, but a particular single nature, then there is no extensive genus by which this species is marked off. The zoologist would need to seek the

definition of this particular species by itself, taking each species that is such and finding its peculiar attributes. The differentiae that mark off this kind of species will be distinct, although analogous to other kinds of animals. For example, human beings have two feet for locomotion and so does the ostrich, but their two-footedness is different and other to both each other and to bird. The kind of feet that belong to human beings and the kind that belong to ostrich are distinct, for the human being are the only split-footed, two-footed animal (*PA* IV.10 686a25-27, cf. 690a27-b10) and an ostrich's feet are hoofed (*PA* IV.14 697b23-25).

An objection to this view is that I have read my interpretation of a single feature defining an animal into the claim "one common nature".²³⁷ Both Balme and Lennox would perceive their interpretations to be consistent with the claim that bird or fish has one common nature although they are defined by many differentiae. The support for my interpretation is the text prior to the solution, for there Aristotle raises the *aporia* again as follows:

Since, however, it is the last forms that are *ousia*, and these, e.g. Socrates and Coriscus, are undifferentiated in respect to form, it is necessary either to state what belongs generally first or to say the same thing many times. And things that belong generally are common; for things that belong to many we call general. There is, however, a puzzle about which of these two should be our subject. On the one hand, in so far as what is indivisible in form is an *ousia*, it would be best, if one could, to study separately the things that are particular and undivided in form—just as one studies mankind, so too bird; for this kind has forms. But the study would be of any one of the indivisible birds, e.g. sparrow or crane or something of this sort. On the other hand, in so far as this will result in speaking many times about the same affections because it belongs in common to many things, in this respect speaking separately about each one is somewhat silly and tedious (644a23-b1).²³⁸

²³⁷ This view is also held by Charles. For his defense of it, see his *Aristotle on Meaning and Essence*, pp. 312-16.

²³⁸ I will note that Balme actually claims that Aristotle gave the view asserted in the first line due to his research into the reproduction of individual animals. So, Balme claims that this passage must be earlier

Aristotle stresses in this passage that the object of study is an *ousia* and it is indivisible and undivided in form. A form defined by many differentiae seems to be neither. On the other hand, since the many differentiae can be used by the zoologist to seek for the definition of the form, the form must be both indivisible and undivided to account for them. Even if someone holds onto the other view that the essence of an animal is defined by many differentiae, the passage above does not conflict with my interpretation. In my view, the strength of my interpretation rests on the fact that Aristotle can both maintain the unity of the definition as one, final differentia and hold onto the view that seeking this definition is through many differentiae that just are the material parts of an animal. No other account that allows the unity the definition of an animal appears in the literature.

The above passage also clarifies why Aristotle can accept both methods for seeking the definition. Aristotle accepts that different species of birds, e.g., sparrow, crane, etc. are also indivisible *ousia* just as a human being is. The difference is that all birds have attributes in common due to their common nature. Once the zoologist has determined what these attributes are, using multiple differentiation and the structure of a demonstration, the zoologist can grasp the definition of the particular species. The assumption about the nature of animal that does not fall under an extensive genus is the same. Any animal is defined by one single nature. But some animals share that nature in common with other species, e.g., bird or fish, while other animals do not, e.g., human being and ostrich.

I have now argued what theoretical principles Aristotle establishes in the first book of *Parts of Animals* and how he will proceed to find the definition of any particular

than his work in *Generation of Animals*, which, according to Balme, must be Aristotle's most mature work in zoology. See Balme, *De Partibus Animalium I*, p. 168.

kind of animal. An animal is defined by its form, which is its end, and the various parts of animals can be grasped and used as facts to seek out the definition and middle term that demonstrates why these attributes belong to that kind universally, necessarily, and *per se*. Aristotle's rejection of dichotomous division and seeking a definition via multiple differentiae are fully compatible with the claim in *Metaphysics* Z.12 that the form and *ousia* of an animal is the one, final differentia. The science of zoology is an inquiry into the nature of this form and its definition. The parts of an animal are the means by which we seek this definition. Hence, it is important for zoology to follow multiple lines of differentiation, but this path does not undermine the unity it will ultimately recognize in a nature.

Even if my defense of the theoretical principles and multiple differentiation hold, there is still a large problem for my view. Literally, there is a large problem for any one who accepts Aristotle's solution to the first aporia. Aristotle just simply does not proceed in such a manner. He does not begin his inquiry into the nature of the various extensive genera, e.g., bird or fish, or the nature of a species that does not fall under an extensive genus. Rather, Aristotle begins with what is in common with animals. Even worse, this is what he announces at the end of *Parts of Animals* I.5. Finally, it seems Aristotle is comfortable showing attributes belonging to an animal through multiple middle terms. This would seem to imply that there is no unified definition of the form. Form is composed up of various parts. In the next chapter, I will explore these problems and see how Aristotle's method in the rest of *Parts of Animals* is consistent with the theoretical and methodological principles I have argued for in this chapter.

**CHAPTER IV:
FROM THEORY TO PRACTICE:
PARTS OF ANIMALS I.5**

4.1 Introduction

Given the solution of the first aporia in *PA* I.4, we would expect Aristotle to begin his practice of zoology by finding the essences of various extensive genera and the essences of those kinds that do not fall under an extensive genus and then demonstrate what belongs to each of these kinds *per se*. This is not exactly what occurs in the next three books of *Parts of Animals* though Aristotle does something like this in the last five chapters of the fourth book. This leaves us with a question: what is Aristotle doing in the prior books? Why is he not the methodology he proposed to resolve the first aporia? Balme, Gotthelf, and Lennox take this as a sign that Aristotle cannot demonstrate the various parts of animals through the same middle term.²³⁹ Rather than claiming that the scientific logic developed in the *Posterior Analytics* is too rigorous to be applied to zoological entities, these scholars argue that each animal falls under various genera. Each genus has its own distinct nature that explains the various *per se* features. Their position is that empirical research into the nature of animals led Aristotle to the view that an animal is too complex for all of its various features to belong through the same middle term. These scholars also argue that the explanations are in conformity with the logic

²³⁹ Balme sees no need for the same middle term in practice because it is the *Metaphysics* that ultimately resolves the unity of the animal. Gotthelf and Lennox are more conservative in their answers. They simply claim that it is the case that Aristotle appeals to different middle terms in practice. Balme, "Aristotle's Biology was not Essentialist", in *Philosophical Issues in Aristotle's Biology*. Lennox, "Material and Formal Natures in Aristotle's *De Partibus Animalium*", in *Aristotle's Philosophy of Biology*. Gotthelf, "Notes towards a Study of Substance and Essence in Aristotle's *Parts of Animals* ii-iv", in *Aristotle on Nature and Living Things*.

developed in the *Posterior Analytics*. Gotthelf and Lennox follow Balme here. Aristotle uses collection and division to group together various animal parts or other features of an animal such as habits or actions so that the zoologist can seek the cause, a generic character.²⁴⁰ Those who take this approach must admit that Aristotle cannot maintain some of the claims made in the *Metaphysics* concerning *ousia* in the zoology.²⁴¹ Charles also subscribes to this view, but for different reasons than Balme, Gotthelf, and Lennox.²⁴² Charles takes the theoretical claims developed in the first book of *Parts of Animals* to be consistent with the views of *ousia* developed in the central books of the *Metaphysics*. Both demand the unity of form. Charles understands this unity to be simple, so the definition of an animal must be non-complex. The problem, according to Charles, is that Aristotle does not locate a non-complex definition of any animal to demonstrate what attributes belong *per se* in the biological writings. According to another view of why Aristotle's practice of zoology differs from what his theory requires, Pellegrin argues that Aristotle is not concerned with species in his zoology, i.e., finding the essence of any given species, but rather with finding animal parts and their natures.²⁴³ For Pellegrin, the zoologist's work is to locate various genera, each of which turns out to be the nature of some part. The zoologist then divides the genus to find the specific

²⁴⁰ Balme has good reason to hold this view. Aristotle states something like this methodology in *History of Animals* (I.6 491a7-12). I do not object to the methodology in one way. What I will show in the fifth chapter is that the various middle terms and causes used to explain why the parts of animals belong are nested, so that, if the final differentia that defines a species entails all previous differentiae and the original genus, the explanation is at least possible through one middle term. I will argue later in this chapter why Aristotle does not present his zoology in this format, but the answer is simple. It will be tedious and silly, as the first aporia says (644a33-35). For Balme's view, see "Aristotle's Use of Division and Differentiae", pp. 80-89.

²⁴¹ See Balme, "Aristotle's use of division and differentiae", Gotthelf, "First Principles in Aristotle's *Parts of Animals*", and Lennox, "Divide and Explain: the *Posterior Analytics* in practice", all of which are in *Philosophical Issues in Aristotle's Biology*.

²⁴² See Charles, *Aristotle on Meaning and Essence*, Ch. 12.

²⁴³ Pellegrin argues that Aristotle only discusses the parts in his zoology because these are the only features sufficient to form genera and by divide via proper differentiation. See Pellegrin, "Aristotle: A Zoology without Species", in *Aristotle on Nature and Living Things*.

nature of the parts. The specific kinds of animals, if they are known at all, are known through what kinds of parts they have. Finally, Jonathan Barnes would likely say that the difference between Aristotle's theory and practice of science is not due to any special features of the zoology because in no case is the theory able to accommodate empirical complexities.²⁴⁴ On the other hand, G. E. R. Lloyd disputes the Balme-Gotthelf-Lennox claim that Aristotle does follow his own theory of scientific logic to a significant extent. He argues that the demonstrations in the biological writings do not have the same rigor in respect to the theory developed in the first four chapters of the first book of the *Posterior Analytics*.²⁴⁵

There is a web of problems that must be resolved in order to see that my interpretation of the theoretical solution of the problem of one or many differentiae is also followed in practice, since it depends both upon the main claims of the central books of the *Metaphysics* being assumed in the zoology as well as the fact that Aristotle can find the essence of a natural kind and construct demonstrations in the zoology. I will argue in this chapter that Aristotle makes a transition from the theoretical chapters of the first book to the practice of zoology as presented in the rest of *Parts of Animals*. The theory laid out in the first four chapters of *Parts of Animals* has not yet been adequately developed to handle all issues in respect to the practice. The final chapter of the first book of *Parts of Animals* addresses these above issues raised by the various scholars. This final chapter of *Parts of Animals* shows how the zoologist can seek the essence of an

²⁴⁴ See Barnes, "Aristotle's Theory of Demonstration", in *Aristotle's on Aristotle: Vol. I*,

²⁴⁵ Lloyd argues that Aristotle uses the *term* demonstration to refer to numerous forms of arguments, many of which do not conform to the rigor of the *Posterior Analytics*. The demonstrations in zoology fail, as discussed in the previous chapter, due to the fact the middle term is a final cause and demonstrates its antecedents and not the consequences of it. See Lloyd, "The theories and practices of demonstration", in *Aristotelian Explorations*, Cambridge: Cambridge University Press, 1996.

animal without violating the unity of the definition of the essence. This transition will also help prepare us for what to expect in the last three books of *Parts of Animals*, both the order of the presentation and the kinds of explanations used. The main argument of this chapter will show how there can be various middle terms employed to explain *per se* attributes of the same animal yet not threaten the unity of that being or its definition.

The various positions in the literature concerning the zoology above seem to point to two main problems: is it possible for there to be demonstrations in the zoology and are these demonstrations through the same or different middle terms? I have handled the objection to whether there can be demonstrations in the previous chapter, and the solution to the first aporia implies that one middle term is sufficient to demonstrate all the *per se* attributes, but the practice of zoology tells otherwise. Scholars interpret the plurality of middle terms to explain *per se* attributes as equivalent to the problem of horizontal unity of the differentiae. There seems to be no unifying feature of an animal that explains the multiple of differentiae that belong to one particular species. I will argue in this chapter that *Parts of Animals* I.5 refines the methodology of seeking the middle term to accommodate and resolve the problem of horizontal unity. The reason why I believe this problem has not yet been solved is that the problem is really a problem of vertical unity. On my view, the multiple of middle terms are really nested genera ultimately implied in the final differentia that Aristotle is seeking.

I will argue in section 4.2 that Aristotle's return to the first aporia is to settle methodological issues that will clarify how he proceeds in the practice of zoology. Aristotle's methodology requires that the higher genera ruled out in the first argument of *Parts of Animals* I.4 need to be sought out to help locate both the extensive genera and

the species that are unique. But if Aristotle argues that there are various levels of explanation of a single animal, such a claim leads to the second problem raised by the commentators, specifically Charles. If there are various levels of explanation for why the *per se* attributes belong to an animal, would this not threaten the unity of the definition? I will argue in section 4.3 that Aristotle's teleological view of the nature of an animal is a pathway out of this problem. The various parts of an animal all belong ultimately for the sake of one complete end (*PA* I.5 645b15-20). I will also argue here that physics both assumes the unity of the definition, for the thing being defined is one, and analyzes the various features found in the definition. In section 4.4, I will turn to Aristotle's main terms of zoology: action (πράξις) and work (ἔργον). These terms will answer what aspect of the animal is sufficient to serve as the final cause. Although there are several kinds of actions that belong to an animal, the argument stresses that there is one primary action of any given animal. Now, since an animal has several actions, and each action unifies a plurality of parts, it would seem to follow from this that there would need to be various levels of explanation and even kinds of explanations present in zoology. This last point also connects to the final issue of this chapter. Aristotle states that there are at least three if not four different kinds of explanations in zoology (640a33-b1). I will conclude this chapter, section 4.5, with a look at how each of these kinds of explanation is either through the essence or presupposes the essence in the demonstration to be explanatory. I will now turn to the relevant parts of *Parts of Animals* I.5 to show how Aristotle transitions from theory to practice in zoology starting from Aristotle's return to the first aporia.

4.2 Method and Order of Inquiry: A Return to the First Aporia (*Parts of Animals* I.5 645b1-14)

Aristotle oddly returns to the first aporia at the end of *Parts of Animals* I.5. My claim is that this return signals Aristotle's own admission that not enough has been said to prepare the reader for the transition from theory to practice. As already stated, Aristotle does not begin his practice by locating the nature of the various extensive genera and the nature of the various particular species through his empirical inquiry into the nature of parts. Rather, he begins by discussing parts that are common to all animals. Aristotle suggests this starting point in the first aporia (639b19-20) but claims that these levels of explanation are irrelevant in respect to solving the first aporia (644a12-23). But as I argued in the last chapter (3.7), these levels of explanation or generic natures are not ignored because they have no role in the science of zoology. They are ignored as relevant in finding the definition of a particular species of animal. The natures of these higher genera do not unify the pertinent facts of an animal that enable the zoologist to seek the middle term and definition of an animal. Aristotle's return to this issue suggests that the nature of these genera do play some role in zoological inquiry. Let us turn to the passage where Aristotle returns to the first aporia to see what role these other genera play in Aristotle's zoology:

It is necessary first to divide the attributes associated with each kind (γένος) that belong in themselves to all the animals, and next to try to divide their causes. Now it has been said before that many common features belong to many of the animals, some without qualification (such as feet, wings, and scales, and affections too in the same way), and others analogously. By analogously I mean that while some have a lung, others have, not a lung, but instead something different which is to them what a lung is to those that have one; and some have blood, while others have its analogue, with the same potential that blood has for the blooded. To speak separately about each of these animals as particulars, as we

said before, will result in saying the same things many times, whenever we speak about all the attributes; the same attribute belongs to many animals. Let these matters be determined in this way (645b1-14).

Now, both Balme and Lennox acknowledge this return to the first aporia, but they have very little to say why Aristotle returns to it here.²⁴⁶ Lennox makes the more substantial claim that Aristotle is attempting “to integrate the discussion of division, similarity, and difference with the teleological conception of animals defended from 639b14 to 642b4.”²⁴⁷ I agree with the general claim that Lennox makes here. But there is a deeper issue here. According to Aristotle, the first aporia has already been resolved (644b1-7). Further, this solution is already in accord with Aristotle’s teleological conception of an animal. The essence of the extensive genus or species is the generic end or specific end for which all of the parts are for the sake of. Why does Aristotle return to the issue of the first aporia that has already been resolved? My claim is that there is an aspect of the essence of an animal that accounts for certain *per se* attributes that extends further than the extensive genus or the form of a particular species. Aristotle is returning to the first aporia to solidify the method and order of his inquiry for his practice of zoology. The problem of repetition of explanation will help explain why Aristotle begins with the features that extend further than the extensive genus or form as we find is the case in Aristotle’s actual practice of zoology in *Parts of Animals* II-IV. If this is the correct interpretation of Aristotle’s return to the first aporia, this shows why Aristotle appeals to various middle terms in his practice of zoology. Each of these natures will serve as a middle term in some way.

²⁴⁶ Balme, *De Partibus Animalium* I, p. 124-5. Lennox, *On the Parts of Animals* I-IV, p. 174-5.

²⁴⁷ Lennox, *ibid.*, p. 174.

There are other troubling aspects of the above passage (645b1-14). Aristotle speaks of dividing by the attributes, which seems to contradict the rule at *PA* I.3 643a27-30 that the zoologist should only divide by what is in the *ousia*. Is this passage consistent or inconsistent with the rule at 643a27-30? Another issue is whether Aristotle accepts blooded animals and bloodless animals as genera. The literature tends to deny this view.²⁴⁸ Certain language in the passage seems to imply that being blooded and being bloodless are genera, for being bloodless is analogous to being blooded and each accounts for attributes held in common due to these natures. Aristotle has already implied that things that have analogous attributes are different in genus (644a19-23). Further, a genus has a nature that will explain why certain attributes are held in common. The discussion of these issues will lead into a more refined view of the problem of one or many differentiae. There seems to be many levels of explanation of why the *per se* attributes belong to an animal. This implies that there are many middle terms to demonstrate these attributes. The middle term is the essence of the kind, so any animal would have many features in its essence. This last claim does not seem consistent with the view of *Metaphysics* Z.12 that an essence of an *ousia* is defined by one, final differentia. It appears that Aristotle, when turning to the practice of zoology, has either abandoned his view that an *ousia* is one in formula or he needs to present a different kind of solution to the unity of the formula of the essence in zoology. I will argue the latter option in the next section (4.3).

Now, in the quoted passage (645b1-14), Aristotle states that he is seeking the causes of why parts belong to this or that genus of animal. *Parts of Animals* I.1

²⁴⁸ For example, see Balme, *De Partibus Animalium* I, p. 120-21. Gotthelf leans towards saying that these could serve as genera, but he does not construct an argument for this position. See his "Notes towards a Study of Substance and Essence in Aristotle's *Parts of Animals* ii-iv".

concludes that this cause must either be the final cause or the cause from necessity. It would seem that Aristotle is speaking of the final cause. The final cause is primary (639b12-21), and it is this cause that explains primarily why the attributes belong (641a23-27). Final cause is also the form (639b14), for it is the formula, and the *ousia* (641a26-27), since the end of an animal is to be the thing that it is (cf. *Physics* II.7 198a24-26). But this gives us some access into why the first aporia is not entirely settled. What has been settled thus far is that the nature of some animals is held in common, and this must be sought first out to understand why the *per se* attributes belong and to seek the definition of these species, whereas the nature of other animals is distinct, and, in this case, the nature of the species is sought out straightaway through each species' particular attributes. What is being sought is the what it is of a thing and its form. Aristotle tells us that the formal cause of a thing, which is the same as the final cause, is the formula of the essence (*Physics* II.3 194b26-27). But this formula includes not just the final difference but also the genera of this difference and the definition's parts (194b27-29). So, if there are genera that fall below animal but above the extensive genera, e.g., bird, fish, etc., and the species, e.g., human being, then these genera too would be included in the nature of the animal and be part of the formal and final cause. It seems that Aristotle does admit that there are such genera or the aporia that begins *PA* I.4 (644a12-23, see also section 3.7) has no real bite. These genera, such as being blooded or being lunged, were ruled out not because they were not genera nor genera that have explanatory and causal significance for animals but because they failed to account for the appropriate kinds of attributes that are unified by a single cause. Aristotle is now returning to the question of the genera he excluded in the solution of the first aporia in *PA* I.4. The claim now, as I

interpret it, is that if the nature of an animal includes these genera in its formula, they must be sought out as well. These higher genera, e.g., being blooded, (if they are genera) will be the cause of why certain attributes belong to an animal. But the question remains why seek them out according to their own nature rather than as simply included in the nature of the extensive genera, such as bird or fish, or in the nature of a particular species? In other words, why begin with these higher genera rather than begin with the extensive genera or the distinct particular species, especially if Aristotle has already excluded them in resolving the first aporia?

The passage answers this question. If these higher genera are not studied in their own right the same problem in the first horn of the first aporia will arise: the zoologist would repeat the same explanation for why these attributes belong many times. Once again, repetition suggests, according to the *Posterior Analytics* (I.5 74a25-32), that the scientist has failed to locate the proper explanation for why such attributes belong. But there may be more going on in this passage. The first line of this passage points toward a methodological issue that Aristotle develops in the second book of the *Posterior Analytics* concerning how to seek both the what it is and to locate various levels of causes. This passage states:

It is necessary first to divide the attributes associated with each kind (γένος) that belong in themselves (καθ' αὐτὰ) to all the animals, and next to try to divide their causes.

Although the passage mentions the “attributes associated with each genus”, the attributes here being grouped and divided are those attributes that belong to all animals *per se*. This passage also suggests that by grouping and dividing these attributes, this will be

helpful in seeking the cause. Aristotle develops why division is helpful in finding the cause in *Posterior Analytics* II.14. The chapter even uses a biological example:

In order to get to grips with problems, you should make excerpts from the anatomies and the divisions. Do this by supposing the kind common to all the items and excerpting – if e.g. it is animals which are being studied – whatever holds of every animal. Having done this, next excerpt whatever follows for every instance of the first of the remaining terms (if, e.g., it is bird, whatever follows every bird); and in this way always excerpt whatever follows the nearest term. It is plain that we shall now be in a position to state the reason why whatever follows the items falling under the common kind holds of them – e.g. why they hold of man or of horse. Let A be animal, B what follows every animal, and C, D, E individual animals. It is clear why B holds of D: it does so because of A. Similarly in the other cases. And the same account will go for the lower items (98a1-13).

How will this methodology be helpful in seeking the cause? We must first state what a problem is for Aristotle in the technical sense. A problem, according to the *Topics*, is a thing about which there is a syllogism (I.4 101b17). So, for Aristotle, answering a problem entails determining whether a certain predicate belongs to a thing or not, e.g., whether a bird is a beaked thing or not. The predicate belonging to a subject would be the conclusion of a syllogism. A scientific problem would not only entail this question but also include answering the problem through the cause. In the passage above, Aristotle is showing how the method of collection and division helps solve problems and locate the cause at the proper generic level. For example, if an attribute follows for every animal, then the generic level of the cause is located. The cause for this attribute's belonging will be the nature of animals or some part of it. But if attributes are distinct for certain animals, then the cause will be at a lower generic level. Division, then, provides a way of grouping attributes and locating the proper level of their cause. So, if the zoologist seeks the cause for the *per se* attributes belonging to any animal, it would be best and most efficient to seek the widest generic cause first and then continue dividing

and grouping attributes beneath this genus to find causes for why various attributes belong.

The reason why Aristotle refers back to the first *aporia* should now be clear. The zoologist should start from the widest genus possible and, using division, discern the proper cause for the attribute belonging. Failure to do so results both in saying the same cause many times and also suggests that the scientist has not actually determined the proper cause for the part. Once again, we see that division of the attributes leads to a causal explanation and seeking out what is predicated in the *ousia* of a thing, assuming that the *ousia* is also the essence. So, the methodology of dividing the attributes does not conflict with the rule that the zoologist should only divide by what is in the *ousia* of an animal (643a27-31). If this is the case, then division aids in seeking out the one term that will define an animal, for division can mark off this one term from the higher genera under which the particular animal falls. I will spell this out in some more detail below. But we will also see that division does not occur independently of the empirical inquiry: collecting counter-predicates. Collecting counter-predicates helps locate where the zoologist should divide.

Division helps find not only the kinds of attributes held in common due to the nature of a higher genus, but also locates those attributes that are distinct to an extensive genus or to a particular species. And, in many cases, there is a generic attribute shared in common that is also differentiated specifically in accordance with the nature of lower kinds. For example, teeth are present in animals for a common reason: for the sake of the preparation of nutrition (*PA* III.1 661b1). But it is also the case that teeth differ according to specific kinds (661b2). Division of teeth will help us seek out these various

kinds. One example is the teeth of human beings: which, especially the front teeth, contribute to the making of articulate sounds (661b15-16). The ability to make articulate sounds with teeth belongs solely to human beings. This suggests that human beings have a specific nature distinct from all other animals. Conversely, the distinctiveness of human teeth suggests what human nature is: rational thought. Aristotle gives other examples in this passage. Some animal kinds will have teeth for the sake of protection, e.g., a lion. Other kinds, such as fish, will have many, razor sharp teeth to break up the food quickly so as not to take in too much water while eating (662a10-15). So, starting from the widest kind that encompasses all animals or the first division that encompasses all animals provides two distinct advantages for the inquiry. First, since all the genera to which any particular species belongs is in its formula, the zoologist will be able to grasp the nature of each of these genera in the formula and know what attributes belong to the kind of animal through these genera. Second, in investigating the widest genera, the zoologist can also begin to locate more specific kinds that reveal more about the nature of the particular species being studied.

This interpretation of the passage (645b1-14) explains why dividing by the attributes does not violate the rule that one should divide by what is in the *ousia* of a thing (643a27-31). By grouping and dividing the attributes, the zoologist is led to locate the various genera in the *ousia* of an animal. Each group of attributes that can be counter-predicated will pick out a different generic level of an animal. Grouping and dividing these attributes will help locate generic and specific levels of explanation for these animal parts. This also follows the other model of inquiry developed in the previous chapter (3.3). The counter-predicates pick out genera. Once the subject of the

inquiry is determined through counter-predication, the subject along with its predicates serve as conclusions of demonstrations, and these can be used to seek the middle term and the cause for these attributes belonging. Dividing the attributes, as we saw above in the case of teeth, helps locate lower generic levels of explanation such as fish and human being. This dividing will help the zoologist locate another set of counter-predicates and so also another generic or specific level of explanation. On these grounds, then, there seems to be no conflict between dividing by the attributes and dividing by what is in the *ousia* of an animal. Both help seek out the same thing: the middle term and the cause. Further, it shows an intimate connection between division and explanation, two different tools to seek out definitions, and how both can arrive at the same definition of an animal.²⁴⁹ But the question still remains, are the various levels between the genus animal and the extensive genera or particular species also themselves genera?

The problem is that the literature often does not take Aristotle to accept that distinctions like being blooded and being lunged are genera. Balme considers the blooded and bloodless distinction to be only groupings of genera.²⁵⁰ Lennox explains that that blooded and bloodless classes do not form genera because neither one has forms that fall under it differing by the more and the less.²⁵¹ But Lennox also holds that things with analogous likenesses are of different kinds.²⁵² Aristotle states that bloodless animals have analogous parts to bloodless animals and lungless animals to lunged animals (645b6-10). These classes of animals also fit other criteria for being a genus according to

²⁴⁹ This is one of the concerns of Charles in his book *Aristotle on Meaning and Essence*. I do not claim to have shown necessarily that both methods, division and explanation, always hit upon the same definition. But I have given a rough view of how to develop this line of argument. For Charles' concern, see especially, Ch. 9 "Towards a Unified Theory of Definition", pp. 221-44.

²⁵⁰ See Balme, *De Partibus Animalium I*, pp. 120-21.

²⁵¹ See Lennox, "Kinds, Forms of Kinds, and the More and the Less", in *Aristotle's Philosophy of Biology*, pp. 160-81.

²⁵² See Lennox, *On the Parts of Animals I-IV*, p. 168.

Aristotle. Each of them, e.g., being blooded and being lunged, seems to be the cause of a plurality of parts belonging to an animal. For example, blooded animals have a heart (*PA* II.1, cf. *PA* III.4), at least one stomach (*PA* III.14), a skeleton (*PA* II.9), and all five sense receptors located primarily in the head (*PA* II.10).²⁵³ Lunged animals also have parts in common from this source. Each lunged animal has a neck, an esophagus, and a windpipe (*PA* III.3). Aristotle suggests that lunged animal is a genus by stating that the kind is nameless, unlike ‘bird’, and is present in the *ousia* of these kinds of animals (*PA* III.6 669b7-12). Further, in response to Lennox, it makes sense that genera like blooded or bloodless animals would not have species (εἶδη) that differ by the more and the less beneath them. This would only hold for those genera that are marked off as extensive genera, such as bird and fish, where the specific nature of each species is just a difference of that very genus. The genus of blooded animals has diverse kinds that fall under it that could not be grouped by such a rubric. Nonetheless, the parts that belong because of the blooded nature of an animal do differ by the more and the less. For example, bones differ by the more and the less in different animals, for some have strong bones, e.g., vivipara, others have weak bones, birds, some have cartilage, and others have fish spine (*PA* II.9 655a17-34). Finally, Aristotle states several times that being blooded is in the formula of the *ousia* of specific kinds of animals (*PA* 678a33-34, 693b5-6, 695b19-20). So, there are good reasons for treating being blooded and being lunged as genera in zoology.

This raises a problem for my view. If any particular animal’s formula is composed of many genera, can the formula still be one in formula as *Metaphysics* Z.12 argued. In other words, is each genus a proper difference of the genus above it or the first

²⁵³ Touch, of course, is located throughout the body, but it is the one sense capacity necessary to be an animal. Taste seems to be so as well. The other three sense capacities, sight, hearing, and smell, are for the sake of living well, and Aristotle argues in *PA* II.10 that the head is the best place for these capacities.

difference and genus beneath animal? For example, if the genus animal is divided into blooded and bloodless animals (647a24-33), then is there a proper difference of being blooded? It is hard to say. But if there seems to be none, then it would seem that any definition of an animal will have multiple genera that are not one in formula. This result will be tantamount to Aristotle abandoning the view that an animal is defined by one, final differentia. On the other hand, Aristotle may appeal to a different solution within physics and the science of zoology. The next argument in *Parts of Animals* I.5 will help resolve the problem of the unity of the formula of an animal. Aristotle argues next that all the parts of the body are for the sake of the end of an animal and this is its soul and its definition.

But we can now solve one problem raised at the beginning of this chapter. Zoology is about the parts, but it is not only about the parts as Pellegrin argues. The zoologist is seeking the explanation for why these parts belong to various animal kinds. The problem now is that there appear to be various animal kinds, and kinds nested within kinds, e.g., a sparrow is both a bird and a blooded animal. Can this plurality in the formula be avoided? More will be said below about why Aristotle accepts levels of explanation in zoology, but for now we have seen sufficient textual evidence for this and learned that Aristotle treats these various levels of explanation as genera, each with their own nature.

4.3 The Unity of the Thing and the Unity of the Definition: *Parts of Animals* I.5 645b15-27

Aristotle has now made clear the order of the inquiry into the nature of an animal. The zoologist will proceed by locating the widest kinds first and then dividing by the

attributes to seek out lower genera and finally the nature of a particular species of animal. But this view of inquiry leads to the problem that the definition of an animal, the formula of its essence, has a plurality of parts that are not clearly one. The various genera of the formula are themselves distinct aspects insofar as they state something about the *ousia* of the animal. These genera are not themselves a difference of a difference. But Aristotle has another way out of this problem. On the one hand, Aristotle will show that the composite whole is one being. The various parts of an animal are for the sake of the end. It is also the case that these material parts altogether are not different than the end. If this latter is the case, and if some of the material parts belong to an animal are due to nature of the various genera, then the nature of these genera would seem to be included in the end as well. I interpret the ultimate end to be what is expressed by the final differentia. The various genera will be nested and all will be included in the final differentia. Any lower genus entails the nature of those which it falls under. This does not appear to be as strict of a unity as the solution in *Metaphysics* Z.12. But the science of zoology, being a branch of physics, may not itself be able to propose a more strict solution. For, the science of zoology is also of the material, and, since the material is understood through the form, and this form entails many genera, then the zoologist must also break apart the definition of the form into its different genera so that he may understand why all the parts belong to a certain kind of animal. Although the relation of nested genera is not the same as proper differentiation, at least for the various genera found in the formula of the essence of any animal, it does not differ from the solution in *Metaphysics* Z.12 in a significant way. For, if each genus entails the nature of its previous genera, there seems to be little difference between this relation and taking the difference of a difference and

assuming the first genus is itself either material or nothing apart from the species that fall under it. The result is the same, primarily because proper differentiation is a kind of subsumption. The final differentia is still the form and the *ousia* of an animal, and the other parts of the definition are subsumed in this differentia implicitly. I will develop this interpretation of the unity of the formula below beginning from Aristotle's argument that the composite whole is one thing and so must have a definition that is itself one.

Before we take a close look at the argument for the unity of an animal, we need before us the most important aspect of Aristotle's zoology: an animal is an *ousia*. The *Metaphysics* tell us that the defining feature of an *ousia* is one, final differentia (Z.12 1038a19), and this differentia is also an actuality (ἐνέργεια) of some material (H.2 1043a6). We also learn that the soul is the *ousia* according to the formula (λόγος) of an animal (Z.10 1035b14-5). And the formula is most appropriately of an animal's essence or *ousia* (Z.5 1031a10-1). All of this can help us understand Aristotle's comment in the first chapter of *Parts of Animals* that zoology as a science is not possible without a defining *ousia* and essence (642a26). An argument at *PA* I.5 645b15-20 shows how Aristotle thinks zoology makes use of essential definition:

Since every instrument is for the sake of something, and each of the parts of the body is for the sake of something, and what they are for the sake of is a certain action (πράξις), it is apparent that the entire body too has been constituted for the sake of a certain complete action (πράξις). For sawing is not for the sake of the saw, but the saw for sawing; for sawing is a certain use. So the body too is in a way for the sake of the soul, and the parts are for the sake of the functions (ἔργα) in relation to which each of them has naturally developed (645b14-20).²⁵⁴

We must first analyze the argument before we see how it answers on what grounds Aristotle can include various generic levels in the definition without violating its unity as

²⁵⁴ Translation by Lennox, *On the Parts of Animals I-IV*, p. 15.

well as how the definition of a particular kind of animal includes features in common to all animals. But we should first acknowledge this passage confirms the main thesis of this dissertation that what holds the animal together as a unity is the final cause and this is defined by one, final differentia. The body as a whole has a teleological end that governs its organization. This should come to no surprise, since this is akin to the definition of the soul we find in *De Anima* II.1: “the soul is the first actuality of a natural body with the potentiality of having life; and a body of this kind would be one which has organs” (412a27-b1).²⁵⁵ This passage found in *De Anima* defines the soul as a potential of a natural body that is organized for a certain activity or work. I will show that the above passage (645b15-20) is consistent with this definition of soul found in *De Anima*. More importantly, I will show that Aristotle accepts that the whole body is organized for one end. This one end is best defined by what is one, which is a single differentia. Let us try to reconstruct the argument in the above passage now.

The argument presented in this passage is often criticized for committing the fallacy of composition and actually resembles the infamous function (ἔργον) argument of *Nicomachean Ethics* I.7.²⁵⁶ But this argument above does admit to this fallacy. We should note that one of the premises Aristotle provides is that the action of a thing is primary over the thing or its material parts that are for the sake of this action (645b16). Aristotle is not arguing by claiming that since the parts are such, the whole must be such. What the argument is assuming is that the whole body is like an instrument (ὄργανον), and an instrument has a work (ἔργον) that governs its organization. An instrument is

²⁵⁵ Translation by Hippocrates G. Apostle, *Aristotle's On the Soul*, The Peripatetic Press: Grinnell, Iowa, 1981, p. 19.

²⁵⁶ See Lennox, *On the Parts of Animals I-IV*, p. 176. Lennox proposes a solution, take “complete action” to mean just the composite of all the parts, but he quickly realizes that this view is not sufficient. Aristotle replaces “complete action” with “soul”.

assumed to be something non-uniform: composed of a plurality of simpler parts—either uniform or non-uniform. Aristotle asserts that only the non-uniform parts have a work (ἔργον) in the very next chapter, *PA* II.1 646b12.²⁵⁷ Now, the main assumption of the argument seems to be that whatever organizes and unifies either uniform or non-uniform parts must be a work. Further, all the parts of an animal must work together in the organism. Given these two assumptions, the conclusion follows without the fallacy since the whole does organize and unify a plurality of parts in a determinate way. The whole body must be a work that is its organizing principle. Since the whole body is one, this work or action must be one.

Now, one could object to this argument by denying the claim made here that the whole is like an instrument. The argument seems to conclude otherwise. The whole animal is not for the sake of something else. But this is one reason why Aristotle distinguishes between form and material. The whole animal, in a way, is the material for the soul. Aristotle concludes that the soul, not the whole body of an animal, is a complete action as opposed to an action or work that is for the sake of something else, like an instrument. So, the whole body can still be like an instrument. But there is another problem with this argument. There seems to be no reason to accept the main assumption. Why is a thing organized by its work? Even more to the point, why is the thing the same thing as its work? It seems to me that Aristotle's claims in the *Metaphysics* warrant this analogy insofar as the soul is an actuality (ἐνέργεια). The word “ἐνέργεια” itself contains the Greek word “ἔργον”. The soul has a work to be the very kind of thing it is or, more appropriately, the soul just is the capacity to do a certain kind of work. But if

²⁵⁷ This word “ἔργον” is usually translated as “function” but I render it as “work”. My reasons for translating this term such are given in the next section, 4.4.

the soul is also the capacity for a certain kind of work or action, what is the work that is proper to the soul? The soul is that which holds the whole body together. This is the work of the soul as first actuality. The second actuality of the soul is the soul engaging in its complete action. For a bird, the first actuality would be the soul holding the body together so that the soul can engage in flying, and the second actuality is the soul engaging in flight. This is the significance of the metaphysical arguments concerning *ousia* in the central books of the *Metaphysics*: they fill in the missing support to this argument, specifically the analogy is made through the fact that both the parts and the soul just is its work. Aristotle's *De Anima* clarifies how the soul can be both a work and a capacity by clarifying the various senses of actuality that apply to the soul (II.1 412a10-11).²⁵⁸ With this argument (645b14-20) clarified, we can now answer how Aristotle resolves including the common features of an animal in its definition.

Given that the animal is an organized whole, of which the whole body is for the sake of the soul, it follows that, since the essence and *ousia* of an animal just is the soul (641a28), all parts in some way will be explained by the essence and the *ousia* of an animal. Since an animal has various capacities, e.g. perceptive, locomotive, and nutritive capacities, it requires some feature to unify these capacities so that the animal will be one thing and a whole. Without such a unity, the capacities may not conform to the same end. This threatens the very being of an animal as an organized whole. Aristotle claims that the part that unifies these capacities is the heart (*PA* II.1 647a30-31), and the work of

²⁵⁸ Someone might object that *De Anima* uses the term “ἐντελέχεια” rather than “ἐνέργεια”. My argument would seem to confuse these two terms in Aristotle. But Aristotle claims in *Metaphysics* Θ.8 that “ἐνέργεια” points towards “ἐντελέχεια” (1050a21-23) and also is the form and the *ousia* (1050b2). So, in the highest kind of being, an *ousia*, ἐνέργεια and ἐντελέχεια refer to the same thing, the form.

the heart is to radiate heat and to make and to distribute the blood.²⁵⁹ Since the essence is what makes the animal one, and having a heart is due to the blooded nature of an animal (or just is what it is to be blooded), being blooded must be included in the nature of the essence insofar as it is responsible for the unity of the potentials—the various capacities. The work of the heart is not to be confused with the essence itself, as I will argue in the next chapter. But one part of the argument for this claim is already in place. The essence will be of a certain action, but the heart’s action is neither the action of perception, locomotion, or nutrition and growth but is the primary potential of each of these. This view can also be argued on the grounds that having a heart extends further than the various genera and the specific species that are blooded. Thus, neither the heart nor being blooded is the definition of any animal, but no blooded animal could be defined apart from this nature. So, being blooded must be predicated in the what it is of a thing—*per se* in the first sense.²⁶⁰ Aristotle claims this three times in *Parts of Animals* or at least implies it by his language (678a32-33, 693b5-6, 695b19-20). We are still left with the puzzle of exactly how being blooded can be in the definition of the essence and the formula remain one? But it is not hard to see how this puzzle can be answered.

The various genera presupposed in the definition as part of but subordinate to the final end. These genera do not have being apart from the end to which they belong or the individual animals. In a similar way as the difference of a difference is implied in the final difference, these genera are entailed by the final difference. Now, the definition of

²⁵⁹ I used “distribute” rather than “circulate” so as not to confuse the reader into thinking that Aristotle’s conception of the heart is akin to the modern conception that the heart pumps blood throughout the body in such a way that the blood returns back to the heart just to be pumped back out. We should be aware that Aristotle argues that the heart fashions the blood and the pressure that builds up moves the blood to various parts of the body through the veins. See, for example, Aristotle’s analogy between the aqueducts and blood vessels where the heart is the one origin in *PA* III.5 668a14-24 and the flow of blood in these veins at 668b14-19.

²⁶⁰ *Posterior Analytics* I.4 73a34-5.

an animal must be one because it is of something that is one. The argument above (645b15-20) proves that the composite thing is one and is one through the primary action of the animal. This one end subordinates all other parts.

This subordination occurs in two ways. The first way is one that we have already seen. The parts are subordinate to the end in that they can only be defined in respect to that end. All the parts of an animal are understood through the unity of the form. Aristotle argues this, first, by establishing that the primary cause in zoology was the final cause because it is the formula (639b12-21). The final cause and the formula are responsible for why the various parts belong to an animal. Second, these parts will be spoken of as belonging in virtue of (κατά) the *ousia* of an animal (641a23-25). As stated in section 3.5, I interpret this use of “κατά” here as the second sense. This means that the formula of a part of an animal cannot be expressed without including the nature of the kind to which the animal belongs. This kind will be the species and the formula of the species is the formula of the form: so the part will include the definition of the form in its formula. But Aristotle also accepts that the subordination of various actions is like the subordination of various material parts (645b27-30). The same would apply to the genera in the definition of the form. The cases are not strictly identical because these genera are not defined in respect to the form, but rather the nature of the genus is part of the nature of the form. The genus will be said *per se* in the first sense of the formula of the essence. Now, the nature of blooded animals has no being apart from the particular natures of animals. The blooded nature of animals is for the sake of the one main action as well, but in a different way than the parts that follow it. The relation in the case of the genera is that of subsumption. The genus blooded animal is subsumed, for example, by the nature

of the genus bird (*PA* IV.12 693b12) and is also subsumed by the nature of a human being (*PA* IV.10 685b35, 686b21, cf. section 5.4). A sign of this is that parts that belong due to the blooded nature are further differentiated according to lower kinds such as bird or human being, for example, the lack of teeth in birds (*PA* III.1 662a34-35) or the present of teeth to make articulate sounds in human beings (661b14-16).

This unity stipulation differs from the one argued in the *Metaphysics*, but, on the other hand, this solution is appropriate to the science. The various parts of the definition of a form of an animal need to be analyzed (loosened up from the one, final differentia) so that the zoologist can demonstrate the various parts that belong through the appropriate middle term. The appropriate middle term will be the one with the correct extension. Hearts belong to birds and fish and four-footed vivipara, etc., so the zoologist needs to grasp the nature that covers these kinds and is responsible for these kinds of parts belonging. But this solution of the unity of the definition in zoology does not contradict the solution in the *Metaphysics*. Both are assuming that the genus or genera that make up the definition either have no being apart from the final differentia or are entailed by the final differentia. This still holds in zoology, as I will show in the next chapter.

This interpretation of the levels of explanation and the unity of the definition responds both to the Balme-Lennox-Gottself view that multiple middle terms show that Aristotle no longer accepts an animal to be defined by one, final differentia as well as Charles' problem that the middle term is not a simple unity in the demonstrations that can be constructed from the text. The middle term and essence of an animal has both a plurality of genera implicit in it and one defining feature expressed as a final differentia.

On the other hand, the only attributes that can belong to any animal *per se* must be distinct to that species and not be held in common. Division is helpful in deciding which attributes belong distinctly.

But why should we accept this interpretation of the argument, i.e., why is the argument at 645b15-20 concerned with the unity of the thing as well as the unity of the definition of an animal? The problem is that Balme, Gotthelf, and Lennox would object that the multiple genera are coordinate rather than subordinate to one end. The argument at 645b14-20 suggests otherwise. As I said in the introduction, I am solving the problem of horizontal unity by showing that the multiple genera used in the zoology are subordinate genera. But I also have a questionable assumption in my interpretation: that there is connection between 645b1-14 and 645b14-20. The latter passage solves a problem raised by the former passage: if there is a plurality of genera in the definition of an animal, how is the definition of that animal still one? But there is good reason to claim that these two passages, 645b1-14 and 645b15-20, are concerned with distinct issues. The former passage ends with what appears to be a concluding remark, suggesting that Aristotle is moving on to a new topic: “Let these matters be determined in this way” (645b14). The problem with this interpretation is that it cannot explain how Aristotle draws the conclusion he does from the argument at 645b15-20. He concludes as follows:

Therefore (ἄρα) one should first discuss the actions (πράξεις) – those common to all, those according to kind (γένος), and those according to form (εἶδος). I call ‘common’ those that belong to all the animals, and ‘according to kind’ those whose differences from each other we see in degree; for example, I speak of bird ‘according

to kind', but I speak of mankind, and everything without any difference according to its general account, 'according to form'. For what is common some have according to analogy, some according to kind, and others according to form (645b20-27).

The conclusion asserts that this conception of animals demands various forms of explanation. But it is not clear how this conclusion follows from the previous passage unless we recognize that the argument at 645b15-20 is to resolve how being blooded and other features that belong to animals in common are to be accounted for either by being in the essence or according to the essence at various levels. How does Aristotle draw a conclusion about what is in common, what is according to kind or genus, and what is according to species from a discussion of action and work of the soul, of the whole body, and of the individual parts? Insofar as the nature and primary action of the soul is the one common nature, Aristotle can conclude from the argument at 645b15-20 by itself that there are two kinds of explanations in zoology, according to genus and according to species. But this is already known according to the solution of the first aporia. Now, if these two kinds of explanations follow from the solution of the first aporia, and if Aristotle modifies this solution of the first aporia at 645b1-14, then this shows how the other kind of explanation follows from these two passages. The explanation according to what is common can now be included as an adequate explanation in zoology because this kind of explanation still appeals to the essence of an animal, if only a part of that essence. According to my interpretation of the argument at 645b15-20, the essence must be responsible for these features that extend further than the features according to the extensive genus or form insofar as the animal is to remain a unified whole. This final

conclusion of the chapter (645b20-27) tells the zoologist in what order to proceed: by finding the explanation of the parts held in common to all animals first, then the explanation by genus, and finally the explanation of those parts that belong due solely because of the animal's species. All of this is to avoid one of the problems present in the first aporia: the repetition of an explanation. This will enable the inquirer to locate the proper cause for why these various attributes belong. I have now shown that the various middle terms that are sought and can be used to demonstrate why the parts of an animal belong in *Parts of Animals* are part of the essence. Further, this plurality of features in the essence is not incompatible with the kind of unity assumed to belong to an essence and the kind of unity of the definition of an essence as presented in *Metaphysics Z.12*. We now have determined both the method and the order of proceeding in *Parts of Animals*, but we must comb over these arguments one more time to arrive at a more specified conclusion. These arguments will also make clear the main terms of the zoology and exactly how attributes will be shown to belong *per se*, universally, and necessarily to a kind of animal.

4.4 The Main Terms of Aristotle's Zoology: πράξις and ἔργον

We can now turn to the second main theme of this chapter: the various kinds of explanations that are present in the next three books of *Parts of Animals*. Aristotle presents several kinds of explanations at 639b33-640a1. There is much debate about exactly how many explanations are present.²⁶¹ I will turn to this issue in the last section of this chapter. Before we can decide this issue, we need to determine the main terms of

²⁶¹ See Lennox, *On the Parts of Animals I-IV*, pp. 134-35.

Aristotle's zoology, for explanation will be through these terms. These are the terms that are used to characterize both the soul, which is the end of all the other parts, and the parts themselves. The arguments discussed in the previous section actually help fix these terms in respect to the levels of explanation. The main terms of the zoology are *πράξις* and *ἔργον*, both introduced in the argument at 645b15-20. There is little discussion in the literature about these terms in relation to Aristotle's zoology. Part of the reason for this stems from the fact that the end of *PA* I.5 seems unclear to most scholars. We will return to the arguments discussed in the previous section to help clarify not only the main terms but how these terms help locate various levels of explanation in Aristotle's zoology.

The argument at 645b14-20 uses both *πράξις* and *ἔργον*, which for now I will translate as "action" and "function", to refer to primary aspects of the soul and of the parts of an animal respectively. But the argument is also contingent upon an analogy between the soul and its parts. Thus, there is an analogous relation between the terms action and function that characterize the soul and the parts respectively. The actions of an animal appear to be minimally nutrition and growth, perception, and locomotion. It could also refer to breathing and even waking.²⁶² The functions of the different parts are diverse, but Aristotle makes clear at *PA* II.1 646b5-9 that only the non-uniform parts, e.g., hand, foot, wing, etc., have a work or just are their work. The non-uniform parts have a kind of completeness to them that is lacking in the uniform parts, e.g., blood, flesh, bone, etc. This makes clear the analogy. The being of a uniform part is entirely determined by its relation to something else. Bone does not organize some whole but

²⁶² These two are less certain, at least textually. Aristotle lists "waking" under affection or action at 645b34. It is not made clear which or if "affection" and "action" are used as synonyms. The latter option is unlikely since an affection is passive. But the main point here is the actions are primarily the main functions of the soul.

rather is a constituent of some whole. On the other hand, a part is both a constituent of some larger whole, the whole body, and itself a whole in respect to the work it does. The non-uniform part organizes some material into a whole through its function. So, the argument here is showing that the soul is ultimately identified with one primary action that is also a work, just like a part is identified with one primary work. But it appears that an action only belongs to a thing that is wholly complete—it needs nothing else to satisfy its work. This is not true of a part, insofar as any part needs other parts to do its work, e.g., a hand needs the arm and the heart to impart motion and do its activity, as well as belonging to a larger whole, e.g., a hand is not a hand in the proper sense apart from a living animal and cannot do its work separate from the living thing to which it belongs (641a1-4). An action, on the other hand, needs no additional thing to do its function because it only belongs to a complete whole, e.g., the whole living body of an animal.

Now, although the term “action” translates the term “πράξις” well, the translation of the term “ἔργον” proves to be trickier. It is normally rendered “function”, but this is not its most common meaning in Greek. The common meaning is “work”, such as plowing a field or making a chair or even the result of the work, e.g., the chair.²⁶³ The difference in meaning of these two translations may have little affect on the interpretation of the argument, but there is some difference in understanding Aristotle’s zoology. As we saw above, “ἔργον” is the root word of “ἐνέργεια,” usually rendered as “actuality”

²⁶³ See Liddell and Scott, *Greek-English Lexicon*. It can also mean the completed product of a work, e.g., the ἔργον of a chair maker is a chair. But, in respect to a living thing where its ἔργον is its ἐνέργεια, the doing and the product are the same. Aristotle uses the activity of seeing to make this clear: it is the same to be seeing and to have seen in the act of seeing. It is complete at every moment. See *Metaphysics* Θ.6 1048b28-36.

though rather problematically.²⁶⁴ Another translation of this term put forth by Joe Sachs is “being-at-work”.²⁶⁵ The idea, which is not captured by “function” or “actuality”, is that the thing, be it the soul or the part, is fundamentally a doing—literally working. Functions, on the other hand, are usually understood to belong to a thing and not to be the thing. But Aristotle makes clear that the being of a thing is its ἐνέργεια just as the part is fundamentally its ἔργον (see *Metaphysics* Θ.8 1050b2). This will affect the way we read the middle term being sought in the explanations in the last three books of *Parts of Animals*. On the other hand, we need to be careful. Aristotle understands the soul as the capacity for an action or work, not the work itself. This is made clear in his argument in *De Anima* II.1 where the soul is the first actuality (ἐντελέχεια) of the natural body with organs (412a27), which just is the capacity for a certain action.²⁶⁶ But the main idea is still the same, what is the primary being of the soul or a part and that which defines it is its primary action or work. With this understanding, we can shed even more light on the argument at 645b15-20.

This passage asserts that the parts of an animal are for the sake of a complete action, which just is the soul. We should clarify what “complete” means first. The Greek word that Lennox translates as complete is πολυμερής.²⁶⁷ This literally means “many-parted.” But it makes some sense, given the nature of *ousia*, to translate the “many-parted” action as a complete one. This is precisely what is demanded of a complete action. Many distinct parts are necessitated by the action so that the action can be

²⁶⁴ For example, Owens renders it as “act”. See *The Doctrine of Being in Aristotelian Metaphysics*, p. 334.

²⁶⁵ See Joe Sachs, *Aristotle’s Metaphysics*, Santa Fe, NM: Green Lion Press, 1999, p. li.

²⁶⁶ Although ἐντελέχεια and ἐνεργεία may not have the exact same meaning, they coincide in an *ousia*.

²⁶⁷ There is a variant for this term found in certain manuscripts. The term is “πλήρους” which means “full” or “complete” as well. Balme supports this reading of the text. Lennox does not actually make clear which term is rendered “complete” in his edition. There is no note on it in his edition. But I would argue that either term serves Aristotle’s purpose here well.

performed by the thing. The animal is complete insofar as it has the capacity to perform the action simply through itself, which is possible through the organization of the material. So, this completeness is just another expression for another term that Aristotle uses to characterize the soul, ἐντελέχεια (*De. An.* II.1 412a27, *Metaphysics* H.3 1044a9). This term, “ἐντελέχεια”, is usually translated as “actuality”, but it literally means something like holding in the end or, as Joe Sachs translates following Heidegger, being-at-work-staying-itself.²⁶⁸ More significantly, the complete action can also be a unifying principle since it itself is also one. The argument itself suggests this insofar as “πράξις” is stated as a singular noun (645b16). Lennox emphasizes this in his translation with “a certain complete action”, and he even goes as far to say the argument implies this oneness of the action in his commentary.²⁶⁹ Thus, the nature of the soul can be grasped through the one action for which the whole body is organized. An animal just is the capacity to perform a certain action. This is actually textually confirmed in at least three places that Aristotle employs this conception in explanations later in *Parts of Animals* IV.²⁷⁰ This interpretation of the argument will also explain the conclusion that follows from this argument. As noted above, the next two passages are logical conclusions of this argument, and this is often ignored by the scholarship. But it is clear from Aristotle’s

²⁶⁸ For Sachs’ best defense of this translation, see his introduction to *Aristotle’s Metaphysics*, Santa Fe: Green Lion Press, 1999, pp. li-iii. It should be obvious in one sense that “actuality” is not a sufficient translation if only that it also translate the word “ἐνέργεια”. Although these two terms converge in an *ousia*, there may be some difference in connotation between these two terms. As for the best translation of either of these two terms, I have no definite position other than “actuality” needs to be discarded because “actuality” mainly implies “existence” in English rather than being something active.

²⁶⁹ Lennox, *On the Parts of Animals I-IV*, p. 176.

²⁷⁰ These are found at IV.10 686a28-9, IV.12 693b13-4, IV.13 695b20. Aristotle will also refer to other subordinate actions in other explanations in the previous two books, e.g., II.8 653b23, II.10 655b30, III.1 661b1, and III.3 664a18.

language choice in the text that this is so. Aristotle uses “ἄρα” at 645b20 and “μὲν οὖν” at 645b28 to begin the next two passages, each of which can signify an inference.²⁷¹

We have already discussed how the first passage (645b20-27) follows from the argument at 645b15-20 in respect to the resolution of the first aporia stated at 645b1-14. The conclusion is that there are three levels of explanation, the explanation by what is in common, by the genus, and by the species. All of these explanations are via the essence or by what is in the formula of the essence. But there is a question in the literature about what is being claimed in the passage. Let us remind ourselves of the passage again:

Therefore (ἄρα) one should first discuss the actions (πράξεις) – those common to all, those according to kind (γένος), and those according to form (εἶδος). I call ‘common’ those that belong to all the animals, and ‘according to kind’ those whose differences from each other we see in degree; for example, I speak of bird ‘according to kind’, but I speak of mankind, and everything without any difference according to its general account, ‘according to form’. For what is common some have according to analogy, some according to kind, and others according to form (645b20-27).

Both Balme and Lennox question the clarity of the passage in their commentaries.²⁷²

Lennox tries to smooth over the rough spots of this passage by proposing that Aristotle is speaking of both actions and parts at 645b20-24, but this is textually ruled out, as can be seen above.²⁷³ Lennox’s own confusion may actually help us illuminate the argument here. Lennox writes:

²⁷¹ See H. W. Smyth, *Greek Grammar*, 2787 and 2901c.

²⁷² Balme, *De Partibus Animalium I*, p. 124. Lennox, *On the Parts of Animals I-IV*, pp. 176-77.

²⁷³ See Lennox, *On the Parts of Animals I-IV*, p. 176.

The language here is somewhat confusing. ‘Common’ is spelt out in terms of what *belongs* to all animals, which presumably means an action or part. Both ‘according to kind’ and ‘according to form’ refer, however, to the animal, not the attribute—to bird, or human being.²⁷⁴

The confusion Lennox refers to seems to stem from the fact that “kind” and “form” here (645b20-27) really refer to the essences of each, but Aristotle uses the name “bird” and “human being” rather than the formula of the essence of each. But if that is the case, we just learned that the essence of an animal, be it the species or the genus, just is a potential for a certain action. Aristotle is not confused here but very clear: each kind of explanation is marked off by an action, not a part.²⁷⁵ Aristotle’s claim here is that there are certain actions that all animals share in common (or analogously) and others that are distinct by genus and yet others that are distinct by species. How do we interpret these distinctions now? How are they all explanations from the essence?

Let us start by discussing what is held in common. What “common” refers to here is the trickiest of three, if for not any other reason than Aristotle has already determined genus and form in the solution of the first aporia (644b1-7). Explanations by genus or by form are always via an essence—the one common nature. But the last sentence from the quote of 645b20-27 makes clear that what is held in common could be so in three ways: by analogy, by genus, or by species. To clarify what “common” refers to here in respect to an animal we should ask what action or actions are held in common by all animals? An obvious answer is nutrition and growth, for this is fundamental for an

²⁷⁴ Ibid.

²⁷⁵ Lennox acknowledges the point I am about to make when he claims to clear up Aristotle’s confusion. Ibid.

animal's existence and yet it is also something necessary for the animal to perform its primary action. But nutrition and growth cannot be the primary action of an animal, for this defines the nature of a plant as well.²⁷⁶ Given these two claims, this action can only be included in the articulation of the essence. Now, nutrition and growth occur in two analogous ways in animals. The blooded animals are nourished through their blood (*PA* II.3 650b2-3), and the bloodless animals in an analogous way. Thus, being blooded or being bloodless marks off the character that is responsible for the various attributes that are held in common. This conclusion coincides with the arguments that we have already noticed above in section 4.3 that being blooded is included in the essence of a blooded animal. But the nature of being blooded does not determine uniformly all the parts due to this nature alone, for some blooded animals have features that others lack, e.g., some lack kidneys while most have them (*PA* III.9 671a27-30). The lack of a kidney is explained either via the kind (e.g., bird) or via the form (e.g., *hemus*) (671a30-b2). Thus, nutrition and growth differs within the blooded animals by kind or by species as well. Another example where a form determines an attribute that is associated with being blooded is human beings, who have a long intestine, so that they may have time to think and contemplate instead of constantly searching for food. How exactly Aristotle is conceiving of being blooded and being bloodless will be made clear in the next chapter. But we can see that Aristotle's view that the higher genera, such as being blooded, are also determined by lower genera or even the species suggests that the unity of the definition is assumed.

One could raise the question why perception and locomotion do not also fall under the rubric of being held in common? Discussing these two features will help us

²⁷⁶ See *De Anima* II.2 413a25-413b3.

locate what action is appealed to in explaining via the genus or via the species. I will argue that perception is similar to nutrition and growth insofar as being blooded and being bloodless explain these features for the most part, but some animals will have certain perceptual organs or features of these organs explained by genus or by form. For example, that birds lack ear lobes and only have auditory channels is explained by the nature of a bird (*PA* II.12 657a17-24). Human beings have a particular kind of tongue that is appropriate for making articulate sounds (*PA* II.17 660a15-27). But aspects of the perceptual features are held in common amongst the blooded animals, such as all eyes have blood vessels that lead to the heart and so do the other perceptual organs (*PA* II.10 656b16-25). The origin of perception is analogous in bloodless animals (*PA* IV.5 681b29-32). So, it appears that perceptual features fall under the rubric of being held in common, for they differ in all three ways, by analogy, by genus, and by form.

That leaves locomotion. We need to remember that Aristotle also asserted that the whole body has one primary action. Although in one sense we may say that locomotion is held in common by most animals, it cannot be conceived under this rubric of what is common. Within the blooded animals, there are various primary movements that make the animals differ in essential attributes. It would not be explanatorily revealing to capture locomotion under what is common. The same point is made in the first aporia about locomotion: it differs by form (or by the nature of an extensive genus) (639a29-b3). This also connects with Aristotle's definition of soul in *De Anima* as the actuality of the natural body with organs. A different kind of locomotion will demand a different kind of organization. Thus, locomotion is the best candidate for the primary action—the complete action that just is the account of the soul. Aristotle will appeal to the

extensive genus of an animal to explain the parts that are required for that particular kind of locomotion and why its body is organized as such. But there may also be anomalies in the animal kingdom that do not fit under any particular extensive genus. Human beings and the ostrich are such instances. Their parts and organization can only be understood in respect to their species. Thus, the parts of animals demand explanation at both the level of the genus and the level of the species given the work and the action they are for the sake of.²⁷⁷ We will see this concretely in Aristotle's practice of the science in IV.10 explaining human beings, in IV.12 explaining birds, in IV.13 explaining fish, and in IV.14 explaining the ostrich. I discuss these chapters in the next chapter. What is significant here is that the actions of the soul at any level allow us to construct explanations for why the parts belong. These explanations will be through a middle term that expresses the capacity for a certain action of the particular animal or genus in question. This will be an explanation via the essence. But this will not explain all parts. How these other parts will be explained is the second conclusion following from the argument at 645b14-20. Let us turn to that passage now.

Aristotle's second conclusion from the passage at 645b14-20 is as follows:

So it is clear, then, that whenever there are actions that are for the sake of other actions, the things whose actions they are differ in the same way that their actions do. Similarly, if some actions are in fact prior to, and the end of, others, it will be the same way with each of the parts whose actions are of this sort. And thirdly, there are things that are necessarily present because others are (645b27-32).

²⁷⁷ One may assert that this is worded too strong, since only certain animals would demand an explanation at the level of species. But either every animal has a certain attribute due to its species rather than its genus or the particular way in which an animal expresses an attribute will be particular to its species. Either way, the being of this attribute would be explained through the particular essence.

This passage makes clear both the levels and the hierarchy of explanations. Aristotle is aware that animals have a variety of actions they perform. If one action is primary, then all others are subordinate to this one action. The parts that are for the subordinate actions are subordinately explained. This is clear enough. But Aristotle also adds that some parts will be necessitated, not by the action, but by the presence of a certain other part or parts belonging. Thus, there are at least three levels of explanation: explanation via the primary action, explanation via the subordinate actions, and explanation via the parts that necessitate certain things of their own accord. But these latter parts are obviously explained indirectly via the essence, for the parts that do the necessitating are themselves explained via the essence.

The theoretical developments in *Parts of Animals* I.5 respond to the problem of a plurality of genera in the definition of an animal. The complexity of the animal arises due to various kinds of actions of each animal. The attributes that belong to any given animal have various causes at different generic levels relating to the actions of an animal, but I have argued that these generic levels are nested and implied by the final differentia. This final differentia can explain all attributes of an animal. Thus, it is at least theoretically plausible that the solution to the problem of one or many differentiae can be carried out in practice. Our final task of this chapter is still before us. We need to make clear the various forms of these explanations to make sure they can be actual demonstrations that conform to the standards of the *Posterior Analytics*. The last question this chapter intends to address can now be raised: how do the various explanations relate back to the essence of each species of animal?

4.5 The Various Kinds of Explanations of PA: I.1 640a33-b1

We now know that a demonstration in zoology will connect a predicate to a subject by showing how the part's work contributes to the primary action (or other subsidiary actions) of that kind of animal. Since there are various actions appropriate to any kind of animal, there will be various levels of explanation, subordinate in respect to the action that is primary. Now, the literature focuses on the passage at *Parts of Animals* I.1 640a33-b1 to determine the various kinds of explanations Aristotle employs in his zoology.²⁷⁸ So, I will turn to this passage to see what kinds of explanation there are in zoology and whether the explanation appeals to the essence of an animal in some way. This passage also ranks these explanations as to which one is best and the one which is next to best. We will see in what way this is relevant to the issue at hand, which is both how many kinds of explanation there are in zoology and how they are explanatory of the facts of the thing. The passage is as follows:

Hence (διό) it would be best to say that, since this is what it is to be a human being, on account of this it has these things; for it cannot be without these parts. If one cannot say this, one should say the next best thing, i.e. either that in general it cannot be otherwise, or that at least it is good thus. And these things follow (640a33-b1).

The standard problem in the literature is how many different explanations are listed in his passage. Balme argues for four different explanations, which both Lennox and Gotthelf support.²⁷⁹ John Cooper argues for the three distinct explanations.²⁸⁰ Finally, Richard

²⁷⁸ See, for example, Balme, *De Partibus Animalium I*, p. 87, John Cooper, "Hypothetical Necessity", in *Aristotle on Nature and Living Things*, pp. 151-67, Allan Gotthelf, "Notes towards a Study of Substance and Essence in Aristotle's *Parts of Animals* ii-iv", and Richard Sorabji, *Necessity, Cause, and Blame*, Ithaca, NY: Cornell University Press, 1980, pp. 155-56.

²⁷⁹ These three scholars agree on the number of explanations present in this passage, yet they do not agree on how to interpret each kind of explanation. This will be important for my interpretation and will be discussed later in this section as well as exemplified in the next chapter. See Balme, *De Partibus Animalium I*, p. 87, Gotthelf, "Notes Towards a Study of Substance and Essence in Aristotle's *Parts of Animals* ii-iv", pp. 28-9, and Lennox, *On the Parts of Animals I-IV*, pp. 134-6.

Sorabji argues for only two distinct explanations.²⁸⁰ Lastly, under my interpretation, I need to explain how each explanation is made possible by the essence without an essence the unity of explanation is lost as well as any account of any animal is one thing. As we can see, this passage is also stated as a conclusion that is supposed to follow from what preceded it. This presents a puzzle for interpretation. It does not appear that the conclusion follows from the assumptions of the previous arguments. Just to remind us, the arguments that precede this passage show that the final cause is naturally first in the order of explanation, the mode of demonstration is distinct in zoology, and that *ousia* is prior in being even for those things that come to be. We can conclude from this that the explanation via the essence, which just is the *ousia* and the final cause, is best. But there is at least one other kind of explanation and up to three more depending on how one reads the passage. How do these explanations follow from the previous arguments? I propose that the last chapter of the first book of *Parts of Animals* actually provides the premises necessary to distinguish these alternate explanations. But we need not conclude that Aristotle does not provide some support for his conclusion at 640a33-b1 in the passages that preceded it. There is one small clue that can help us understand the conclusion from what is stated preceding this passage (640a33-b1): Aristotle's analogy of nature to a craft (639b12-21, 640a10-32). Yet, at the same time, we can use what we developed above in respect to *PA* I.5 to help us clarify what this passage claims. We will see that the levels

²⁸⁰ See Cooper, "Hypothetical Necessity".

²⁸¹ Sorabji actually picks out three explanations, but the latter I do not include as being part of this passage. This other explanation for Sorabji is of processes rather than parts – the coming to be of an animal. My interpretation claims that this kind of argumentation is subordinate to the other four kinds of explanations and is presented in *Generation of Animals*. Thus, for my present purposes, Sorabji only sees two explanations in the passage I am concerned with above. See Sorabji, *Necessity, Cause, and Blame*, Ithaca: Cornell University Press, 1980, pp. 155-62.

of explanation presented above will match up well with the levels of explanation in this passage at 640a33-b1.

I would like to begin defending the view that there are four kinds of explanations in this passage. I follow the Balme-Gotthelf-Lennox interpretation. My view of these explanations follows Lennox' interpretation most closely, yet I will conclude, unlike Lennox, that they all are possible only through there being a unified essence. I agree with Lennox that no explication of this passage is sufficient without recourse to the practice of zoology in the latter three books of *Parts of Animals*. Thus, I will not present a full defense of the view that there are four explanations present in this passage. Rather, here, I defend the view in expectation of these explanations being employed in the rest of *Parts of Animals*. I will also show minimally how each explanation needs to have either a direct or indirect connection to the essence of an animal to count as a legitimate form of explanation in zoology.

The first explanation is the one through the essence (640a33-4), which all scholars agree is present (though about how the explanation works, there is some disagreement). Unlike Balme and Gotthelf, who take this explanation to be what is in the essence, the Greek makes clear that the kind of explanation shows what follows from the essence: διὰ τοῦτο ταῦτ' ἔχει ("on account of this it has these things") (a34). I take "διὰ" to signify that the explanation happens through the essence, here, stated as "τοῦτο" and in the singular. The term "ταῦτα", in my view, refers to what follows from the essence, and is plural, for a plurality of parts will follow from the essence. Lennox suggests that this is a plausible read, but I also take it that it excludes the Balme-Gotthelf reading that this kind of explanation shows what is in the essence. This kind of explanation should have used

the preposition “ἐν” rather than “δι’.” This follows from the way in which Aristotle discusses these issues in the *Posterior Analytics*.²⁸² But the next line could be interpreted to conform to the Balme-Gottthelf reading: οὐ γὰρ ἐνδέχεται εἶναι ἄνευ τῶν μορίων τούτων (“for it cannot be without these parts”) (a34-3). I assume that they read the “οὐ ἐνδέχεται”, “it is not possible that,” as these parts belong in the essence. But I read it, like Lennox does, as a way of expressing conditional necessity. In other words, without these parts, it is not possible for the essence and the soul to have its primary capacity of action to be the kind of thing it is.²⁸³ The parts are what follow from the essence, given conditional necessity. The problem with this interpretation is that conditional necessity also functions at another level of explanation—why certain material belongs to a part, e.g., why teeth are made up of hard, bony material (for some animals). But, following Lennox, conditional necessity can function at various levels of explanation, so that what is conditionally necessary at one level may be essential at another.²⁸⁴ Now, I have not ruled out completely the Balme-Gottthelf reading of this kind of explanation. The real proof is that we will find no such explanations of the sort in *Parts of Animals* or no such explanations can be constructed as such. We will find that Aristotle proves that parts belong through a definition of a genus or form, the part belonging because the formula of the part includes the definition of the animal in question. We should note that Aristotle claims that this is the best kind of explanation to provide in zoology. This is consistent

²⁸² It may not always be the case that Aristotle is consistent with his use of language, but it seems there is a significance difference in logic from something being “in” and something being “through” the essence. See esp. *APo.* I.4 73a34-5 and II.8 93a36. The former passage speaks of what is in the what is, and the latter passage speaks of what is known through a middle term, reading “δι’ ἀμέσων” as “διὰ μέσων” like J. Barnes does.

²⁸³ I do not mean to imply that Lennox reaches this same conclusion, for he is hesitant to state that Aristotle holds onto the view that an animal has one primary capacity by which it would be defined.

²⁸⁴ See Lennox, *On the Parts of Animals I-IV*, pp. 134-5.

with the view that ultimately the animal species admits to its own definition and using this definition, the zoologist can demonstrate the parts that belong. We will, unfortunately, find few examples of explanation through the essence of the species in *Parts of Animals*, but I will show some signs of Aristotle heading in that direction in the next chapter.

The second kind of explanation poses a difficulty as well. It is stated here as follows: εἰ δὲ μή, ὅ τι ἐγγύτατα τούτου, καὶ ἢ ὅτι ὅλως ἀδύνατον ἄλλως (“If one cannot say this, one should say the next best thing, i.e. either that in general it cannot be otherwise”) (a34-5). Sorabji reads this kind of explanation to be the same as the first. We will see near the end of this discussion that there is some motivation for this view, but the two are not identical. This explanation will be through the essence, but at a more generic level. The passage itself begins with a clear contrast with the previous passage: “εἰ δὲ μή”. Sorabji’s reason for taking the explanation in this passage as identical to the previous one is that both appeal to conditional necessity. But one key word tells how they differ in this appeal—“ὅλως.” Lennox translates this term as “in general”. I interpret this expression to refer to what is common to all animals or a certain kind of animal, such as blooded or bloodless animals. This would imply that the explanation appeals to the essence, but a generic feature within the essence. Specifically, I can say now, given the argument of the previous section (4.4), that the explanation will be through a generic capacity of that animal kind. For example, various explanations will occur through the fact that a certain kind of animal is blooded and not because it is a bird, fish, or human being. These explanations are still good because they are through the essence, but they are not as good as showing the attribute belong through the essence. For, some of the

attributes that belongs through these natures are further specified according to the nature of an extensive genus or the species. This is how I interpret why these explanations are not as good as the first kind. Once again, this reading of the passage can only be confirmed by finding this kind of explanation in *Parts of Animals*.

The third form of explanation is stated as an alternate to the second kind of explanation: ἢ καλῶς γε οὕτως (“or that at least it is good thus”) (a36-b1). This kind of explanation does not have the form of conditional necessity. The middle term here makes the connection insofar as it is better for the animal to have this feature or part. My claim is that the explanation is through the essence, for the essence or something in the essence is the reason why the part is good for the animal. There are various examples of this kind of explanation in the latter three books. The standard example is the kidney (*PA* III.7 670b22-4). Aristotle connects the nature of the kidneys to that of the bladder. The bladder is to collect and to expel excess moisture from the body. The kidney is present to those animals with a blooded lung, for these animals take in more excess moisture. The kidney is good for this end, though the bladder could do all the work, but the work is better done with a kidney. The explanation then is through the generic essential nature of a blooded, lunged animal with a certain kind of lung. But other examples make it clear that the nature of the better follows from the animal’s specific essence, such as the explanation where the sense receptors are located (*PA* II.10 656b27-32). The argument here pertains most appropriate to the human faculties (656a10), and the missing assumption can be filled in from *Metaphysics* A.1—sense perception is both for its own sake and for the sake of acquiring knowledge. Since the essence of a human being is that of a rational animal (*PA* IV.10 686a27-9), it would seem that when the zoologist explains

why human faculties are arranged thus it is not independent of an appeal to the essence of a human being. I will present the argument for this in more detail in the next chapter. So, yet again, the explanation is through the essence.

The final kind of explanation is simply expressed in these words: ταῦτα δ' ἔπεται (“And these things follow”) (b1). Balme notes that this language is used in *Posterior Analytics* II.14 98a22-3 to refer to additional aspects of a thing that follow from that parts or attributes of what has already been shown to follow through the essence. For example, having a spleen follows from the fact that there are certain residues of the liver and those around the bladder (*PA* III.7 670a30-2). But if the liver follows from some aspect of the essence, then the things that follow the liver will be indirectly shown to belong due to the essence. It is not clear the kind of necessity that Aristotle appeals to in this kind of explanation. We will have to see if it is always the same kind of necessity or different in different explanations. Both options are reasonable at the outset. The latter is more appealing, for various features will follow from other features in different ways. But the significant point here is that the explanation for such parts is derivative from the essence itself, though the essence is not responsible for it being there other than the fact that the essence demands another part from which this feature will follow. This does not threaten the unity of an animal but precisely the opposite. The feature that follows another feature is needed to preserve the unity of the animal, for the feature according to the essence is not sufficient or demands something else. The feature that follows will ultimately conform to the nature of the animal by following from a part that is in accordance with the nature of the animal. Thus, I have shown good reason to believe that the essence is necessarily present in all these forms of explanation, whether directly or indirectly. This

would imply, in conjunction with the argument I developed in 3.5 that the use of conditional necessity does not hinder the rigor of a demonstration, that the various inquires seeking the middle term and the cause in *Parts of Animals* can be constructed as demonstrations. I have also shown that there is good reason to believe that there are four distinct kinds of explanations present. How do these different explanations follow from what Aristotle has stated in the previous arguments, for the passage begins with a term that marks off a conclusion “διὸ μάλιστα” (a33)?

My claim is that they follow from the analogy between nature and a craft. Think about making a chair. The craftsman first needs to know what a chair is, so that he can both understand what parts belong and in what order he needs to construct a chair. The essence, then, tells us what parts belong. But it may not tell us that all the parts belong directly. For, the character of the material or the generic character of a chair may dictate certain features, such as what parts or material should one use to connect the various parts together, e.g., nails or glue or some other adhesive. This will be covered by the second kind of explanation. In other words, there is a generic nature of chair, e.g., things made in a certain way or made out of certain materials, which will dictate what parts will belong. The analogy is not perfect, of course, because an animal has a more complex generic nature than a chair. The third kind of explanation is present in crafts as well. If one desires to make not just a chair, but a beautiful chair, then certain features will be present due to this cause—the good. But the good of a chair or a beautiful chair cannot be understood as such apart from the nature and essence of a chair. Finally, there may be other features that simply follow from the fact that other features of a chair must be present. Once again, there may not be many of these features in craft objects, but given

the complexity of an animal, these features may be more abundant in the latter than in things made by craft. But the point is that we can imagine such features following from certain aspects. For example, if one wants to upholster the chair, then other features will follow such as the way the upholstery is connected to the chair. The key idea is this last point: the various features belong so as to support the given end and work of the object, be it an artifact or a living being. The kind of unity present is that all parts are directly or indirectly for the sake of the end. Once again, I have argued that final cause is the source of unity for the composite *ousia*.

But we see that the four kinds of explanation also match up well with the three levels of explanation presented in *Parts of Animals* I.5. The level of the extensive genus and the level of form are both explanations through the essence. The level of what is common is through what belongs generically and cannot be otherwise in respect of being an animal. The explanation of the good is through the essence but makes a different kind of connection of the extremes through the explanation. And the last kind of explanation does not need its own distinction, for it simply shows what will follow given the other three forms of explanation. We are now in position to judge how well Aristotle can follow his theory of zoological explanation in practice and see whether his aim in explanation is showing that there is one essential nature of an animal that makes possible the various explanations needed to explain why parts belong to this animal. The last chapter will proceed by constructing demonstrations from various passages in *Parts of Animals* and showing how the inquiry leads towards finding the one, final differentia of the form of various kinds of animals.

CHAPTER V: THE PRACTICE OF ZOOLOGY IN *PARTS OF ANIMALS* II-IV

5.1 Introduction

I have one last inquiry to conduct to show that Aristotle accepts that an animal is defined by one, final differentia. I must show that such a view is compatible with the practice of zoology presented in *Parts of Animals* II-IV. My argument will not rule out other interpretations but simply show that there is sufficient evidence in the practice of zoology to support my interpretation. This task presents several challenges that have yet to be addressed or addressed in a thorough manner. I will construct my view briefly of how I read these books of *Parts of Animals* and the way in which it at least points towards the kind of solution I have argued for the problem of one or many differentiae. I will then present the challenges that the practice of zoology presents. Following from my analysis of *Parts of Animals* I in the last two chapters, we should expect the practice of zoology to address four different kinds of unity in respect to the explanation of the parts of an animal: 1) the unity of the *per se* attributes with the essence (this is the unity of predicate with the subject in a demonstration) (section 3.5), 2) the unity of the definition (which is also the unity of the middle term of a demonstration) (section 4.3), 3) the unity of particular capacity of action, e.g., nutritive capacity (section 4.3 and 4.4), and 4) the unity of the various capacities together in the thing, the animal (section 3.7 and 4.3). This last kind of unity is most important for presupposes the unity of the other three kinds. This last unity shows that all of the *per se* attributes of an animal need to belong to one thing, so there should be one thing responsible for all of them belonging. All the material

parts of an animal, then, should be explained by the same middle term. But different kinds of parts have a larger extension than others, e.g., having a heart extends to all blooded animals but standing upright only belongs to human beings. So, there will be various levels of explanation, implying that the middle term and definition will be a plurality. The unity here of the various features of the definition is that of nested genera. The final differentia of each animal tacitly entails all the levels and each higher level is implied by the lower level. But the various levels of explanation point towards another plurality: the fact that there are many actions by which an animal is defined. Each animal engages in at least nutrition and perception and most kinds of animals engage in locomotion. Each kind of action will explain the parts necessary for this capacity. This is yet another kind of unity: the unity of the system that just is the capacity for this action, e.g., the nutritive system. So, even if all the levels of explanation are subsumed, there can still be a plurality in the thing, the animal, insofar as it is composed of several unified systems. But the explanations Aristotle provides will begin to connect up the various systems, subordinating one system of parts to the system of parts required by another, higher capacity. This is the principle articulated at the end of *Parts of Animals* I.5 that subordinate actions are for the sake of higher actions and so the parts that belong for subordinate actions are also subordinate to the parts that belong for higher actions (645b28-32). Now, there is no complete explanation of an animal in *Parts of Animals*, so my argument will simply show that Aristotle is continuously moving towards this kind of explanation with greater precision, i.e., moving closer to the middle term and final differentia that is explanatory of all the parts.

These various unities are the sources of tension in solving the problem of one or many differentiae in Aristotle's practice of zoology. Scholars have exposed the problems concerning these unities in the practice of zoology in *Parts of Animals*. This has led them to conclude that there is no solution to the problem of one or many differentiae. I will go through the problems that scholars raise that seem to show that Aristotle has abandoned the view that an animal is defined by one, final differentia. I diffuse these problems by showing a way either to construct the explanation to avoid these problems or by showing how Aristotle's conception of explanation overcomes these problems. The first problem is that many explanations require various middle terms to explain just one part of an animal. Gotthelf develops this criticism in his paper "The Elephant's Nose: Further Reflections on the Axiomatic Structure of Biological Explanation in Aristotle."²⁸⁵ He traces out the various premises that Aristotle provides to explain why the elephant's nose belongs. He shows that the explanation entails both material features and formal features of an elephant. Even if the material features are subsidiary in the explanation, i.e., they only explain what kind of material belongs for the sake of the end, he argues that there is still another problem about the formal explanation. His claim is that there are multiple middle terms that cannot easily be placed within a "linear, branching structure". I interpret this to mean that although some middle terms may entail others, some of them are not entailed by others, so there is no neat way to organize them as a unity. So, the problem that Gotthelf raises focuses on the unity of the middle term and definition of an animal. On Gotthelf's view, the essence is composed of many differentiae because it is not possible to explain every part by a single feature of that

²⁸⁵ Found in *Aristotelische biologie: Intentionen, Methoden, Ergebnisse*, edited by Wolfgang Kullmann and Sabine Follinger Stuttgart: Franz Steiner Verlag, 1997, pp. 85-95.

animal. I will defend the unity of the definition by showing that the various features of the essence Aristotle appeals to in explaining the elephant's nose are subsumed by the formal nature of the elephant.

The second threat follows similar lines in that it challenges the unity of the middle term. It is developed by Charles in his book *Aristotle on Meaning and Essence*. He finds that the middle terms that are often used to explain the *per se* attributes are often complex, but worse, include the material nature of the animal. One of Charles' examples is that the explanation that a fish is gluttonous, a *per se* attribute, is due to the defective nutritive equipment, assumed to be part of the definition of a fish.²⁸⁶ Another explanation that Charles finds problematic is that methods of reproduction are not explained via mode of life or way of locomotion, the latter being what will define an animal on Charles' view, but rather through internal heat and moisture of that kind of animal.²⁸⁷ There are other examples as well, including using the size of an animal to explain various features such as horns or kind of defense. Nutritive equipment, heat, and size are all material parts of an animal. So, material ends up explaining essential attributes of an animal. This criticism cannot be solved in the same way as Gotthelf's, for the essence does not entail the material nature but only genera that make up the essence. I will defend the unity of the definition against this challenge by arguing the material nature here is really an aspect of a generic nature found in the essence.

The third and final threat comes from Lennox. He argues that some parts of an animal are shown to belong solely through the material nature of the animal or at least it is the primary cause in his article "Material and Formal Natures in Aristotle's *De*

²⁸⁶ See Charles, *Aristotle on meaning and Essence*, Oxford: Clarendon Press, 2000, pp. 333.

²⁸⁷ *Ibid.*, pp. 333.34.

Partibus Animalium.” One of his examples is the lack of the epiglottis in a bird is due to its material nature.²⁸⁸ This threatens the teleological unity of explanation, for it is no longer the end or formal cause that is primary in explanation. This threatens various kinds of unities, primarily the unity of the definition. But this also threatens the unity of a capacity. A single capacity will not be responsible for all the parts that contribute towards its particular end, e.g., reproduction or nutrition. There will also be at least two distinct middle terms, one as end and one as material, so not all predicates will be connected to the subject by the same term. But Lennox also, indirectly, provides a way out of this problem. He develops what he calls the “principle of functional priority” and also a generic structure encompassing the kinds of explanations parts receive in the *Parts of Animals*. I will appeal to both to defend the claim that Aristotle does follow in his practice of zoology the theoretical solution to the problem of one or many differentiae that I have argued. Lennox describes it as follows:

Given the presence of a certain material, it [the material] will be directed to location L for the sake of natural function F, unless function F is subordinate to function F*, in which case it will be re-directed to L*, the location of F*.²⁸⁹

If a function or work subordinates another work, it will have the priority in explanation and be primary in explaining where the material is directed and how it is organized. We will see that the epiglottis is a subordinate work that only arises due to two other functions. But we will see that Aristotle appeals to this type of functional priority on numerous occasions and that layers of explanations are to be traced to one, final differentia.

²⁸⁸ See Lennox, “Material and Formal Natures in Aristotle’s *De Partibus Animalium*”, in *Aristotle’s Philosophy of Biology*, pp. 196-98.

²⁸⁹ *Ibid.*, p. 192.

In this same article, Lennox provides a generic form of explanation commonly found in the *Parts of Animals*. Since nature is both form and material, many explanations will locate what the part is for, why it belongs, and what that part must be made of. The structure looks like this:

The function of part P is of F.
 Anything which fs must have disposition d.
 Hence P must have disposition d.
 Uniform part UP has d.
 P is UP.²⁹⁰

Lennox leaves out the most important connection though. A complete explanation would show that a part belongs to an animal for the sake of a certain capacity and action of that animal and ultimately be explained by the defining action of that animal. But this structure will be helpful to have before us as we go through the explanations. If Aristotle can connect the part and its function (ἔργον) to the formal nature of the animal, and the material of the part is necessitated by the function, then the animal is a teleologically, unified whole.

We can now connect Aristotle's zoology back to the early theme of the dissertation concerning empiricism and metaphysics in natural science. Aristotle grasps both the work (ἔργον) of the part and its material constituents empirically. The metaphysical assumption is that these parts are related back to and explained by one thing—the essence of that animal. On my view, the metaphysical assumption does not affect the empirical nature of the inquiry into the parts of animals and why they belong. It does, though, provide the intelligible structure of the science of zoology. The assumption gives meaning and guidance to the inquiry. This will become evident as we

²⁹⁰ Ibid., p. 197.

go through various explanations. Let us turn to these now, roughly in the order we find them in *Parts of Animals* II-IV.

5.2 Being Blooded

Aristotle has already done an empirical inquiry into the nature of animal parts in the *History of Animals*. This inquiry establishes the facts, the various ὅτι-predications of the animal world, by seeking out counter-predicates. The counter-predicates also mark off various levels of explanation. In the *Parts of Animals* Aristotle attempts to locate the cause and explanation for these various ὅτι-predications, the parts he has marked off in his empirical inquiry. He now seeks the middle term. But the seeking is done in a determinate way to avoid ignorance of the cause, locating the cause at the proper generic level, as well as preserve the unity of the definition of the animal. The two modes of seeking for a definition come together here in the practice of zoology in *Parts of Animals*. The methodology demands that the zoologist starts from the widest genus, then, by dividing, he will locate the various genera between the widest genus and the particular species that explain the facts already established. I will argue below, in the first subsection, that being blooded along with being bloodless is the first division of the genus animal, and, as such, one of these genera is in the formula of any particular *ousia*. The genus of being blooded will explain the most generic facts of that kind of animal. This follows the methodology of division as argued in *Posterior Analytics* II.13 in conjunction with the methodology developed in *Posterior Analytics* II.8. The former chapter states how to divide in order to find what is predicated in the essence of a thing. The divider needs to find that which is in the essence, divide in the proper order by taking

what is first, and make sure that this all that is (97a23-26). In my view, if the divider can insure that each division is primary one at that level and, when done dividing, all of what has been divided is in the essence, then this person has met the first condition, namely, divide by only what is in the essence. My view, following Balme and others, is that the zoologist makes these divisions in respect to the facts established through the counter-predicates. The facts will help us seek out the middle term, which is the essence. This is the argument of *Posterior Analytics* II.8 (see section 3.3). Now, I will argue below that Aristotle proceeds in his practice of zoology by assuming that being blooded is in the essence of a particular kind of animal because this nature along with being bloodless marks off all animals into two kinds. This kind is first in the division and definition of an animal because the nature of being blooded unifies the three main capacities (δυνάμεις) of an animal—the nutritive, perceptive, and locomotive capacities (*PA* II.1 647a24-33). Since an *ousia* is one thing, and the essence is what makes any animal be one thing, what is in the essence must be that which unifies the animal. The nature of being bloodless serves the same purpose in those kinds of animals because some similar nature fulfills this same unity of the capacities.

This view also resolves some of the problems the literature has about the question where Aristotle explains all the attributes through the essence. The nature of being blooded, although itself a unity, serves as a middle term and cause in various ways. This is because the nature of being blooded unifies three distinct kinds of actions of an animal. So, the middle term will be expressed differently in different explanations, for the part may belong because of the nutritive capacity or the perceptive capacity or the locomotive capacity. I will argue that the way in which the locomotive capacity is realized in an

animal is what marks off extensive genera and particular forms from each other (see section 5.4). We should also recognize within any capacity, there may be diverse explanations pointing back to one fundamental action. This holds for both the nutritive capacity and the perceptive capacity. The former has different works that pertain to it. The nutritive capacity is the way the animal engages in self-preservation. This includes taking in nourishment as well as expelling it and defensive features to protect it from predators. Nourishment also is not simple, for it is both wet and dry. Each kind requires different parts, e.g., the former requires a bladder to expel and the latter the intestines. There will be various works that contribute to this capacity, so we should expect a variety of middle terms that all point back to the generic feature of being blooded as the nutritive capacity. I present four features that belong through the nutritive capacity below: the blood and what follows (5.2.2.1), the teeth (5.2.2.2), the stomach (5.2.2.3), and having horns (5.2.2.4). In the first sub-section (5.2.1), I will discuss the nature of the heart and why it unifies the various capacities. This will be the crucial step in understanding how being blooded can serve in various ways to demonstrate different kinds of attributes. We will also notice that the features that belong through the nutritive capacity can also be further differentiated to mark off lower kinds. I will show this in these sections as well as the section on being lunged (5.3).

Since the perceptive capacity allows for different actions than those through the nutritive capacity, the parts that belong through this capacity will have different middle terms. I will investigate several features that belong through this capacity below in another subsection: eyelids (5.2.3.1), nose (5.2.3.2), and tongue (5.2.3.3). I will spend most of the discussion of the nose on how the explanation of the elephant's nose

conforms to the theoretical commitments I have developed in the previous two chapters. The explanation of the tongue as well as the nose will be beneficial in supporting my view in another way. Both the tongue and the nose are perceptive capacities that connect to the nutritive capacity. The explanation of these parts will connect the different capacities, showing that these capacities work together to make possible a complete unified whole: the living animal. Let us turn first to how Aristotle locates the feature in the essence of an animal that is responsible for the unity of the three capacities that belong to almost all animals.

5.2.1 The First Division of the Genus Animal: Being Blooded and Being Bloodless

An animal, according to Aristotle, is defined according to its primary action (645b15-20). But an animal has various actions which it performs. These actions are teleologically organized insofar as subordinate actions are for the sake of higher actions and ultimately the primary action (645b27-30). So, the explanation of subordinate parts is both through the subordinate end to which that part serves and also the primary end that organizes the whole body (645b30-32). But there is the obvious prior problem: if an animal has more than one action, what will make the animal be one thing? For, even if an animal is teleologically organized by one action that is primary, it could still be the case that each action is a separate principle organizing different material to be for that action. Aristotle solves this problem by locating the capacities for all the actions in one primary organ in the *Parts of Animals*. This organ will serve as the principle (ἀρχή) for these capacities, and, as such, it will be the unity for these various capacities and be the source of unity in the animal. Capacities that have one principle are one in respect to that

principle. This primary part for Aristotle is the heart or its analogue in bloodless animals (PA II.1 647a29-31). I will argue below that having a heart, which is having the capacity to function as a heart, just is the nature of a blooded animal. All explanations of the material parts of blooded animal will appeal to this nature in some way. If this is the case, and all animals are either blooded or bloodless animals, then Aristotle has located the two features that constitute the first division of the genus animal. And if this is so, Aristotle has found a feature that is predicated in the essence of any animal. Explanations or parts belonging through these features, blooded or bloodless, will hold of the animal *per se*, albeit generically so. But this does not prevent these generic parts of an animal from being further differentiated by lower kinds. Most of the literature ignores this division of animal either following Balme that blooded and bloodless are groupings of animal or Lennox who claims that no such division is ever pursued.²⁹¹ The passage itself where I claim the division occurs will provide some proof to the contrary, but I will need to argue that such a division is occurring here. Here is the passage:

Since in animals the perceptive, motive, and nutritive potentials are in the same part of the body, as previously stated elsewhere, it is necessary that there be a primary part with origins (ἀρχαίς) such as these. And in so far as it is receptive of all the objects of perception, it must be one of the simple parts, while in so far as it is able to initiate motion and action, it must be one of the non-uniform parts. Hence in the bloodless animals the analogue of the heart is such a part, and in blooded animals it is the heart; for the heart is divisible into uniform parts, just like each of the other viscera, yet because of the shape of its configuration, it is non-uniform. Each of the other parts

²⁹¹ Lennox really admits to follow Balme here. See Balme, *De Partibus Animalium I*, pp. 120-21. See Lennox, "Kinds, Forms of Kinds, and the More and the Less in Aristotle's Biology", in *Aristotle's Philosophy of Biology*, p. 170.

called viscera follows the heart. That is to say, they are constituted from the same matter; for the nature of all of them is bloody, on account of their being positioned on vascular channels and rivulets (647a24-b2).

Aristotle is clearly seeking the part that will serve as the principle for all three capacities. The first argument in this passage is a reference back to another passage or several passages.²⁹² Following Lennox, I think that the reference is to several passages I will soon discuss. There is also another argument present, which is the one given in the passage. I will present the argument in the passage below, but first I will turn to the passages where Aristotle has argued elsewhere that the heart is the principle of all three capacities has been expressed elsewhere.

The two passages that Lennox takes Aristotle to refer to here are *De Motu Animalium* and *On Youth and Old Age*. Starting with the most basic capacity, nutrition, Aristotle argues in *On Youth and Old Age* 14 (474a25-b9) that its principle is in the heart, for the heart is both the origin of heat, which is necessary for digestion, and the principle of the nutrient, which is the blood. In respect to perception, an argument that the heart is the origin of these capacities is found in *On Youth and Old Age*. This passage is in chapter 3 (469a10-22) and the claim is that some of the perceptive capacities, taste and touch, lead directly back to the heart. All the other capacities must do the same, for there must be one principle of perception for there to be common sense and imagination. The heart is this principle. Finally, in *De Motu Animalium* 10 (703a4-28) Aristotle argues that

²⁹² Many scholars have noted that no one passage can be found where Aristotle argues that all three capacities originate in the heart or point to a passage that does not contain an argument for this view (*De Somno* 455b34-456a5). Lennox's solution, which I accept, is that Aristotle is referring to these passages in the plural, so there is no reason to expect one passage that argues all three. See *On the Parts of Animals I-IV*, p. 183-4.

the heart must be the part of the body that originates locomotion in the animal. Locomotion in an animal works through pushing and pulling and by nature the heart can expand and contract, originating the necessary motions for the limbs of the body to move. The heart, having the ability to originate motion, has within it what Aristotle calls the connatural spirit or breath (τὸ πνεῦμα τὸ σύμφυτον) (703a14). Now, this passage (703a14) could lead to us to conclude that Aristotle has a materialistic view of the nature of an animal. But there is reason not to draw this conclusion. The passage emphasizes that something must initiate the motion without being in motion, but this cannot be the heart, since it contracts and expands. It must be the soul, then, which does not move, for the soul is very thing that organizes the whole body. What does this mean here? The soul organizes the body such that the heart has the central location so as to be the principle of motion in the material parts of the body. Since this requires heat, and Aristotle takes the heart to be the origin of heat, this may be the primary meaning of connatural breath. So, we see that these passages above lead us to the same conclusion that Aristotle draws in *Parts of Animals* II.1: the heart is the principle and unity of the three main capacities. I now want to turn to the argument presented in *Parts of Animals* concerning the same matter and defend it on his own terms before I show how Aristotle concludes that being blooded and being bloodless must be the primary division of animals so that these two terms will be predicated in the essence of any animal.

Aristotle presents a different argument in *Parts of Animals* II.1 for why the heart is the principle of all three capacities. The argument (647a24-b2), on my interpretation, begins from an unstated assumption: since an animal is an *ousia*, and an *ousia* is one, so all of its capacities must belong to one feature of that animal. The second step he makes

is to determine what same feature or same part could be the principle for all three capacities. The perceptive capacity must belong to what is uniform in nature, for what is uniform in nature receives the medium by which perception is possible and is where perception takes place. But the locomotive capacity must belong to what is non-uniform in nature, for only what is non-uniform can impart motion. Imparting motion requires pushing and pulling, so a distinct part is needed for each. So, the part that unifies the capacities must be both uniform and non-uniform. The viscera are each of such a nature to be both uniform and non-uniform. The heart is the principle of all the viscera, since each of these is bloody in nature. Therefore, it must be the heart that is the part that is the origin for all three capacities.

Is this a good argument, or at least on Aristotle's own assumptions? The argument should strike us as problematic, since the common belief today is that the brain is the primary organ of the body and makes each of us what we are, and the heart's function is not to heat the blood. Aristotle obviously did not have all the facts that we have today of biological entities. But even on Aristotle's own assumptions Lennox points out three problems.²⁹³ The first lies in Aristotle's claim that the faculty of sense perception requires a uniform part to receive the sense percepts of touch or sight or hearing. This is based on the assumption that something external that carries the sense percepts must have contact with something simple in the sense organ. Clearly, the heart does not have contact with what an external sense receptor would receive. So, this premise seems unwarranted. Second, although the capacity of locomotion requires that an animal have non-uniform parts, it is not clear why the principle of locomotion demands such an assumption. On Aristotle's own assumptions, since a principle does not

²⁹³ See Lennox, *On the Parts of Animals I-IV*, p. 184.

necessarily move, this seems to be false. Finally, Lennox claims that the viscera are only materially uniform, being composed up of the same material, rather than being a part that is both uniform and non-uniform by nature, so the conclusion to the argument at 647a24-33 does not follow. I will address each of these concerns and then raise a different problem about the nature of the heart, namely, whether and how it relates to or just is the essence of an animal. This will help us focus on the main issue of this section, which is to answer how being blooded along with being bloodless is the primary division of the genus animal. My defense against Lennox's criticisms will also show that being blooded is in the essence of any animal of that kind.

Lennox's first criticism is that the principle of perception does not have to have contact with the perceptive medium to perceive, only the organ. So there is no reason why the principle of perception must be a uniform part. Clearly, the heart does not have contact with any perceptive medium. But it is also the case that one reason why the heart is the principle of perception is because it serves as the faculty of common sense. If the organ where the faculty of common sense is located receives all the sense perceptions, and if each kind of sense perception requires a uniform part to receive the medium of perception that carries the perceptible form, then it follows that, if the heart receives the sense perception, this faculty must belong to a uniform part. Otherwise, the faculty would be incapable of receiving the perceptible form. Further, for Aristotle, the blood serves as the medium that carries the sense perceptions to the heart from the sense organ. Although this may seem quite mysterious to us, even more so when we realize that Aristotle does not believe that the heart pumps blood but rather radiates heat, it does make good sense on Aristotle's own terms. Blood, being both moist and hot though not

in its underlying nature (see 5.2.2.1), serves as a kind of intermediate between the primary potentials of elements—hot, cold, dry, moist (*PA* II.3 649b22-34). Thus, if some basic element is receptive of the sense perception, blood has this capacity as well. It may be that we cannot expect more of an explanation than this, unsatisfactory as it is. Aristotle is less concerned about mechanism in a living being than he is concerned about its being. The being of an animal is its capacity for a primary action, and the parts are there for the sake of making possible that capacity. The mechanisms are good to know, but, for Aristotle, nature is primarily an end (*Physics* II.1 193b6-7, cf. *PA* I.1 642a16).

The second problem points to a deeper metaphysical issue: the principle of locomotion in the body must be non-uniform to impart motion. This problem may even seem to conflict with Aristotle's conception of a soul, which is supposed to be a principle of motion without itself being in motion. Locomotion demands non-uniform parts. This is obvious. Even for the paramecium or the amoeba to move, each must be divisible into somewhat distinct parts. But how can there be a non-uniform part that is the principle of locomotion if the soul is the principle of locomotion? Aristotle is claiming that the heart is the principle of this capacity. Should the heart itself be unmoved as the principle? This is not clear. It seems that Lennox answers no, for this seems to motivate his criticism. On the other hand, if we take seriously that the heart is the potential for the capacity of locomotion, not the soul itself, nothing demands that the heart be unmoved in any significant sense. We must now fill in why the heart must be a non-uniform part. If we turn to the passage in *De Motu Animalium*, which I did above, that argues the heart is the principle of locomotion and how motion works, we will see there it is necessary that the heart be a non-uniform part to impart motion. All locomotion arises for Aristotle due

to pushing and pulling, and the heart does this by expanding and contracting (703a19-21). The heart can only expand and contract if it has a certain configuration on its own. One could object that muscles expand and contract (though this is not clearly Aristotle's position) while remaining uniform. Aristotle's response, I believe, would be that muscles expand and contract due to external causes, namely the decisions to pursue or avoid something coming from the faculty of common sense, and their configuration that enables them to expand and contract so as to produce motion is not the nature of muscle by itself but in relation to other parts such as bones and sinews. The heart expands and contracts of its own accord for Aristotle to set off other motions in the organism. Thus, it must have a non-uniform configuration for this activity. So, the heart is not the soul, though its work is most soul-like. But it seems to follow that the heart is most soul-like of all of the parts of the body. We will have to qualify this claim later in section 5.4. We can also understand the distinction between the soul and the heart. The heart undergoes a change to initiate motion, but the soul does not. The animal remains the thing it is while moving, but the heart changes from one condition to another, from not expanding and contracting (or not that much) to doing so (or increasing the frequency).

Finally, the last problem is how can Aristotle claim that the heart and all viscera are both uniform and non-uniform in their being and not just one way according to their material and another way due to their configuration? The latter is Lennox's interpretation of the viscera. The answer is that the work of the heart or any viscera demands that the part be both uniform and non-uniform in its being. The heart's work is to make and fashion the blood, which is receptive of the sense perceptions, the primary nutritive element, and to expand and contract in order to move the other parts of the body for

locomotion. The heart's work then requires a uniform part for the nutritive and perceptive capacities. But its work also demands a non-uniform part for the locomotive capacity. Work is what defines the part (641a2), thus, the heart and all the viscera do not have their being apart from being both uniform and non-uniform in themselves.

Now, we can see that Aristotle has some support for holding that the heart is the primary organ as the origin of the three capacities. This confirms Aristotle's suggestion in *Metaphysics* Z.10 (1035b25-27) that some part must hold the power (κύριον) of the *ousia* in its being and be in the formula of it. Aristotle suggested there that this part was either the heart or the brain, but we now see that the zoology shows it is the heart. So, we can conclude that being blooded, which is the same thing as having a heart, is in the formula of this kind of *ousia*. It is also the case that this kind, being blooded, is part of the first division of the genus animal, along with being bloodless, for this feature unifies the three capacities of an animal. There is no more basic feature of an animal, and this division of animal into these two kinds divides all the animals. Thus, this division fulfills the requirements laid out in *Posterior Analytics* II.13 (97a23-26) given above. How did Aristotle make this division? He located various different sets of counter-predicates and then sought out what is the cause of these predicates belonging to one generic kind using the structure of a demonstration. Below, I will show how Aristotle determines that the blooded nature of an animal is the cause of these various parts belonging. But since being blooded unifies several capacities, each of which can serve as a cause and middle term, I must divide these capacities up as Aristotle does. I will begin with the nutritive capacity, since it is the most basic (5.2.2) and then move to the perceptive capacity

(5.2.3), discussing some of the features that are shown to belong through this one nature, being blooded. The locomotive capacity will be discussed in section 5.4.

5.2.2 Being Blooded as the Nutritive Capacity

Aristotle's claim is that being blooded is the first thing predicated in the essence of a certain kind of animal. This feature unites the three main capacities. The nutritive capacity is the most basic, without which, the other capacity would not belong to the animal (*De Anima* II.4 415a22-26). We also know that the generic material potential that must be present for nutrition is heat (*On Youth and Old Age* 14 474a25-b1, cf. *De Anima* II.4 416b27-28). The parts that belong to an animal through its nutritive capacity will be for the sake of digesting the food (stomach) (5.2.2.3), moving the food to digestion (mouth, esophagus, etc.), breaking up food for digestion (teeth) (5.2.2.2) handling the waste of the nutrients (intestines, bladder, kidneys), and moving the nutrients to the rest of the body (blood vessels). But Aristotle must also determine the basic nourishment of the body. This is the blood (5.2.2.1). Other parts will follow due to nature of the blood. Some of these parts, e.g., fat and marrow, will also be discussed in section 5.2.2.1. The explanations of these parts will be the fourth kind of explanation, i.e. certain things follow given the nature of a part (see section 4.5). But the nutritive capacity is also that by which the living thing is said to be alive (*De Anima* II.4 415a25-26). This would seem to imply that it is also the cause of defense in the animal. One of these defenses Aristotle speaks in details and seems to mark off as a genus—the horned animal (5.2.2.5). These explanations show that having heart is explanatory of these various features. This kind of explanation is one through the essence, albeit generically. My claim is that a generic

explanation through the essence is the second kind of explanation discussed in 4.5, that which in general cannot be otherwise. Finally, the third kind of explanation is also present in this discussion of the blooded nature. Kidneys belong for the sake of the good or what is better (5.2.2.4). So, three kinds of explanation are present, and I will show that each one leads back to the specific essence of an animal, but, here, the explanation leads back to something predicated in the essence of the animal, being blooded. The argument I develop below will not only show how the explanations of the various parts work by appealing to the nutritive capacity but also how these parts are interconnected in these explanations. The interconnections of the parts that the explanations provide point to the kind of unity that is present to an animal for Aristotle: all the parts work together for the sake of one end.

5.2.2.1 Blood and the Uniform Parts that Follow

The first group of animal parts that Aristotle locates causes for is blood and those parts that follow from the nature of blood. On my view, blood is a material part that differs from the generic nature of being blooded. As stated above, the ordering in *Parts of Animals* II-IV follows the methodology developed in respect to the first aporia so that the zoologist can determine the proper generic level of explanation and the cause. This order is from the most basic and common features to those that are more specific in nature. Beginning with blood makes sense on these terms from two vantage points. First, blood belongs in common to all blooded animals, since each has a heart and the heart is the principle of the blood (*PA* III.4 666a23-24). Second, blood is the material for the rest of the body and is for the sake of the most basic function of any animal: the

nutritive faculty (*PA* II.4 651a12-15). But Aristotle is also following another principle he states in the physics, but in an inverted way. At *Physics* II.2 194b8-9, he claims that material is relative to a form, so a different form requires a different material. But physics also begins from what is more known to us (i.e., the material) rather than what is more known in itself (i.e., the form). So, nothing is wrong inverting this principle, at least in respect to a natural *ousia*, that a different form requires a different material to say a different material implies a different form. In finding the basic material first, the zoologist is in the position to build up the animal from the most basic material on up. Logically, the end determines what parts must belong, but, if science is an inquiry, we ignorant of this end, and seek it by seeking what material parts belong. This will also enable the zoologist to find various differences that will distinguish the various animals, either at another lower generic level or the level of form. We will see this at work more clearly in the next section on teeth (5.2.2.2), but there will be some sign of this occurring in respect to the blood and the parts that follow from this nature.

When turning to the nature of blood, we are immediately faced with another methodological question: how should the zoologist study the nature of blood, i.e., does blood have an essential nature, and if so, what would constitute this nature? Aristotle argued in *Parts of Animals* I that a part will be defined by its work (*ἔργον*) (641a2). But he qualifies this claim at the beginning of the second book. Only the non-uniform parts have a work in the proper sense whereas the uniform parts are for the sake of these (*PA* II.1 646b10-14). The uniform part will have a certain material potential (*δύναμις*) that contributes towards the work of a non-uniform part. These potentials are softness, hardness, dryness, moistness, and heat. These potentials will derive from the nature of

the constituents of the uniform part—the fundamental material elements. So, knowing what a uniform part is made of—specifically, the potentials of what it is made up of—is knowing in what way it can contribute to the work of a non-uniform part and to the whole composite animal, i.e., one of the animal’s main capacities. This also makes sense of how Aristotle seeks out the nature of blood. We should remember that the basic feature of nutritive capacity is heat. So, it is natural to assume what will nourish the body is also hot. But “hot” has various senses (see *PA* II.2 648a33-649b7). Aristotle concludes in *PA* II.3, after a long discussion in the previous chapter of the different senses of hot and cold, that blood is essentially hot and moist (649b36). But the way in which blood is hot is like boiling water. The heat does not belong essentially to the underlying subject (τὸ ὑποκείμενον) but to the blood as blood. Blood is the material for the whole body inasmuch as other parts are concocted from it and so, it is, as such, the final nutrient (650b2-12, cf. 651a14). So, as a uniform part, blood will be defined by its primary potentials. Why, then, is blood hot and moist by nature, and how does Aristotle determine this? In one way, Aristotle determines this empirically. Blood is hot and moist when it is present in the body or has recently left the body. After leaving the body of a blooded animal for some time, most blood turns cold and dry.²⁹⁴ This empirical knowledge of the nature of the blood leads us to realize its functional nature. Blood has the character that meets the material conditions for the possibility of there being nutrition and growth. Nutrition requires moisture for any living being (647b27), and it also requires heat to concoct the food that has entered the body (650a3-7).

²⁹⁴ Aristotle cites the deer and gazelles as blooded animals that do not follow this principle. But it has a material explanation for why this explanation does not hold. These animals lack fibers in their blood, which are of an earthen nature. See *PA* II.4 650b14-5.

But if the claims supplied above about the nature of blood are discovered empirically, how can Aristotle conclude anything about the essence of blood? A claim about the essence of a thing is a necessary claim. My answer is that the facts observed supply conclusions to demonstrations. By seeking the middle term, Aristotle can come to know about the essential nature of blood, for this will be connected to and defined by what accounts for blood belonging to the animal. The demonstrations that I believe can be constructed from this inquiry into the nature of the blood are as follows:

Nutrition and growth require heat and moisture.

Heat and moisture is present to blood.

Nutrition and growth require blood.

The nature of blood is for the sake of nutrition and growth.

Nutrition and growth require heat and moisture.

The nature of blood (what it is to be blood) must be hot and moist.

The first empirical claim is that blood is for the sake of nutrition and growth. The middle term and cause that connects these terms is the material necessity present to the capacity of nutrition and growth. This matches the conclusion, which is the material feature required by this capacity. On Lennox's model (see 5.1), the capacity of nutrition requires a certain disposition. The middle term of the second demonstration is part of the generic essence of being blooded. Given the nature of this capacity, the basic material of the body must have certain potentials. So, blood, the basic material, is essentially composed up of certain potentials. Although all of the content is from empirical observation, the conclusion can hold of necessity and inform us of the nature of blood. The explanation is through a generic feature of the essence, so I interpret this kind of explanation to be of the second kind from 640a33-b1: in general it cannot be otherwise. Aristotle has now shown

both that blood belongs for the sake of the nutritive capacity and what is the nature of this blood.

There are two problems still before us. First, since I have just presented two demonstrations constructed from the text, I seemed to have undermined my claim that the *Parts of Animals* presents science as an inquiry. Second, if these demonstrations exhibit the nature of material, then the ultimate material of an animal cannot also be taken as given.

The first problem is answered by the order in the text. Two facts have been established in the inquiry. First, the nature of the blood is hot and moist and in what way the blood is such—not of the underlying subject but of the blood as blood. Second, Aristotle has established that the nutritive capacity requires blood. Aristotle then uses these facts to seek out the cause: the nutritive capacity requires heat and moisture as material causes. One might object that Aristotle already knew the cause, for he appeals to this cause in this passage (650a5-6). But Aristotle empirically determines the nature of blood first (649b22-36). So, textually, he is following the order of inquiry that I described in section 3.3. But it may be the case that the zoologist already knows, but without demonstrative certainty, that the nutritive capacity requires heat and moisture. The *Posterior Analytics* begins by claiming that all teaching and all inquiry depend upon prior knowledge. By placing the observations within the structure of a demonstration, the zoologist can move from knowing that the nutritive capacity requires heat universally (καθόλου) to knowing it simpliciter (ἀπλῶς) (see *APo.* I.1 71a28-29 for this distinction). In the language being used in respect to scientific knowing, I interpret this move to be from having established the fact (knowing universally) to finding the cause and knowing

through a demonstration (knowing simpliciter).²⁹⁵ Demonstration, then, helps the zoologist understand why this fact must be so and cannot be otherwise, but the zoologist of course already knew that the fact holds and maybe even had some notion why it holds thus.

The second question raises a different problem about explanation of an animal for Aristotle: how can blood be both explained through the generic essence of an animal and taken as given in the same science? We should first note that Aristotle asserts that the material is already present to the thing at *Physics* II.2 194b8. This seems tantamount to the assertion that the basic material is just taken as given in a science of physics. Does Aristotle still accept this view in *Parts of Animals*? The following passage may help decide this issue.

Since there is something receptive of all nutrients and generated residues, and the blood vessels are like a container for blood, it is apparent that blood is the final nutrient for the blooded animals, and its analogue for the bloodless. And the amount of blood decreases on account of *not* taking nourishment, and increases on account of taking it. And when the nourishment is wholesome the blood is healthy, while when it is bad, the blood is bad. It is, then, apparent from these considerations that blood is present in blooded animals for the sake of nourishment (650a32-b2).

Aristotle is no longer providing demonstrative knowledge or seeking the cause that the blood nourishes the whole body here, but rather he gives empirical evidence that supports this view. There is no conflict in taking as given that blood is the basic material of the body, but backing up this claim with some supporting evidence. This is what I interpret Aristotle as doing here. But that blood is for the sake of nourishment is not the same claim that blood is the basic material for the whole body. The latter claim is taken as

²⁹⁵ See *Posterior Analytics* I.2 71b9-11, 71b16-22 for the latter distinction. The former distinction is an interpretation, for it is not clear Aristotle ever defines or specifies what knowing universally is in this passage.

given (in conjunction with some supporting evidence) whereas the former is demonstrated (i.e., the nutritive capacity requires blood) and then used to demonstrate what is the nature of blood. So, there need be no conflict in explanation for the facts differ. But an interesting result arises because blood is both the basic material of an animal and the nature of blood is determined by the generic essential nature of the animal. Aristotle can claim that no part of an animal belongs to it that is not due to the specific essence of an animal in some way. The form and material of any given animal can be one as a functional, organized whole. All the material present is there for the sake of the end, and all the material organized as a whole just is this end—the capacity to engage in a certain kind of action. We can see, from drawing this conclusion, yet another reason for Aristotle to begin his inquiry of the nature of the parts of animals with the blood. The proof that blood belongs because of the end is in accordance with his metaphysical views on the nature of an *ousia*.

Now that Aristotle has determined the nature of blood and its role in a blooded animal, he will now discuss other attributes or parts that follow from having blood. Two of these are not discussed extensively here but clearly do follow. One is the stomach, which is required to concoct the food. I will discuss this part and why it belongs to animals in 5.2.2.3. The other is the blood vessels, which are to store the blood while it is outside the heart before it becomes part of the actual body. These two attributes will have different proximate causes than the nature of blood, yet these causes will also be either the nature of the nutritive capacity or some aspect of it. But there are other parts that follow directly from the nature of blood. These are fat and marrow. But before we can understand these, we must understand one more aspect of blood: its material nature.

Blood is essentially moist and hot for Aristotle, but it also is the case that blood has its own underlying material. This is also discovered empirically when blood dries and cools down after leaving the body. The former implies that there is some earth present in the blood. Aristotle calls these fibers, though fibers are not present in the blood of all blooded animals (*PA* II.4 650b14-18). This will help make a differentiation among kinds of fat. But Aristotle claims that there is a connection between kinds of character within animals, e.g., intelligence, bravery, etc., and the kind of blood present. This would appear to us to be a claim made more by a materialist than by Aristotle, but once again we need to understand Aristotle within his own context. Although he claims that the material is the cause of many features, we should understand this within the context of the four causes and his theory of nature. The cause, of course, is the material cause. But material is present in an animal for the sake of the form. Thus, the material causes are present so that the animal may be able to function as the kind of animal it is. I see no reason to interpret these claims as evidence that Aristotle supports a materialistic view of animals, as Martha Nussbaum once claimed.²⁹⁶ Inquiry of the parts of an animal always leads towards the nature of the form of the animal (cf. *PA* I.1 640b23-28).

Fat is an example of a part following from the nature of another part. I interpret the explanation for why fat belongs as the fourth kind of explanation present at 640a33-b1: and these things follow. Since blood has already been shown to belong through the generic essential nature, it would follow that fat and other parts that follow are indirectly explained through this same essence. Why does fat belong to a blooded animal? Due to the nature of the blood and the diet of animal, fat will arise as a certain concoction of rich blood (*PA* II.5 651a21-24). The richness of the blood seems to be due to the presence of

²⁹⁶ See M. Nussbaum, *Aristotle's De Motu Animalium*, Princeton: Princeton University Press, 1978, p.

oil, something composed of moisture, air, and fire. So, it is possible for oil to be present in the blood, given blood's constituent elements. That fat is derived from the blood is recognized by several signs. The kind of fat present, be it soft or hard, follows from how much earth is present in the blood. Further, fat is not perceptive, like blood (651b5-7). Finally, fat is not present in bloodless animals. These considerations lead Aristotle to conclude that fat is a material consequence of having blood. Marrow also follows from the nature of blood, since the marrow in newly formed animals is blood-like (*PA* II.6 651b22-27). Aristotle also claims that it has characteristic that resemble fat, so it is concocted blood in some way (651b27-35). Marrow is present in those animals that form bones around the nourishment, which is not the case for all animals. Those animals with hard bones lack marrow in them. Further, those animals that lack bones, such as fish, do not have marrow present except for their backbone. These kinds of arguments for fat and marrow make sense according to Aristotle's conception of nature. The explanations are merely accounting for the material nature of uniform part and how it points back to the nature of blood. These parts are concocted blood in a certain way, although they can serve some function within an animal, e.g., fat can serve for the sake of protection. The next explanation I will turn to is the nature of the teeth and how Aristotle shows that teeth have both a generic explanation and explanations via the extensive genus or via the form.

5.2.2.2 Teeth

Aristotle's explanation in *PA* III.1 for why teeth belong fits my interpretation well. First, teeth belong generically for the sake of the nutritive capacity, for the preparation of the nourishment (661b1), and for the sake of good concoction (*PA* II.3

650a8-13). My view is that the blooded nature then explains why teeth belong generically. But teeth also differ according to kinds (661b2). Teeth are differentiated in various ways: for the sake of strength, for the sake of eating quickly (fish), or teeth are not present because another distinctive feature is present, the beak (bird). So, there will be both a generic explanation via the blooded nature and a more specific explanation via the nature of an extensive kind or form. My claim is that this is evidence that Aristotle considers the higher genera to be entailed by the lower, for the lower natures explain the way in which these higher generic attributes are realized. So, the specific explanation of the kind of teeth belonging to a certain kind of animal still appeals to the nutritive capacity. This could only be the case if the lower genus entails the nature of the higher genus in its being. I will show this entailment in three explanations: how teeth belong distinctly for human beings, for fish, and why they are not present at all for birds. But, first, let us give the demonstration that teeth belong generically to all blooded animals (with the exception of birds, which can also be explained via the nature of teeth—the material nature of them). This explanation will also show how teeth can have the other capacities, such as strength or ability to help produce articulate sounds in specific kinds.

Aristotle states that teeth both belong for the sake of the preparation of the nutrition and for the sake of good concoction. These are really the same explanation, although the former is stated generically and the latter specifies in what way the teeth contribute to the nutritive capacity. For food to be absorbed and used by the animal, the food must be broken down and then transformed into potential material for the parts. Aristotle calls all of this concoction (πέψις). Teeth are not the cause of concoction, rather, the stomach will be (650a11-13, cf. section 5.2.2.3). The teeth prepare the food

for concoction, or, better, the teeth make sure the concoction goes well by breaking it down some before it reaches the stomach. This claim will be supported by the fact that blooded animals that lack a full set of teeth will need other organs to contribute to good concoction, specifically, more than one stomach. The inquiry here is connecting teeth to their contribution to the nature of the animal. The teeth are in the mouth, and the mouth is the first place where food enters (*HA* I.2 489a1-2). This is why Aristotle begins the discussion of the teeth as such: “Next after the parts just discussed is the nature of the teeth in animals, and the mouth which is surrounded by them and constituted from them” (661a34-35). The teeth are the material for the mouth so that the mouth can perform its work. But the work of the mouth is to take in food and prepare it for concoction. Once again, we see the unity of form and material as argued in *Metaphysics* H.6, here, though, in respect of the work of an organ, the mouth. In the science of zoology, Aristotle’s focus is to take apart this unity to show how form explains material. But since this unity of form and material is the case, the nature of the material can lead us to the nature of the form. We are now in position to see what explains that the teeth belong. The demonstration is as follows:

Blooded animals have a capacity for nutrition.

The capacity for nutrition requires preparatory concoction of the food.

Blooded animals require preparatory concoction of the food.

Preparatory concoction of the food is by the mouth.

Blood animals have a mouth.

A mouth is constituted by teeth.

Blooded animals have teeth.

The obvious problem is that not all blooded animals have teeth, e.g., birds. But the explanation above leaves out the material nature of the teeth. This nature will actually supply the reason why birds lack teeth. Aristotle discusses the material nature of teeth in

Generation of Animals and mentions the conclusion at *Parts of Animals* II.9 655b8-10. He claims that teeth have the same nature as bones and are formed out of bones (II.6 745a18-b20). Bones are for the sake of support but also for the sake of protection (II.9 655b5). So, the material nature of teeth will be hard, for hardness is a material potential required for protection. The demonstration of the material nature of teeth would be as follows:

Teeth are for the sake of protection in a blooded animal.

That which is for the sake of protection in a blooded animal must be hard.

Teeth of a blooded animal must be hard.

Hardness is the material nature of bone in a blooded animal.

Teeth are made of bone in a blooded animal.

Now, Aristotle says the following about birds: “In the birds, the beak, as it is called, is a mouth; for birds have this instead of lips and teeth. It differs according to the uses to which it is put and the protection required” (III.1 662a34-b1). Birds, then, already have something hard as the mouth, the beak, where the food enters and also breaks down the food for concoction. Although Aristotle does not state it, it seems implied here that, since nature does nothing in vain, birds do not need both a beak and teeth. Since a beak follows from the nature of a bird, being useful for its way of life (662b5, cf. IV.12 693a10-23), the nature of the teeth already belongs to the beak. A bird does not need both. In a way, this does not violate the principle that all blooded animals have teeth, for the conclusion of the demonstration is that all blooded animals have the nature of the teeth (661a34), and birds do have the nature of the teeth, hardness, except as a beak. Once again, this is another sign that the blooded nature of an animal will be subsumed by a lower nature, here, a bird. Let us see two other examples where this applies in respect to the nature of the teeth and their organization.

Aristotle begins his investigation of the distinctive nature of human being's teeth by noting that they are well suited for the generic nature of teeth—they can cut up and grind the food (661b7-8). But the organization of teeth in a human being is also distinct. The forward teeth are grouped together so as not to have spaces in between, unlike the teeth of other blooded animals. But the material nature of the teeth is hard, and when placed together in a row, it is clear that this is useful for the tongue to make articulate sounds. An animal with the capacity of speech (λόγος) and reason (λόγος) has need of making articulate sounds. So, the best explanation for the organization of the teeth is the essential nature of a human being. Aristotle does not state the latter in the text directly, but it seems implied by what he says: “But it is especially for language (διάλεκτον) that mankind has teeth such as these and as many as these. For the front teeth contribute greatly to the generation of articulate sounds” (661b14-16). So, here is another example where the explanation of the teeth is entailed by and further distinguished by a lower genus, here, by a form (εἶδος).

The explanation of the kind of teeth fish have follows the kind of explanation present in birds and in human beings—it is distinct by kind. All fish, with the exception of the parrotfish, are saw-toothed and have many teeth including on the tongue and on the roof of the mouth (662a6-7). This is so that fish can break down the food quickly without taking in much water (662a7-9). This pertains to the way of life of a fish—living in water. So, the way in which the teeth are arranged and the number are contingent upon the essential nature of the fish. This is swimming or the capacity to swim (*PA* IV.13 695b17-20). The fish nature entails the blooded nature and then determines the kind of teeth appropriate for a fish's way of life. I take this to be evidence of the unity of any

particular animal nature, for nothing prevents particular kinds of fish, just as particular kinds of birds have particular kinds of beaks, of having distinct arrangement and number of teeth. In this case, the particular nature of the fish will subsume both the fish nature and the blooded nature which are part of its essence. Unfortunately, there is little textual evidence that Aristotle does pursue this line of explanation. But my stress is that there is also nothing in the text that rules out that explanation can be carried to the level of the form for each particular kind of animal.

5.2.2.3 Stomach

It is natural next to turn to Aristotle's explanation of the stomach (III.14), for it, as well as the teeth, is necessary nutrition. The explanation of the stomach is continuous with the explanation of the nature of the teeth. Teeth are for the sake of good concoction whereas the stomach would be for the sake of concoction. What we will find when we turn to Aristotle's explanation of the stomach is that there is stronger connection between the kind of teeth of an animal and the number of stomachs that belong to that kind of animal. It is best to turn to the passage that makes this connection, for, in this passage also, Aristotle explicitly states the work of the stomach.

And indeed, in animals with stomachs the stomachs are like one another neither in their magnitudes nor in their forms. Rather, the blooded and live-bearing animals with a complete set of teeth have one stomach, e.g. mankind, dog, lion, and the rest of those with many toes, as do those which are solid-hoofed, e.g. horse, mule, and ass. And those that, though cloven-hoofed, have a complete set of teeth, e.g. pigs, also have a single stomach—unless some animal, owing to its bodily magnitude and the potency of its thorny, woody, hard-to-concoct nourishment, e.g. the camel, has many stomachs, even as horn-bearing animals do. The horn-bearing animals have many stomachs because they do not have a complete set of teeth; because of this the camel too, though without horns, is not among those animals with a complete set of teeth—that is, because of the greater necessity for it to have such a stomach than to have front teeth. So since the camel is, in this

respect, like those animals without a complete set of teeth , it is like them too with respect to its teeth, since they would be of no use. Yet at the same time, since its nourishment is thorny, and it is necessary that the tongue be fleshy, nature makes use of the earth from the teeth to provide for hardness in the roof of the mouth (PA III.14 674a22-b4).

This passage supplies both the connection of the stomach to the number of teeth and the work of the stomach: concoction. Aristotle states earlier in this chapter that the work of the stomach and the part following it, the intestines, is apparent to everyone (674a12). The stomach holds the nourishment for the sake of concoction and the intestines carries out the dry nourishment that is not used. The nutritive capacity of a blooded animal explains the stomach belonging, then, what follows from the stomach belonging is the intestines. Given the work of the stomach, the intestines are required for nutrition. The work of the intestines relates to the nutritive capacity as the first place where disposable material is placed for its removal. We can see how these demonstrations are constructed:

A blooded animal has the nutritive capacity.

The nutritive capacity requires that which converts the food into nourishment for the body (concoction).

A blooded animal has that which concocts the food.

That which concocts the food is the nature and work of the stomach.

A blooded animal has a stomach (or the work of the stomach).

We should note that Aristotle begins the discussion with the fact: the work of a stomach is concoction of food. He then seeks to explain why this part belongs. The result, as we see above, is that a demonstration can be constructed from the results of the inquiry. Turning to the nature of the intestines, we see that it follows from the nature and work of the stomach.

A blooded animal has a stomach.

A stomach does not concoct all the food.

A blooded animal does not concoct all the food.

That which is not concocted is waste.

A blooded animal has waste.

Waste is first disposed by the work of the intestines.

A blooded animal has an intestine (or the work of the intestine).

The same structure is present here as the previous reconstruction from the text. Aristotle begins from the fact and seeks its explanation. From the results of the inquiry in the text, a construction of a demonstration is possible. We now understand the nature and work of these two parts, let us now see the difference amongst kinds of stomachs.

Now, returning to the main theme in the above passage (674a22-b4), Aristotle makes a connection between the number of teeth and the number of stomachs of an animal. A full set of teeth only requires one stomach. But if an animal lacks a full set of teeth, the animal will require more stomachs. This makes sense. Teeth are the cause of good concoction, but the work of the teeth is temporally prior to the stomach receiving the food. If teeth do not cause good concoction, insofar as the animal lacks sufficient teeth, then the stomach itself must do more work. Multiple stomachs are for the sake of the concoction necessary to turn the food into nutrients. But what we should notice that instead of a plurality of explanations through different middle terms as other scholars stress, Aristotle is really connecting the various features of nutritive capacity to each other. This is the horizontal connection between differentiae or material parts that is required if one differentia ultimately explains all the material parts belonging. Further, we can conclude that the work of the nutritive capacity is really one thing, for all the parts aim at the distribution of the nutrient to the body. We can see this clearly, adding explanations found in other passages in *Parts of Animals*.

The heart is the central organ for such a thing, for concoction requires heat as well as distribution of the nutrient which passes through the blood vessels. The heart is the principle of the blood vessels (PA II.9 654b11-12) and the blood vessels terminate or pass

through the viscera and all the other parts of the body (*PA* III.5 668a4-13). Finally, since the liver is present to all blooded animals, as well as the heart, Aristotle needs to argue that the heart is the origin and not the liver. His claim is that this conclusion is arrived at empirically, for the liver is not the origin of any blood vessels, but has one run through it nor does the liver have a receptacle for blood and it does not lie in the primary position of the body as the heart does (*PA* III.4 666a24-33). But since the liver is present to all blooded animals, it must have some work, and Aristotle claims that the liver is for the sake of concoction of food (*PA* III.7 670a26-27). So, we can see that the connection between the various organs here is the nutritive capacity. Since the nutritive capacity is one thing by having one work or action, the whole of these parts contribute to a single work and form one thing in a way. This may cause concern for all blooded animals have at least two other actions: perception and locomotion. This would seem to imply multiple beings and multiple middle terms. I will address this issue in section 5.2.3 in respect to the perceptive capacity and 5.4 in respect to the locomotive capacity. There will be one exception to this rule: human beings primary work is rational thought not locomotion. We should now briefly explore how wet waste is disposed. The explanation here of the kidney will expose one more kind of explanation: that which is good thus (καλῶς οὕτως).

5.2.2.4 Kidneys

The explanation of the kidneys in *Parts of Animals* III.7 is the standard example of explaining a part as being good thus.²⁹⁷ An explanation that is “good thus” explains

²⁹⁷ See Lennox, *On the Parts of Animals I-IV*, p. 268.

the part not as conditionally necessary for the end but enabling the animal to achieve that end better. The text literally states that the kidney is explained this way (670b24). The kidneys are connected to the organs for the sake of expelling moist residue. The bladder is the primary organ for such an activity in blooded animals (670b26), though not all blooded animals have a bladder according to Aristotle (*PA* III.8 670b34). But I will leave this explanation aside. I want to turn to the passage where Aristotle explains the kidneys belonging for the sake of the good:

The kidneys are present in those that have them not out of necessity; but for the sake of the good and doing well (καλῶς). That is, they are present, in accordance with their distinctive nature, for the sake of the residue which collects in the bladder in those animals which a greater amount of such excrement comes about, in order that the bladder may perform its function better (670b23-27).

Aristotle's very next claim is that both the bladder and the kidney are present for the same need of the animal (670b27-28). The reason the kidney is for the better is that the bladder is sufficient to do its job, i.e., to expel the moist residue. A bladder only belongs to those animals with a blooded lung, for these animals will take in more moisture in their diet (*PA* III.8 670b34-671a6). Not all the moisture can be concocted into nourishment, so some must be expelled. The kidneys, then, are for the sake of better expulsion of this moist residue. Our view of the kidneys today is that they filter impurities, so Aristotle did not have the facts correct, but we need not ignore this kind of argument in zoology. It may very well be necessary to explain certain parts this way, so looking at its logical structure is still of relevance today. Now, the passage that clarifies the work of the kidneys is in *Parts of Animals* III.9:

However, from the cavities of the kidneys two vigorous, bloodless channels run to the bladder, one from each of them; and other strong continuous ones run from the aorta. These things are arranged this way so that from the blood vessel the residue of the moisture can travel to the kidneys, and from the kidneys the

excretion which comes to be from the filtering of the fluids can flow through the body of the kidneys and into their centre, where most of them have a cavity (671b15-22).

Aristotle suggests that the residue of moisture from the blood arrives at the kidney already from the aorta. The kidneys and bladder then supply channels to flush these moist residues out of the body. The kidneys are for sake of the better because an animal with kidneys can expel moisture better: they have two organs performing this work instead of one. We can see that the explanation here still follows the teleological model and the predicate is connected to the subject through end of the animal, here, the nutritive end. I will now show that the nutritive capacity comes full circle, for I began with an explanation of the nature of the blood and there is one aspect of the explanation above still missing. The lack of teeth for Aristotle is connected to having horns. I will turn to this feature next and this will complete my argument how all these explanations are interconnected.

5.2.2.5 Having Horns

Aristotle seems to mark off a natural kind in *Parts of Animals* III.2: having horns. There are several reasons why Aristotle would take having horns to be a natural kind. First, the animals that have a horn by nature have several attributes in common, e.g., being hoofed, being large bodily, being made of earthy material, and lacking upper row of teeth. Second, being horned is an example used in *Posterior Analytics* II.14 about making excerpts in division, for having horns both follows from some nature and other things follow from its nature (98a16-19). In other words, division picks out kinds and orders them. But Aristotle does not state specifically that having horns is a genus, nor

does his use of it as an example give good grounds to accept having horns as a genus. What I will show below is that Aristotle is interested in showing how having horns is connected with other aspects of the nutritive capacity in animals that have horns. This connection points to a kind of unity of the nutritive capacity. It is not essential to my argument that having horns forms a genus, but I will argue below that little speaks against Aristotle holding it as such. Let us turn to the text to see what having horns entails.

Aristotle begins the passage with the following claim: “We must speak about horns; for these too, in those having them, are by nature on the head” (662b23-24). There are two things we should note about this claim. First, Aristotle discussion of having horn arises because he begins this part of the inquiry with the external parts of the head (*PA* II.10 656a7-16). He arrives at this priority because he uses human beings as his model. This is both because human beings are most familiar to us in respect to the organization of their parts and Aristotle prioritized human beings as conforming to the order of the cosmos—standing upright the important parts are above the inferior parts. The more relevant claim for my discussion is that I take Aristotle’s claim here that he is taking up the nature of the horn (662b23-24) to state a fact that he will seek to explain. Aristotle is inquiring into why the nature of the horn is on the head and what kind of thing has horns. The first thing he notes about having horns is that they only belong to blooded animals, for, although some animals may have what are called horns, no other animal has horns for the same work, namely, protection (662b25-27). This locates having horns under the blooded genus of animals. But having horns is more specific than the blooded nature, for many blooded animals lack horns. Aristotle locates the two kinds of animals that have horns: cloven-hoofed animals but also some solid-hoofed animals. What explains the

presence of horns in both these kinds of animals is that horns are for strength and/or protection. This nature of the horns will then be what explains the fact that horns are on the head. Horns would be useless anywhere else because either they could not provide the proper strength or protection, e.g., if they were placed on the shoulders of an animal, or they would hinder another function, e.g., if they were placed on the knees that would hamper the bending of the knees for locomotion (663a34-b11). But it turns out that the strongest point to place the horn or horns is on the head for this is most forward part of the body and able to make the swiftest and most effective blow. So, from the fact that the nature of the horns is on the head, Aristotle can construct the following demonstration of this fact through the above inquiry.

Blooded animals have a nutritive capacity.
The nutritive capacity requires a certain kind of protection.
 Blood animals have a certain kind of protection.
A certain kind of protection is having horns.
 A certain kind of blooded animal has horns.

The nature of horns is strength by blowing.
Strength by blowing is on the head.
 The nature of horns is on the head.

So, it will follow that a certain kind of blooded animal will have horns on the head by nature for the sake of strength and/or protection. But now we need to show why the nutritive capacity is responsible for the nature of the horns and the placement of the nature of the horns on the head.

The connection seems to occur through, on the one hand, the various attributes of the animal are that are connected with the nature of the horns, and, on the other hand, the material of the animal. Blooded animals that have horns are also animals that lack upper teeth and have four stomachs. Why is that the case? Aristotle explains the first

phenomenon through the fact that the teeth are made up of a bony nature, as with the horns (663b28-35), but since nature directs the material for the most appropriate end, the horns are need for strength rather than the teeth. We should recall that teeth also serve for protection and strength in an animal (*PA* III.1 661b2). Nature does nothing in vain. So, horned animals do not need both horns and upper teeth for strength, for nature simply supplies the animal with what is sufficient (663a17-18). As Aristotle states, “the nourishment assigned to the upper front teeth is expended in the growth of the horns” (664a2-3). But since the horned animals lack teeth, they will not chew food well, i.e., have good concoction. This lack of teeth will require more stomachs for good concoction. So, all aspects of why animals have horns (for strength and protection) and what follows from the fact that an animal has horns (lacking upper teeth, having four stomachs) pertain to the nutritive capacity.

Can having horns form a genus? The first problem with a genus of horned animals is would cut across two other generic kinds: split-hoofed and solid-hoofed animals. This would not only affect the unity of a genus but also the rules of subsumption. The second problem is that the camel seems to fit all the criteria for having horns yet lack them, for the camel lacks upper teeth, has multiple stomachs, and a large, earthy nature to its material. Both objections threaten the unity of explanation of having horns and the unity of the animal. Neither objection is conclusive. First, Aristotle never groups all solid-hoofed animals together under one genus nor all split-hoofed animals in another. Nor are they listed in *History of Animals* I.6 as extensive genera. So, it is not clear that either is an extensive genus that can be split up. Second, the camel has a separate explanation for why it lacks horns and has multiple stomachs. Horns are for the

sake of strength and/or protection. But the large bulk of the camel is sufficient for protection (663a4-6), and, since nature does nothing in vain, the camel does not need both features for the sake of protection. The reason camels lack upper teeth is due to the kind of food they eat, which requires a hard roof of the mouth; the earthy material is used there instead of having upper teeth (*PA* III.14 674b2-4). This also explains why the camel has many stomachs, for the concoction of such food without upper teeth requires many stomachs (674b5-14).

There is one more step concerning the nature of horns to complete the explanation. Aristotle needs to consider the material nature of horns and its explanatory role in having horns. Aristotle appeals to the large, bulky nature of these animals and claims that they have excess earthy material (663b28-32). Lennox points out that Aristotle seems to accept this fact of these kinds of animals as primitive (663b31-32).²⁹⁸ But I interpret this claim to refer to the nature of blood and how it differs in different animals. A large animal cannot be bulky without having earthy blood, for earth is what contributes to bulk and size, and blood is the nourishment for the whole body. In a way, the earthy blood of a horned animal is a primitive fact about the blood and one of its constituents. On the other hand, we see that the material is there for the sake of fulfilling the end and action of the animal. The bulk of the animal contributes to its protection and strength. What we are really seeing is the various ways in which the nutritive capacity interconnects many organs for the sake of nourishing the animal, and the blood as the basic material being distributed to where it is most necessary for this nutritive capacity. But this is not the primary action of an animal, since animals hold this capacity in common with plants. The next capacity I will turn to is unique to animals, but we will

²⁹⁸ See Lennox, "Material and Formal Natures in Aristotle's *De Partibus Animalium*", pp. 193-95.

find that it does not organize the whole body either, at least not according to the explanations in *Parts of Animals*, but the perceptive capacity does organize some aspects of the body.

5.2.3 Being Blooded as Perceptive Capacity

The perceptive capacity is also unified by the nature of the heart (*PA* II.1 647b24-33), but it seems to be vastly different from the nutritive capacity. The nutritive capacity has one central activity—nutrition of the body. Even though the nutritive capacity is also responsible for the reproductive capacities of an animal, Aristotle links the capacity of reproduction with the primary nutrient of the body—the blood. So, the nutritive capacity as a whole is a unified system. The perceptive capacity seems to defy having such a unity, for there are five different perceptive capacities—touch, taste, smell, hearing, and sight. The only unity here is that all these perceptions have a common origin in the heart. But this generic unity is already known. All this unity informs us of is that all the sense organs must lead back to the heart. But there is another way in which the perceptive capacity will be a kind of unity of the body of an animal. It will unify certain parts by subordinating these parts to the end and action of perception. Just as various parts were unified by the action of nutrition, other parts will be unified by the action of perception. But what I claim that adds to Aristotle's argument is that the perceptive capacity will connect nutritive parts and subordinate them to the perceptive capacity. So, I will argue that the unity of the nutritive capacity will be entailed and further integrated with the other parts and capacities of an animal.

There is a reason why the perceptive capacity subordinates the nutritive capacity. Aristotle states explicitly that animals are defined by their perceptive capacity (*PA* II.8 653b22). Likewise, the *De Anima* claims that the perceptive capacity marks off the genus animal and defines it primarily (II.2 413b1-3). I will show that Aristotle implicitly unifies other parts of the body through this capacity. The most basic unity supplied by perception is the unity that flesh provides by being the organ of touch. I will turn to this unity first (5.2.3.1). The capacity of taste shows another way in which the various parts are unified as well as the way another capacity is subordinated. Taste is located in the mouth, the organ being the tongue, in conjunction with where the first nutrient enters. I will discuss the unity associated with this faculty second (5.2.3.2). Finally, I will end with a discussion of the nose and nostrils and its corresponding perceptive capacity smell. The other sense capacities together other than touch unify the parts of the head. But some challenges are raised concerning the unity of any of these kinds of explanation, for, according to Gotthelf, numerous principles are used as premises to prove why the elephant's nose is unique. This kind of explanation will expose a different kind of unity—the unity of kinds in the definition of any particular animal.

5.2.3.1 Flesh

Touch is the most basic sense capacity according to Aristotle, and, since the genus animal is defined by the perceptive capacity, it is the natural beginning of the inquiry into what parts belong due to the perceptive capacity. Aristotle makes this previous claim and begins his discussion of flesh in *Parts of Animals* II.8:

Next we need to examine (σκεπτέον) the other uniform parts, and first of all flesh, in those animals which have flesh, and its analogue in the other animals; for flesh

is in virtue of itself (καθ' αὐτὸ) an origin (ἀρχή) and a body of animals. This is clear even from our account (κατὰ τὸν λόγον); for we define animal by the possession of perception, and primary in this account is the primary mode of perception. This is touch, and it is of touch that such a part is the sense-receptor—either the primary one, just as the pupil is of vision, or it taken with the medium, as if one were to add the entire diaphanous medium to the pupil. Now, in the case of the other modes of perception, to do this would be by nature both impossible and useless; but in the case of the capacity of touch, it is done of necessity. For of the sense-receptors, this is either the only, or the most, bodily one (653b9-29).

The capacity of touch and its relation to flesh raises some thorny issues for Aristotle that I will discuss below, but first we should note how this passage conforms to my interpretation of Aristotle's methodology. First, Aristotle announces that he will conduct an examination or inquiry (σκεπτέον) into other uniform parts (he has already discussed blood, fat, marrow, and the brain in II.3-7) beginning with flesh. Part of the inquiry will show why Aristotle begins with flesh—it is a principle (ἀρχή). An animal is defined by having the perceptive capacity, and touch is the most basic perceptive capacity. The capacity of touch is that which no animal can do without (*De Anima* III.12 434b10-15), and flesh is the sense-receptor, either the primary one or that which holds the receptor but serves as the medium. Aristotle has located what capacity will explain the nature of flesh and why it belongs of necessity to an animal. But Aristotle also states that flesh is a principle *per se* (καθ' αὐτὸ) of an animal's body. I hold off on explaining why flesh is a principle, for there is a prior explanation that we need to grasp. This explanation makes clear why flesh is a principle *per se*. The perceptive capacity is according to the formula of animal (κατὰ τὸν λόγον). Further, touch is the primary capacity of perception. These two premises explain why flesh or its analogue belongs to any animal. We still need to explain why flesh belongs to all blooded animals, but now we know that a demonstration can be constructed from the text, for Aristotle states that the perceptive capacity is

according to the formula of animal (κατὰ τὸν λόγον). I interpret this use of “κατὰ” to be *per se* (καθ’ αὐτὸ) in the first sense, for Aristotle is locating a predicate in the formula of any animal. So, it will follow that the capacity of touch must be in the formula of any animal as well for the animal to be animal. So, the first demonstration that can be constructed towards explaining the nature of flesh is as follows:

An animal must have the perceptive capacity.

The perceptive capacity must have touch.

An animal must have the capacity of touch.

But this does not yet get Aristotle to the explanation of why flesh belongs nor why flesh is a principle *per se*. Flesh only belongs to blooded animals. So, blooded animals manifest the capacity of touch through a uniform part, flesh. Aristotle knows this through his empirical observations, and the fact that any sense-receptor must be a uniform part (PA II.1 647a5-6). But Aristotle cannot decide whether the flesh is the primary sense receptor, just as the pupil is the primary sense-receptor of the eye, for flesh could also be the medium and include the receptor for touch within itself. Aristotle waffles on this issue in other texts as well. In *De Anima*, Aristotle both claims that flesh is the medium for the capacity of touch (II.11 423b23-26) but also states that touch is via immediate contact (III.1 424b27). But no solution of this problem is necessary to make clear why flesh is a principle for other parts belonging. For, whether flesh is the sense-receptor or houses the sense-receptor, the other parts that are explained by the nature of flesh will still belong in the same way.

We must now answer why flesh is a principle *per se*. I interpret Aristotle’s use of *per se* here to be *per se* in the first sense. According to what is in the definition of flesh, it will be a principle of the body. As we will see below, the nature of flesh will explain

why other parts belong. Aristotle presents one of these explanations in the following passage:

It is apparent to perception that all the other uniform parts are for the sake of flesh, by which I mean bone, skin, sinews, blood vessels, and again hair, and the kind which includes claws, and any other such parts there may be. For the nature of the bones, being hard as it is, has been devised for the sake of the preservation of soft tissue in animals which have bones; and in those which do not have them, the analogue of bone—for example, in some fish, fish-spine, in others, cartilage (653b30-36).

According to this passage, flesh unifies and is the principle of all uniform parts insofar as they are present to the animal for the sake of flesh. Flesh is the principle of these parts insofar as its nature explains why these uniform parts belong. Now, earlier in Book II, Aristotle had stated that the uniform parts contribute to the being of the animal through their primary potentials. Flesh, then, will explain why various potentials are necessary for the animal and so which uniform parts must belong. Here, we see an example of such an explanation. Bone is for the sake of preservation of the flesh insofar as bone is hard. So, the following demonstrations can be constructed, given the premise that flesh is by nature soft, for softness needs to be present to receive the forms of what can be perceived via touch:

Flesh requires preservation.
Preservation requires hard material.
 Flesh requires hard material.
Hard material is the nature of bone.
 Flesh requires the nature of bone.

Why flesh is explanatory of the other features is not given in the text, but it is not hard to see how other demonstrations can be constructed. Flesh is connected to bone for the sake of protection, but soft and hard natures are opposites. These two potentials can only be joined by an intermediate. Sinews have the nature of what is intermediate between soft

and hard. Therefore, sinews connect flesh to bone. So, sinews are for the sake of flesh as such. Skin is also for protection, but only as a covering for the flesh. If skin were to be too hard, it could prevent the capacity of touch from performing its work. So, skin must be of a nature that is both protective and soft. We can see that the capacity of touch, through the nature of flesh, organizes the various uniform parts so that the capacity of touch can be preserved in the animal.

The capacity of touch also helps decide another issue concerning the unity of the whole animal. Although an animal is defined by having the perceptive capacity, it does not necessarily organize the whole animal. This can be made clear by the fact that flesh requires bone for the sake of protection, but does not organize the bones throughout the whole of the body. Aristotle points to another capacity that is cause of this in II.9.

Aristotle hints that the locomotive capacity is the cause of what we would call the skeleton belonging in one passage, and states it directly in another passage. Here are the two passages:

And since it is necessary when the animal moves for its body to bend, the backbone, though one on account of its continuity, is made of many parts by the division of the vertebrae. The bones of those with limbs extending from the backbone and connected to it are suitably arranged. In so far as the limbs are flexible, the bones are both bound together by sinews and their extremities fit together – either one being hollow and the other curved, or both being hollow, surrounding a knuckle-bone in the middle like a bolt, in order that bending and extension may occur (654b14-22).

Thus bones underlie the other, fleshy parts, and in those parts which move owing to a joint, bones are for the sake of this, while in immobile parts they are present for the sake of protection (654b31-34).

The first passage does not appeal to the locomotive capacity explicitly, but it claims that the joints are bounded and fit together for flexibility. This is a clear reference to the locomotive capacity, for only this capacity would require flexibility of such a sort. The

second passage makes it explicit, but the explanation in the passage does double duty. The explanation here shows how bone can be both for the sake of the perceptive capacity and the locomotive capacity. The joints between bones are for the sake of locomotion and allowing the limbs to move whereas the immobility of the bones is for the sake of protecting the flesh. The joints will be organized in accordance with the kind of locomotion that belongs to the animal. So, the nature of the skeleton of a blooded animal can be for the sake of both capacities and is for the sake of both without sacrificing the unity of the animal, for both joints and immobility are present to the nature of the bones through the skeletal structure. But we cannot draw any further conclusions from this passage, for there is no clear indication here that the perceptive capacity is subordinate to the locomotive capacity. If Aristotle does argue this, it does not occur in this passage, nor should we expect this argument here, since Aristotle is merely concerned with what belongs both to all animals and the blooded animals in particular. The locomotive capacity breaks up blooded animals into different kinds. But the passage does as much as it can given the extent of its inquiry: the explanations here make clear that the two capacities can be realized in the same thing and not affect the unity of the object.

5.2.3.2 Tongue

Aristotle begins the investigation of the tongue, as usual, by announcing what attribute he will explain: “Beneath the roof of the mouth is the tongue” (*PA* II.17 660a14). The tongue belongs as the sense organ for taste. Why animals have a tongue is clear, but Aristotle makes an unusual appeal in respect to his own conception of animal. He subordinates taste to the nutritive capacity. He appeals to this subordination when

explaining why only the tip of a fish's tongue is separated: "And since the perception of the taste found in flavours is for the sake of nutrition, this part is tongue-like, though not in every part equally but mostly in the tip" (661a2-5). The reason this subordination is surprising is that the genus animal is defined by the perceptive capacity and not by the nutritive capacity, for the nutritive capacity extends to all living things. I will defend this subordination below, show how it helps explain a certain kind of unity present to an animal, and argue why this subordination does not violate Aristotle's claim that animal is defined by having the perceptive capacity.

The fact Aristotle is explaining is that animals have the tongue in the mouth. We can see rather plainly that the explanation will be through the nutritive capacity in respect to the mouth. The mouth is the first place for the nutrient to enter the body, and taste is the perceptive capacity that pertains to detecting nutrients through flavor. As such, the mouth is the only proper place for the tongue. The mouth, then, serves to unify the various capacities that pertain to taking in nourishment. The mouth in blooded animals is constituted by having the nature of teeth and within this mouth is the capacity to determine whether the nourishment is appropriate for this kind of animal by having a sense organ that detects flavor, i.e., the tongue. But there is another connection here. Just as the teeth have a common work but differing according to kinds, the tongue is present for detecting the flavor of the nourishment but is distinct according to kinds. Once again, these differences reveal aspects of the nature of these kinds. For example, human beings have the most detached, softest, and broadest tongue (660a16-17). What explains this is that such features are both perceptive of flavors and good for making articulate sounds. The softness and broadness contribute towards detecting flavors, in

that taste is a kind of touch (660a21, cf. *De Sensu* 4 441a3); so it is best for the tongue to be soft, as the sense-receptor of touch is, and broad for detecting many flavors either at the same time or at different times according to different locations. Aristotle does not specify here. These qualities of the tongue also contribute to making articulate sounds, along with the quality of being detached. As Aristotle says, “In fact being soft in this way as well as detached, it would especially capable of being pulled in and pushed out in every way” (660a23-25). Aristotle can then judge what kinds of tongues will be able to perform what works well. Birds can be quite vocal, those with broader tongues (660a33). This also explains why fish have very unpronounced tongues. Fish need to eat quickly and so require little time for perceiving flavor. So, the fish’s tongue is detached only at the tip which is also the primary perceptive part of their tongue (661a6).

Does this explanation of the tongue not violate Aristotle’s conception of an animal as defined by sense perception? One answer is that animals do come to have nourishment in a distinct way from plants, i.e., by having a distinct mouth and tongue that is perceptive of flavor. But there is still a question of subordination: should not the perceptive capacities be the primary explanation for different features belonging? We can appeal to another aspect of the difference between the way in which plants and animals partake of nutrients. Aristotle writes, “All animals have a desire for nourishment in so far as they have perception of the pleasure that arises from nourishment; for desire is of the pleasant” (661a7-9). Animals, unlike plants, will both desire nourishment and will have pleasure in nourishment. Aristotle can even go so far as to say that desire for nourishment is for the sake of living but the pleasure perceived in nourishing oneself is for the sake of living well. The perceptive capacity in animals seems to be for this very

end: living well. But Aristotle does not state this claim. Aristotle does admit, though, that touch and taste must belong to every animal. What explains the presence of all the other perceptive capacities belonging to an animal is for the sake of living well (*De Anima* III.12 434b22-24). So, even if Aristotle does not want to admit that tasting flavor is for the sake of living well, he need not claim that the perceptive capacity is subordinate to the nutritive capacity in everyway. I will now turn to the explanation of what parts belong due to smell, which will present another unity issue as well as continue what else is unified by the perceptive capacity: the head.

5.2.3.3 Nose and Nostrils

Aristotle begins his discussion of the organ of the sense of smell by stating that it differs very little in most four-footed, viviparous animals (*PA* II.16 658b26-27). At most, this organ, the nose and nostrils, differs due to the length and structure of the jawbone. Lennox notes that the contrast here is with the nose of an elephant, which Aristotle says of it that “this part is most distinctive compared with the rest of animals—it is extraordinary in both size and potency” (658b32-35).²⁹⁹ By turning to the explanation of an elephant’s nose, we will see how Aristotle explains that the nose belongs, or at least nostrils, to all blooded animals, save fish. But we are faced with a problem with Aristotle’s explanation of the elephant’s nose. Gotthelf argues that, given the various appeals both to the formal and material nature of an elephant, there can be no linear explanation of the elephant’s nose. In other words, Aristotle appeals to more than the essence of the elephant to explain why it has the kind of nose it does. Non-linear explanation would imply that the various generic levels of explanation are not entailed by

²⁹⁹ See Lennox, *On the Parts of Animals I-IV*, p. 234.

lower levels. This non-linear style explanation questions the unity of the middle term and definition that I have been arguing. Gotthelf claims that there are seven basic facts of an elephant (or at least five) that are present in the explanation of its nose.³⁰⁰ These features of the elephant are as follows: (i) swamp or marsh dweller (659a2-4), (ii) blooded (a4-5), (iii) “walker” (πεζόν) (a3-4), which implies that it breathes or has a lung, (iv) of great size (a7), (v) four-footed animal (a23-25), (vi) cannot eat via front feet due to weight (a23-25), (vii) viviparous or bearing live offspring (a5). The material nature present need not bother us here, as of yet, for I showed in 5.2.2.1 that the basic material of any blooded animal is there for the sake of the end and the form. The question, now, is whether a linear explanation can be found for the elephant’s nose. I interpret this question to mean the following: can the various natures appealed to in the explanation be subsumed properly by each lower kind so that the explanation ultimately appeals to only one middle term? I will argue a positive answer to this question below, and, along the way, I will make clear why a nose belongs to blooded animals with lungs.

The first connection, though not explicitly made, is that all blooded animals have the capacity of smell. Blooded animals are the most perfect of the kinds of animals, and perfect animals have all five perceptive capacities (*De Anima* III.1 425a10). But not all blooded animals have a nose and nostrils, only those that also breathe (459a3-15). The reason the elephant’s nostrils are elongated is for the sake of breathing when in water, since it cannot leave the water fast due to its size (459a4-6). So, the next connection is the organ for the capacity of smell has nostrils in lunged animals for the sake of breathing. But, as Gotthelf notices, there are several other factors in this explanation

³⁰⁰ See Gotthelf, “The Elephant’s Nose”, pp. 87-88.

beyond lunged, blooded animal. There is both the way of life (βίος) of the animal and the size of the elephant that play an explanatory role. So far, though, the explanation, in my view, is proceeding orderly. Both blooded and lunged are distinct kinds of animals, and lunged animals entail the blooded nature (see 5.3). Further, the four-footed viviparous nature subsumes these other two genera. This nature along with the size of the elephant explains why the trunk of the elephant, its nose, needs to be used like hand to grasp its food, for it cannot use its two front limbs due to size and weight (659a20-29). Finally, we should note that Aristotle emphasizes that the elephant's nose is most distinct (ἰδιαίτατον) (658b28). This seems to suggest that ultimately only the specific nature of the elephant will be explain that this kind of nose belongs. I interpret both the way of life of the elephant and its size to pertain to the form (εἶδος). This could mean either that both are part of its essential nature or follow from its essential nature. The elephant's size would be for the sake of protection, so this need not be in the essence but only follow from it. Further, the way of life can also follow from the elephant's nature, given its size and where it gets its nourishment, it will live such a life. It does not seem that Aristotle knows the nature of the elephant, at least he does not state it in this passage. This may be one reason why he appeals to various explanatory premises in this passage (659a2-35). The other reason is that these various aspects in the explanation may turn out to be facts that will help the zoologist inquire into the specific nature of an elephant. We know these facts to belong for they are necessary to explain a feature that belongs only to elephants, much like standing upright belongs solely to human beings. If this interpretation is correct, then the explanation can be construed in a linear fashion, where the elephant's nature subsumes both being lunged and being blooded as well as the nature of being four-

footed viviparous animal and the various other features that follow from the particular nature of an elephant, like way of life and size. So, I have presented a view that it is possible that all seven explanatory features of an elephant could belong to one thing—the form of an elephant.

The explanation has another benefit. By inquiring into the distinct nature of the nose of an elephant, we come to see why all lunged, blooded animals have a nose and nostrils. All blooded animals can smell, and all lunged animals breathe. The nostrils allow in air for breathe and nature locates the sense of smell in this organ, the nose, that houses the nostrils. Birds, though, lacking a distinct nose due to having a beak, have the sense of smell located in the beak itself, which is too small for nostrils. This is due to the nature of the head of the bird needing to be both small and light for the sake of flying (659b5-13). The only kind of blooded animal that does not breathe is the fish. Fish, lacking lungs, do not have either a nose or nostrils. Instead, a fish's receptor of smell is located in the gills (659b15-16). This shows a generic commonality amongst blooded animals that the sense of smell is located in the organ that also allows in the external element that cools them down. The nose breathes in air that enters the lungs and cools down the heart in lunged animals whereas the gills let in water and cools down the heart in fish (*Resp.* 9 474b25-28). All blooded animals require cooling, but the method of cooling differs according to kinds. I assumed this above in my defense that the elephant's nose is explained through one basic nature, the form of an elephant. I will turn to this issue next (section 5.3) and argue that being lunged is also a genus and a division of blooded animals. On these assumptions, it follows that being lunged is in the essence

of any such animal. This will bolster my case for subsumption of kinds within any essential nature of an animal.

But there is one last issue to mention before turning to the nature of lunged animals. I have suggested there is a certain kind of unity that the sense organs of a blooded animal make possible. This is the unity and organization of the head of a blooded animal. The sense organs are located in respect to primacy of their nature. Sight is the best capacity of perception and thus determines both what is the front of the animal and the eyes, its organ, are located near the top of the head. Hearing is next. The ears are located off to the side of the head, at least on humans, and near the top of the head on other four-footed animals, in between the eyes and the nose. The nose and the sense of smell is next, located just above the capacity of taste. This sense organ is lowest in blooded animals, most akin to touch and subordinate to the nutritive capacity. This ordering gives a kind of unity to the head, but also gives the animal body a sense of direction, defining front-back, right-left, and up-down. These distinctions may seem a bit odd to apply to the nature of animals, but they are needed to discuss the nature of locomotion. Since most animals engage in locomotion, and locomotion can be in any of these directions, these six directions need to be specified for each animal that moves. Once again, we see that the unity of the animal is at stake, and, even more, the different capacities of an animal do not affect but really generate and maintain this unity. But if this is the case that the sense faculties define these directions, and locomotion assumes these directions in its explanation of the parts for locomotion, then the locomotive capacity does entail the nature of the perceptive capacity.

5.3 Being Lunged

As we saw in the last section (5.2.2.3), Aristotle appeals to the lunged nature of an elephant as part of the explanation why the nature of its nose is so unique. My claim is that having a lung or being lunged is a division of being blooded. Since being blooded is in the *ousia* of such an animal, then being lunged will be too (cf. *PA* III.6 669b12). If this claim holds, then I have blocked Gotthelf's criticism that the explanation of the elephant's nose cannot be linear. The explanation, as we saw above, simply appeals to various features of an elephant's nature and form that contribute to the nose's belonging to it. But each higher feature of the essence an animal has been subsumed by the lower aspects. It is this very complex nature of each animal that causes confusion in the scholarship. The explanation of the elephant's nose is not seen as linear because scholars fail to see how Aristotle conceives of the genera in the essence of an animal are nested. But this very same complex nature, once we determine what each feature of the essence contributes to the explanation, clears up this confusion. I will now defend the view that the lunged nature of an animal is another feature of its essence and, along with the lungless nature, divides all blooded animals. If being lunged is part of this division, then this nature is also a genus.

This view that being lunged is a genus and in the *ousia* of such an animal faces various problems. The literature often argues that Aristotle either cannot hold this view or he is inconsistent with himself in holding this view, given certain conflicting passages.³⁰¹ I will lay out both the evidence for the view that being lunged is a genus and in the *ousia* of such an animal and the evidence to the contrary. I will begin by citing the

³⁰¹ See Lennox, *On the Parts of Animals I-IV*, pp. 265-68.

last passage in *PA* III.6 that not only gives the primary evidence for treating being lunged as a genus, but it also presents some evidence against this claim.

Generally then, the lung is for the sake of breathing, while it is bloodless (ἄναιμος) and of such a kind (γένους) for the sake of certain animals. But what is common to these animals is nameless; that is, no name has been applied to them as the name ‘bird’ has been applied to a certain kind of animal. For this reason (διό), just as being for a bird is constituted from something, so too having a lung (τὸ πλεύμονα ἔχειν) is present (ὑπάρχει) in the *ousia* of these animals (669b8-12).

Aristotle seems to mark off the genus of animals with a lung in the above passage. He clearly states that having a lung is in the *ousia* of these animals (669b12). But he also begins this chapter with the following claim: “A certain kind (τι γένος) of animal has a lung because it is land-dweller (τὸ πεζόν)” (668b33). Aristotle’s own language seems to imply that he takes being lunged as a genus. There is also supporting evidence that animals with a lung share various parts in common differing by the more and the less: having an esophagus, larynx, and windpipe (see *PA* III.3). But the literature raises many problems with treating being lunged as a genus. First, Aristotle admits that the genus is nameless (669b9-11) and does not try to name it, unless having a lung (τὸ πλεύμονα ἔχειν) is its name. But Balme objects that this use is adjectival and as such can only become a name if it has truly become a noun.³⁰² Further, the division of this kind of animal cannot be systematic, for Aristotle attributes it to land-dwellers (τὸ πεζόν) (668b33) but the kind also includes certain water-dwellers, namely, the cetaceans (669a7).³⁰³ Balme also objects that this genus does not have forms that fall under it differing by the more and the less. There are also textual ambiguities and lack of clarity

³⁰² See Balme, “ΓΕΝΟΣ and ΕΙΔΟΣ in Aristotle’s Biology”, *Classical Quarterly* (56), p. 91.

³⁰³ See Balme, “Aristotle’s Use of Division and Differentiae”, p. 86.

in respect to Aristotle's final argument that being lunged is in the *ousia* of such animals (669b8-12, quoted above). First, Aristotle seems to mark off this genus by a part and not by a kind word, such as blooded, or by its work, such as breathing. Scholars find this curious.³⁰⁴ Second, the marking off of this genus seems to follow from the above passage insofar as Aristotle uses the word “διό”, usually signifying a conclusion. But the conclusion does not seem to follow from what was previously said.³⁰⁵ Finally, Aristotle states that there is a certain kind of animal that has a bloodless lung at the end of this chapter as well (669b8). There is no discussion of this bloodless lunged animal anywhere in this chapter, and it seems unlikely to be all the animals with a lung, for Aristotle claims that the vivipara have a blooded lung (669a25-26). Let us see if we can respond to these objections below.

I will start with the problem that this genus, being lunged, has no name. It does not appear that this is a real problem for the claim that Aristotle is marking off a genus in *PA* III.6. Aristotle admits that some genera have yet to be named (644b5, cf. 642b15). So, the only objection in respect to the name or lack thereof can be the name itself, i.e., whether the name, having a lung, is proper. This seems odd in two ways. First, Balme takes it to be adjectival, having a lung (τὸ πλεούμεονα ἔχειν), but this use here appears to be a noun and the subject of the sentence at 669b11-12. But Balme may be right that Aristotle is not entirely happy with this name, for Aristotle is still claiming that the genus is unnamed. Aristotle, though, makes the same claim about blooded and bloodless kinds lacking a name (642b15). The claim about lacking a name only implies that there is no

³⁰⁴ See Lennox, *On the Parts of Animals I-IV*, p. 267.

³⁰⁵ Lennox does not see the inference, but does try to construct one simply on the grounds that various animals have a lung in common, like various animals having the capacity of flying in common. See Lennox, *On the Parts of Animals I-IV*, p. 267.

name already in common usage, not that there is no generic nature of this kind. So, having a lung or being lunged could suffice as the name of this genus.

Second, Lennox finds it odd that a part is said to be in the *ousia* rather than the work. But this should not strike us as peculiar, since a part just is its work (641a2). Aristotle may be sliding back and forth between the name and the work it does. The passage above (669b8-12) does begin with the connection between having a lung and breathing. Having a lung is the same thing as breathing just as a hand that cannot grasp is not a hand (*PA* I.1 641a2). But the connection between having a lung and breathing will help us answer how Aristotle draws an inference at the end of this passage that having a lung is in the *ousia* of this kind of animal. If this inference is sound for Aristotle, then objections in respect to the name lose their force.

Aristotle picks out generic essences in respect to the action that is performed (*PA* I.5 645b20-27). Breathing is not only an action, it is also an essential action of an animal that breathes. The action of breathing is for the sake of refrigerating the internal heat generated naturally to sustain the life of the animal (*Resp.* 10 475b15-19). Aristotle takes the blooded animals to be hotter internally than the bloodless animals, so they require external cooling from the air or water. Aristotle seems to arrive at this explanation from the observation that only blooded animals have the means to cool themselves externally, having either lungs or gills. So, all lunged animals fall under the blooded kind. But it is also the case that lunged and lungless divide all blooded animals, for the lungless animals are those with gills, and there is no blooded animal that is not one or the other and no animal is both (*Resp.* 10 476a14-16). So, even though being lungless is a privative term, it has an essential nature that can be defined, having gills. But we can also understand

why being lunged needs to be its own genus. It does not simply follow from the blooded nature. This is because not all blooded animals are lunged. But there is a more important reason in line with my view of how genera are marked off: the action of the lung, breathing, does not pertain to the capacities unified by the heart directly. The action of breathing does pertain to the heart, keeping it cool so as not to overheat, but since the action of breathing is neither nutritive nor sensitive nor locomotive, it has a separate nature and unity from these other capacities.³⁰⁶ But we should not take this as a sign of lack of unity of a composite animal. The opposite is the case. The lungs regulate the heat of the heart, maintaining a uniform heat of the body in blooded animals. Further, there is a mechanical unity of the two parts as well. The heart does play a role in respiration. Breathing works, according to Aristotle, in that the heat from the heart expands the lungs, allowing air from outside to enter, but since the air from outside is cooler, the lungs contract and expel the hot air, taking excess heat with it and cooling the area around the heart. The action of the lungs take advantage of what John Cooper calls Democritean necessity.³⁰⁷ This is the kind of necessity that belongs to the basic elements of the cosmos. Aristotle gives this very example of breathing when discussing how something can be both for the sake of something and by (Democritean) necessity:

One should explain in the following way, e.g. breathing exists for the sake of *this*, while *that* comes to be from necessity because of *these*. But ‘necessity’ sometimes signifies that if that—i.e. that for the sake of which – is to be, it is necessary for these things to obtain, while at other times it signifies that things are thus in respect of their character and nature. For it is necessary for the hot to go out and enter again upon meeting resistance, and for the air to flow in. This is

³⁰⁶ Aristotle argues that breathing is not for the sake of nutrition at *Resp.* 6 473a3-14. It is obvious that breathing is neither for the sake of perception nor for the sake of locomotion, for there is no corresponding sense capacity for breath and breathing occurs both during locomotion of an animal and while that animal is resting.

³⁰⁷ See John Cooper, “Hypothetical Necessity”, pp. 151-67.

directly necessary; and it is as the internal heat retreats during the cooling of the external air that inhalation and exhalation occur (*PA* I.1 642a32-b2).

We can now see why breathing is necessary for a certain kind of blooded animal and how it works. The conclusion derived from 669b8-12 comes from the fact that breathing is a necessary feature of a certain kind of animal due to its nature and form. This is why having a lung is in the *ousia* of such an animal.

We must respond to three more objections. The first of these presents the biggest problem to my claim that being lunged is part of the division of all blooded animals. The animals marked off by the differentiae being lunged are not uniform because, although most are land-dwellers, some are not. The same problem also threatens the unity of this generic nature. The other two problems concern Aristotle's mention of the bloodless kind of lung and whether being lunged has species that differ by the more and the less underneath it. I will address the problems in this order.

As already stated, Aristotle begins this chapter on the lung, III.6, by stating that it belongs to certain animals because they are land-dwellers. Aristotle is quick to revise this claim, for he declares that there are some water-dwellers that have a lung, the cetaceans (669a7). Lennox takes this to be a sign that there is a lack of uniformity in this kind of animal or that Aristotle ends up concluding that the lung is not present due to the nature of being a land-dweller. His evidence for the latter is that Aristotle's short treatise *On Respiration* makes no mention of a lung being present to animals because of being a land-dweller.³⁰⁸ Aristotle rectifies the problem of certain water-dwellers having a lung within *PA* III.6. He claims that certain water-dwellers are dualizers (ἐπαμφοτερίζει, which literally means "tending to both sides") and have the nature of the land-dwelling

³⁰⁸ See Lennox, *On the Parts of Animals I-IV*, p. 265.

animals in a certain way: as breathers (669a9-13). This may seem like an ad-hoc solution to the problem, but, under Aristotle's own assumptions, it is sufficient. The fact that certain water-dwellers have a lung seems to be explained by them partaking of the kind of lifestyle of land-dwellers. They must breathe above water, and such animals have all the capacities and organs that pertain to breathing as well. The organs would not be present without the corresponding nature, since nature does nothing in vain. So, we may believe something is not quite right with such an escape route, but it is at least consistent with Aristotle's assumptions. Further, Aristotle seems to have no problem in his theory with dualizers, unlike modern taxonomic systems. The ultimate explanation for the parts belonging is the form, and the form may demand characteristics from different classes. But what is marked off as lunged animals does not upset any classificatory schema for Aristotle. Dolphins and whales are not fish but their own kind. So, being lunged forms a unity that is not upset by some water-dwellers having the nature as well. The lunged nature falls under the blooded nature but is above the extensive genera that fall under it. The genera are nested linearly and each generic nature entails the nature of the previous genera above it.

There is another challenge to the unity of being lunged. Scholars find Aristotle's mention of a certain kind of animal with a bloodless lung (669b9-10) either problematic or cryptic or both. If Aristotle is claiming that certain bloodless animals have lungs, then the unity of the genus is upset. If Aristotle is claiming that there are lungs with blood and others that lack blood, he may seem to be contradicting previous passages in this chapter (III.6 669a25). To what is Aristotle referring here? The passage about animals with bloodless lungs raises the following concern. Aristotle seems to mark off this kind of

lunged animal as distinct from other kinds, since the bloodless lung is for the sake of its own kind, not clearly the kind of lunged animals under discussion.³⁰⁹ For this reason, the claim does not seem to fit in its spot or comes too abruptly to interpret. Aristotle is also discussing how this genus of animals with bloodless lungs or the genus of animals with lungs lacks a name. It is not clear whether this reference of lacking a name for the genus is of the animals with a bloodless lung or to all lunged animals. One way this passage could be read is that Aristotle is claiming that there is more than one kind of lunged animal. There is little evidence to decide these concerns. It would seem the most appropriate interpretation of the passage would be that Aristotle is speaking of the same thing throughout the whole passage: being lunged. But Aristotle clearly admits that there are lungs that have blood (669a25-27). Why refer to a bloodless lung, and at this point? My suggestion is that Aristotle is marking off the lung from the other viscera. The viscera have their origin in the heart and are bloody by nature (*PA* II.1 647a34-b1). The lung simply has blood flowing through it but is not by nature bloody. I suggest that the term “bloodless” (ἄναιμος) can be ambiguous. One meaning is lacking blood either for the most part or entirely, as a bloodless animals would. Another meaning, the one I suggest here, is that it is not constituted by blood nor has its origin directly from the heart. The lung is bloodless because its origin is not the heart but the nature of land-dwelling animals. This claim, of course, has its problems. Aristotle states that the lungs are viscera in the very next chapter (*PA* III.7 669b13-14). I have very little response to this objection other than it seems possible that Aristotle can treat the lungs as viscera in one way, as internal organs, and not in another, as being constituted by the blooded

³⁰⁹ See Lennox, *On the Parts of Animals I-IV*, p. 267.

nature. I do not expect this response to be satisfactory. Aristotle's lack of clarity of the subject matter of this sentence (669b8-9) seems to baffle most scholars of the passage, so I am not sure a proper defense can be constructed. I do think that there is more coherency to the overall passage if read this way, for this interpretation does not imply that there is completely different kind of lunged animal, and, read this way, it provides further evidence for the conclusion drawn at the end that being lunged is in the *ousia* of this kind of animal (669b11-12).

There is one last objection that being lunged cannot form a genus. Does being lunged have species underneath it that differ by the more and the less? This problem is similar to that was raised about being blooded. The answer here is the same as there. There are not species proper to this difference in blooded animals but there are parts that follow from this nature that differ by the more and the less. The species fall under the extensive genera properly. But parts have natures, and, if certain parts follow from the lunged nature, and if these parts differ by the more and the less, this would be sufficient for the lunged nature to be a genus. Aristotle discusses what parts follow from the generic nature of being lunged in *Parts of Animals* III.3. This chapter argues features that belong to animals that have a neck. The main feature of the neck is the larynx, which is where the air travels both to the lungs and out of the lungs (664a18-20). Aristotle recognizes that this is because all blooded animals with a neck have a larynx whereas all blooded animals without a neck lack it. These facts are then explained by the presence of a larynx or the lack thereof, but this fact, the presence of the larynx, is explained, in turn, by being for the sake of breathing. So, the demonstrations that can be constructed from this passage through its inquiry are as follows:

Animals that breathe require a passage for inhaling and exhaling.

The passage for inhaling and exhaling is the larynx.

Animals that breathe have a larynx.

That which has a larynx has a neck.

Animals that breathe have a neck.

But also the privative fact of lacking a neck can be explained.

That which breathes has a neck.

No fish breathes.

No fish has a neck.³¹⁰

So, we can see that being lunged does have parts that follow from its nature and the lack of this capacity explains the lack of these features in other blooded animals. The nature of these parts will obviously differ by the more and the less depending on the position of the mouth in respect to the lungs.

We can still raise the objection that if being lunged is in the *ousia* of a certain kind of animal, this would interfere with the unity of the middle term and the definition of any particular lunged animal. This is tantamount to an animal being defined by many differentiae. I will answer this problem in the same way I answered the problem with the blooded nature being in the *ousia* of a certain kind of animal. The lunged nature entails aspects of the blooded nature in its explanations, so, on my view, ultimately the final differentia entails all these natures. The clearest example of this is the esophagus. The esophagus connects the mouth to the stomach. But this part is not necessary for the sake of nutrition, for it contributes nothing towards the concoction or digestion of food (664a23-24). It is possible for an animal to have its stomach next to the mouth, as in the case of fish. But fish have no neck. In animals that do have necks, such a part is necessary to pass food from the mouth to the stomach. So, the nature of the esophagus

³¹⁰ Lennox constructs similar demonstrations as I have done. The only differences I assume there to be between our constructions is that Lennox does not mention Aristotle starting from the fact and seeking the explanatory middle term. See Lennox, *On the Parts of Animals I-IV*, pp. 250-51.

only belongs to those animals with a neck and a lung. The nutritive capacity is entailed by the nature of being lunged insofar as the latter capacity contributes to the organization of the former. Once again, we see that Aristotle's explanation aim at expressing the unity present to a composite *ousia*. Each part of the essence contributes towards the final end and action of that kind of animal.

There is another kind of problem lurking now. By nature, the esophagus must be behind the larynx and windpipe, but no food can pass through the larynx, for it connects to the lungs, not the stomach. The nature of the animal must prevent this from occurring. This is the nature of the epiglottis (664b20-22). The epiglottis covers the windpipe when food enters the throat and reopens after the food has passed so air can continue to pass in and out for the sake of breathing. The problem is that not all lunged animals have an epiglottis. Lennox notes this explanation because he interprets that the material nature of the animal is the cause of there being no epiglottis. Here is the passage that contains the explanation:

The animals just mentioned do not have the epiglottis because their flesh is dry and their skin hard, so that in them a part of this sort, constituted from flesh and skin of this sort, would not move easily. Rather, the closure of the uppermost walls of the windpipe itself would occur as quickly as an epiglottis made of the appropriate flesh, such as animals with hair have (665a1-5).

Lennox admits that the explanation here is still functional in character, but the significant fact is that the absence of the epiglottis is explained due to the kind of material nature present to a bird.³¹¹ Does this mean that the material nature is explanatory of a part? It does not seem to be the case for two reasons. First, there is no explanation of a part here. The part is missing. Nothing requires the nature of a bird to have this part, for the material present to the bird is different in character and can perform the work of the

³¹¹ See Lennox, "Material and Formal Natures in Aristotle's *De Partibus Animalium*", pp. 196-98.

epiglottis. However, we just saw that Aristotle does explain lack of parts in that fish lack a larynx, esophagus, and windpipe. So, this is not a sufficient response. Second, the material present to any animal is there to serve the end of the animal. Therefore, any explanation through the material nature of an animal ultimately points back to the form or generic kind of the animal. It is not clear that Aristotle explains why birds have this kind of material nature for their esophagus, but this is merely a sign that the science of zoology is not complete, not that material nature is primary in any explanation of a part belonging or not belonging. Further, Aristotle forewarns of this possibility in *Parts of Animals* I.1:

Clearly, then, there are two sorts of causes, and first and foremost one should succeed in stating both, but failing that, at least attempt to do so; and clearly all who do not state this say virtually nothing about nature. For nature is an origin more than matter (642a13-16).

Aristotle does precisely this in the explanation of the lack of an epiglottis. He locates the kind or kinds of animals that fail to have one. The obvious fact to appeal to is the material nature, for it is empirically observable. Aristotle does not make the connection why such formal natures have certain material natures, but we see the explanation strives for such by noting the generic, formal nature of the animal that lacks an epiglottis. I take the stress of the explanation of the lack of an epiglottis to mirror the above quote (642a13-16). The zoologist should seek out the origin that is responsible for such a feature or lack of feature, but, in absence of that, note the kind and see the material nature that is present. Failure to state either one is a failure to grasp nature.

There is another way around this problem as well. The epiglottis is a derivative part. It does not follow from the nature of either the esophagus or being lunged but from the fact that one part, the windpipe, must be in front of another, the esophagus. Nature

can solve the problem in various ways. But this sense of nature is the form, not the material, for it is the form of the animal that organizes the material. Here, the form makes use of the material present to the animal to resolve the problem of the esophagus being behind the windpipe. Even if Aristotle has not found the precise explanation yet, it seems this is the best interpretation of the passage, for, as even Lennox notes, the explanation of why the epiglottis does not belong has the same structure as the explanation for why it belongs—both appeal to the work of the part and the material present.

So, given the fact that various actions belong to the same animal, and action is what marks off a kind and nature, the animal will have a complex essence: the formula of an animal will have many parts. I have been arguing that this complexity does not sacrifice the unity of the definition of an animal, for the various parts are always entailed by the lower parts. The final differentia will entail all the parts of the formula of the essence. This presents the last difficulty. Is Aristotle seeking the final differentia that defines a particular species of animal? This is not explicit, but I will defend the view that it is at least possible for Aristotle to proceed in this way on the grounds that Aristotle finds the essence of one animal: human being. I will now turn to the last step of my argument and show how Aristotle can seek out the final differentia of any particular animal.

5.4 Explanations According to the Extensive Genera and Particular Forms

We have now reached the section of *Parts of Animals* (IV.10-14) where Aristotle will seek out the essence of a thing by the attributes known to belong of a thing. The

parts are known to belong universally in the sense that the zoologist knows *that* it belongs. Knowing *that* something is the case is grasping something of the being of the thing (*Apo.* II.8 93a28). Using the structure of a demonstration, the zoologist can seek the middle term and the essence of that thing. So, once the middle term and essence is found, demonstrations can be constructed. But the question remains: is the essence of an animal still going to be of one, final differentia? The problem here manifests itself in two different ways. The first is the problem we have seen all along: is the essence one or many? But there is a new dimension to this problem in the practice of zoology. The other problem is whether Aristotle is even attempting to find the essence of any particular species. There seems to be few if any examples of such inquiries. He discusses the essence of bird (IV.12) and the essence of fish (IV.13) but never picks out a species of these kinds and defines that species. I will answer that Aristotle does find the essence of at least one species, a human being, and he is in position, at least theoretically, to find the essence of various birds and fish as well as other kinds of animals. But my defense of this view is contingent upon showing that Aristotle still maintains in the *Parts of Animals* the kind of unity he assumes in the *Metaphysics* to belong to an *ousia*: zoology must assume that a species is one in formula. There are two challenges to this view that Aristotle assumes that form is one in formula. Each comes from a similar source, the unity of the middle term. I will develop these challenges below and show how the demonstrations that can be constructed in the text can conform to the view that the species is still one in formula.

The first challenge comes from David Charles. He objects that some of the syllogisms in *Parts of Animals* appeal to the material nature of an animal as part of the

middle term to prove what *per se* attributes belong. The material nature is not part of the essential nature according to Charles. Thus, the practice of zoology leads Aristotle away from the view that only the essence is used as a middle term to demonstrate *per se* attributes. My analysis of *Metaphysics* Z.12 partially undermines Charles' thesis. On the one hand, *Metaphysics* Z.12 argues that the form and definition of an animal just is the final differentia. On the other hand, although the essence is one as such, this unity includes within it both the previous differentiae and the primary genus. So, there is some complexity to the essence of an animal and to the middle term in zoology. But Charles' objection can still hold. His claim is that Aristotle uses material nature as a middle term in certain demonstrations. The problem with Charles' view is that the blooded nature of an animal does not seem to refer to its material nature but rather its formal nature. Aristotle claims three times in *Parts of Animals* that being blooded is in the *ousia* or in the *logos* of the *ousia* (IV.5 678a33-4, IV.12 693b5-6, and IV.13 695b19-20). One reading of this expression is that this states that being blooded is a generic nature in the formula of the essence.³¹² Being blooded, on my interpretation, is not material but rather expresses the kind of material that intrinsically belongs to an animal, i.e., having a heart. But is this formal element of the essence one with the final differentia? I have been arguing that the unity present in the zoology of the formula is by an entailment. The blooded nature is particularized by the nature of lower genera and even further by the species. Human beings manifest their blooded parts, e.g., stomach, intestines, even eyes and ears, in a different way than the blooded parts of a bird or a fish. And particular species of birds manifest their parts differently than other species of birds, if only by the

³¹² See *Met.* Δ.30 1025a30-1.

more and the less. But that is still a difference and one that is formal. So, Charles' objection cannot stand.

Even if this critique of Charles is accepted, Lennox raises another problem for my interpretation that the middle term has a plurality of elements subsumed by the final differentia. Lennox objects that since being blooded has a wider extension than bird, it cannot be a feature in the *ousia* of an animal. Lennox appeals to two separate passages to show that Aristotle holds this position.³¹³ The first passage is *Metaphysics* Z.13 where Aristotle argues that no *ousia* is also what is common or universal. The second passage is *PA* I.3 643a1-5 that no unitary *ousia* can belong to animals that differ in form. Aristotle then mentions (*PA* I.3 643a3-5) that if blood is a part of an animal's *ousia*, the blood must differ.³¹⁴ Lennox suggests that Aristotle could make this claim, but he does not, at least not in his explanations of external parts in *PA* IV.10-14. Lennox's solution, not surprising, is that only a conjunction of parts will be able to pick out the *ousia* as unique. This raises the unity problem. But Lennox's critique, in my view, is missing the main point here. First, Aristotle claims that being blooded is in the *ousia*, which is not equivalent to being the *ousia* or essence. A formal element is not the definition but just a part. As such, it can be a genus: yet, as nested, this nature is also further differentiated and finally uniquely realized in the final differentia. This solution to the unity of the definition at least mirrors the solution in *Metaphysics* Z.12. The final difference just implicitly entails all the previous differentiae and the initial genus. Although it may not

³¹³ See Lennox, *On the Parts of Animals*, p. 332.

³¹⁴ What is odd is that neither Lennox nor Charles note that Aristotle appeals to the blooded nature to explain the two-footed nature belonging to human beings. This may have some affect on Lennox's claim that Aristotle nowhere states that the blood is different. Aristotle is taking it as obvious that human beings manifest the blooded nature different than that of a bird, and eagle manifesting it different than a humming bird.

be the case that being lunged is a proper differentia of being blooded, I have shown that being lunged further refines aspects of an animal that belong because of the blooded nature, and the lunged nature is also further fined but lower natures because there are various kinds of lungs (*PA* III.6 669a24). This applies to other parts as well for the lower natures, e.g., the extensive genera and the particular forms of animals. For example, human beings have the kind of feet that is by nature blooded, just as birds have the kind of wing that is by nature blooded. There is a deep connection between the differentiae that fall under the blooded nature and being blooded, for the former further differentiate the parts that belong because of the nature of the latter. If this is the case, then the kind of blood that belongs to each *ousia* is different, since the kind of blood that belongs to each is further differentiated. This resolves Lennox's objection.

Given what I stated about the nature of scientific syllogisms and what I said above about the essence of an animal including its material, we must see whether these chapters also have scientific syllogisms that can be constructed from the inquiry and to see that these constructions require that the kind of material be included as part of the middle term. First, the middle term of these syllogisms will either be the essence of a particular animal, e.g., human being, or the essence of a genus of animal, e.g., bird. Second, the essence either of the animal or the genus is a capacity for a certain action, mainly locomotion with one exception, human beings. Third, all of the syllogisms appeal to the kind of material belonging to that animal or kind of animal. Finally, the essence only causes those attributes which are commensurate with the subject. The proof for those attributes that extend beyond the scope of the particular essence lie higher than the specific essence, as I have explained in my previous two chapters. But since the essence

also includes within the kind of material, and this kind or genus is the cause for these other attributes belonging, there is no discrepancy between this claim and the claim that the kinds of definition in *Metaphysics* Z.12 and *Parts of Animals* I.3 are compatible in that the essence of an animal is defined by one, final differentia. Aristotle is seeking this definition in his practice of zoology. The levels in the essence, made by divisions according to proper differentiation, are what account for this apparent discrepancy. This responds to Gotthelf's claim that in the *ousia* or in the *logos* of the *ousia* exists at different levels of generality. What Gotthelf misses is twofold: (1) Aristotle is often defining the *ousia* primarily by its genus, which is not an *ousia* but can be something in the *ousia* and (2) other levels of generality really are included in the essence of a thing. We shall now turn to these explanations, according to each essence, to see how these explanations work in practice.

5.4.1 Human Beings

Aristotle seeks out the essence of a human being in *PA* IV.10. We can construct demonstrations of the *per se* attributes of a human being from this inquiry. There is at least one unique fact about the structure of a human being: we stand upright. But it is also the case that we are two-footed in respect to locomotion and have two free limbs called hands that do not engage in locomotion in themselves. Aristotle seeks out what explains these three unique facts about human beings. He proposes that our rational nature explains all three facts. Since these three facts are unique to us alone, it follows on Aristotle's assumptions that these attributes can only be shown to belong through the essence of a human being. Thus, Aristotle is seeking the essence of at least one species

in *Parts of Animals*. There are other unique facts about human beings, but Aristotle shows that the middle term that accounts for them is not our rational nature. These other facts follow from our standing up straight or being two-footed. But since both of these are shown to belong because of our rational nature, this latter is assumed in the other explanations. We will see that these explanations require a complex middle term yet all of the terms are entailed by our rational nature. If our rational nature just is the final differentia that defines a human being, then it seems that my interpretation of Aristotle's zoology is maintained in practice. Let us now turn to the various explanations Aristotle seeks out in this chapter of *Parts of Animals*.

The following passage will help show that Aristotle is seeking out the essence of a human being by finding what explains the unique facts that human beings stand upright and are two-footed:

Mankind, however, instead of forelimbs and forefeet has arms and what are called hands. For it alone of the animals is upright, on account of the fact that its nature and *ousia* are divine; and it is a function (ἔργον) of that which is most divine to reason (νοεῖν) and to think (φρονεῖν). But this is not easy when much of the body is pressing down from above, since the weight makes thought and the common sense sluggish. For this reason, when their weight and bodily character become excessive, it is necessary that their bodies incline towards earth, so that for stability nature placed forefeet beneath the four-footed animals, instead of arms and hands. For it is necessary that all those able to walk should have two hind limbs, and such animals become four-footed because their soul is unable to bear the weight (686a25-b2).

We should note the textual evidence that Aristotle is seeking an explanation of these facts through the essence before constructing the demonstration. Aristotle states explicitly that the features he is about to explain belong to human beings alone. The explanation must be through what is unique about human beings. But does this need to be the essence? A sign that the explanation is through the essence is that Aristotle is not simply discussing

what is in the *ousia* of a human being but just simply states what the *ousia* of a human being is.³¹⁵ Although the *ousia* is at first apparently defined by being divine, we see that Aristotle clarifies this by stating that its work (ἔργον) is to reason and to think. It is these latter two terms that will define the essence of a human being and be used as the middle term for any scientific syllogism proving *per se* attributes that belong. This points to a deeper issue whether these two capacities are the same or different or whether they have or are the same principle, at least for human beings. Aristotle unfortunately does not address this issue here in *Parts of Animals*. I will show below that the demonstration that can be constructed from this passage appeals to reason to connect the part to the subject. But it will not be our rational nature alone that makes possible a demonstration. As the passage makes clear near the end, Aristotle also appeals to the blooded nature, which requires four points of locomotion (*Progression of Animals* 707a19-21). This is consistent with the way Aristotle begins this chapter, stating that he will take up again the blooded, live-bearing animals again (685b29-30). The construction of the demonstration below will make clear that being blooded is included implicitly in the essence of a human being.

As I interpret the above passage, the premises of the demonstration are as follows. First, the rational nature is sluggish and hindered if the body presses it downward. This will connect standing upright with human nature. The second connection is between standing upright and two-footedness. Any blooded animal must have hind limbs by

³¹⁵ Gotthelf misses this subtlety textually and simply claims that Aristotle is loose with his terminology. But there is no reason to suspect this. The obvious point is that human beings must be defined by themselves since they do not fall under a wider genus such as bird or fish. An *ousia* is not a genus, so the essence of a human being will not be in the *ousia* but just simply be the *ousia*. This is what we find textually, and it conforms to the arguments of *Met. Z* as a whole. See Gotthelf, "Notes towards a Study of Substance and Essence in Aristotle's *Parts of Animals* ii-iv" in *Aristotle on Nature and Living Things*, 1985, pp. 45-50.

which it can move locally. Also, blooded animals require four points of locomotion, so they must have four limbs for motion. Aristotle argues this in *Progression of Animals* (707a19-21). The reasoning here may seem strange to us today, but Aristotle assumes that blooded animals are most perfect of the animals and will move in the most elegant way. The least amount of points required for motion are four: up, down, right, and left. An animal will move backwards or forwards by moving their limbs either up or down and left or right. So, since a human being must stand upright due to its rational nature, human beings will only have two hind limbs by which to move. This explains the two-footedness of a human being. It is the beginning of the explanation why we have two arms and two hands, for these play a role in our locomotion by moving in a certain way when we walk. I will turn to this explanation next. Importantly, the connection being made that explains both standing upright and being two-footed are teleological: being two-footed and standing upright are for the sake of the capacity to reason and to think.

Now, I will construct these two demonstrations. The first one is as such:

Human beings have the capacity to reason and to think.

That which has the capacity to reason and to think cannot be weighed down.

Human beings are blooded animals not weighed down.

A Blooded animal not weighed down stands upright.

Human beings stand upright.

The trick is that being blooded is assumed as being part of the formula of a human being.

Someone could object here that the subject, middle term, and predicate are not commensurately universal. Commensurate universals all have the same extension, which here would be human beings. Aristotle claims in *Posterior Analytics* I.4 that all the terms of a demonstration must be of the same extension (73b33-74a4) otherwise the explanation of the predicate belonging will not be *per se*. But the universals in this

demonstration are commensurately universals. Human beings are the only kind of blooded animal that stands upright. In other words, the essence of human being has both subsumed the blooded nature as well as particularized it as the blooded nature of a human being, so the attribute of standing upright belongs *per se* to human beings. The problem of commensurate universals will get trickier with the next demonstration.

Here is the construction of the demonstration that human beings are two-footed by nature.

Human beings are blooded animals that walk.

Blooded animals that walk must have two hind limbs.

Human beings have two hind limbs.

That which has two hind limbs and stands upright and is blooded is two-footed.

Therefore, human beings are two-footed.

The problem with the commensurability of these terms is more problematic. Aristotle must refer to the generic nature of blooded animals that they must have two hind limbs. Human beings are just a particular kind of blooded animal. It seems that Aristotle has violated his commensurability assumption or, simply put, this cannot be a demonstration for Aristotle. But the solution to this problem can really be the same as above. We understand the first middle term, blooded animals that walk, as really rational, blooded animals that walk. For, if blooded animals that walk must have two hind limbs, and the rational nature of a human being subsumes this blooded nature, the rational nature will also particularize this claim in such a way that it will be commensurate with human nature. This is simply because human nature is the middle term. Finally, Aristotle makes clear that the two-footed nature of a human being is distinct from other instances of two-footedness in other animals. Birds are also two-footed by nature but their knee bends the

other way and the kind of foot they have is different and other.³¹⁶ It is also the case that birds do not stand upright but at a diagonal.³¹⁷ We can see now that Aristotle has sought out the middle term that explains these facts and has really found, under his assumptions, the what is and essence of human beings, so these attributes belong *per se*.

Other objections to the above demonstrations should be discussed. It might be said that they do not conform to the standards of the *Posterior Analytics*' assumption that a demonstration must have premises that more known than the conclusion, prior to it, true, immediate, and primitive (I.2 71b21-23). Lennox raises two objections that question the immediacy of the premises, which I interpret to mean that a connection is missing or left unexplained. His criticisms run as follows: "it is never explained why humans have a less heavy upper region than four-legged animals, or how soul functions are hampered by having bodily material above."³¹⁸ I will address the two criticisms in order. It seems to me that Lennox misses a subtlety of the premise he is criticizing in the first objection. This premise does not demand that the upper body of human beings be less heavy but rather be able to support the weight of this upper body. Aristotle does provide proof for this claim: "And further, the bodies of those that are hotter are more erect, which is why mankind is the most erect of all the animals" (PA II.6 669b4-6). The heart is the origin of heat in a blooded animal, so the human heart must radiate enough heat to keep the human torso erect. Lennox agrees with this, but he misses the fact that a human being's midsection is held up not because it weighs less but due to material necessity. But this material necessity belongs to human beings for this very reason, so

³¹⁶ These two claims are made by Aristotle in the following places. For the claim that birds' knees bend the other direction than a human's knee, see PA IV.12 693b2-3. The claim that a bird's foot is different is at IA 11 710b30-711a2. Aristotle also makes this claim at PA I.3 643a3.

³¹⁷ Aristotle argues that birds do not stand upright at PA IV.12 695a4-13.

³¹⁸ Lennox, *On the Parts of Animals*, p. 318.

that the torso can be held upright. We do not understand that human beings stand upright without both explanations, i.e., the why and the how. But the “how” is present for the sake of the end, which is the “why.” This is just one reason why Aristotle concludes in *PA* I.1 with the claim that both teleological explanations and explanations from necessity are needed for a complete explanation of an animal (642a13-5, a32-5). But we should also note that the “how” is also explained, in part, from the kind of material that must be present to human beings, the blooded kind of material. In response to Charles’ criticism that this is a material aspect of the animal, I interpret this material nature in the essence of an animal to be different than the material necessity of the relevant properties of the material of an animal, such as the heat of blood. Aristotle is clear that when he includes what appears to be material in the essence of an animal, it is really the kind of material, which is intelligible, as opposed to the material parts that are not intelligible in themselves.

The other problem that Lennox raises is more troubling: there is no account that bodily material weighing us down will hamper our reasoning faculty. But is the *Parts of Animals* the place for such an explanation? The problem is that *PA* I.1 excludes the study of the rational soul by itself, for this extends beyond the realm of physics. The rational soul is not a capacity for change. Does this qualification prevent Aristotle from providing support for this premise? Or is it the case that Aristotle is appealing to a cultural assumption so deep that he does not recognize it? The former option is most likely the case: Aristotle does not see the need of providing the support in a text concerning physical objects. The answer really extends beyond physics to the nature of the thinking itself. Aristotle proves in *De Anima* III.4 that *nous* is immaterial. It is clear

that *nous* is our primary faculty for reasoning, although our *nous* does not grasp forms apart from the faculty of common sense. But if *nous* is immaterial, it is obvious that a more material existence interferes with its work, e.g., when we are eating food or get really hungry or tired or angry. But why does standing upright prevent more interference from these affections occurring? This may not be the case, or it may be connected in some way with controlling our passions through habit. Either way, Lennox seems right that there is an explanation lacking. Now, it may be the case that we stand upright to see the heavens, which are images of perfect motion due to the thinking of the unmoved movers. Only by seeing the heavens move do we get that idea that there is orderly motion and motion governed by thinking itself. We must stand upright to be able to study the motions of the heavens for a sufficient enough time to gain knowledge of them. So, if rational thought is best exercised or better exercised in studying the heavens, then we must be able to stand upright.³¹⁹ Whether one accepts such an explanation is one question, but it seems to me that for Aristotle to justify this premise in a work dedicated to the parts of animals extends beyond the scope of the work. There is also the response to Lennox's criticism that, since zoology is not yet a complete science for Aristotle, later research into the matter may be able to make this connection and construct the demonstration for this claim.

Let us now turn to the next part to be explained: the hand. Aristotle notes that hands are unique to human beings as well. He also seeks the explanation for this unique fact after he explains our two-footedness. Aristotle begins his inquiry into why hands belong with a response to Anaxagoras' claim that human beings are most intelligent

³¹⁹ Aristotle does claim within *Parts of Animals* that knowledge of the heavens is superior to knowledge of terrestrial objects including animals (I.5 644b23-35).

because they have hands. Aristotle believes that it is more reasonable that the causal order be the opposite way: we have hands because we are intelligent. Aristotle's assumption here is that nature supplies attributes to the things best able to use them. The end is the form and nature of the animal. Before we construct the demonstration for why hands belong to human beings, let us look at the explanation in the text:

So if it is better thus, and nature does, among the possibilities, what is best (βέλτιον), it is not because they have hands that human beings are most intelligent (φρονιμώτατος), but because they are the most intelligent of animals that they have hands. For the most intelligent animal would use the greatest number of instruments well, and the hand would seem to be not one instrument, but many; indeed it is, as it were, an instrument for instruments (687a15-20).

The Greek word Aristotle is using for “most intelligent” (φρονιμώτατος) helps us connect this point back up to the essence. This word relates to “φρονεῖν”, one of the words by which Aristotle defines human nature (686a28). This term usually has more of a connection with agency than with theoretical thinking for Aristotle.³²⁰ Under this assumption, we will be able to see the connection made by the middle term more clearly. But there is a problem with my interpretation: there seems to be no mention of being blooded in the passage. But if we turn to *Progression of Animals*, once again we will find the solution. At 706a28-9, Aristotle claims that of the four points of motion by which human beings move, two of these are the arms, to which the hands are attached.

³²⁰ “φρονήσις” is usually translated as “practical wisdom” in Aristotle, and it is the main discussion of *Nicomachean Ethics* VI.5 and VI.12-13.

Since a blooded animal has no more than four points of motion, two more limbs are required to move properly. These are the arms or maybe, most properly, the shoulders.

But why do we have hands? An animal with the capacity to $\varphi\rho\nu\epsilon\acute{\iota}\nu$ engages in deliberative actions, which are often better when accompanied by instruments. The hand is an instrument that has the capacity to use other instruments. Aristotle at first characterizes the hand as many instruments, but then he corrects this description and calls the hand an instrument of instruments. This latter stresses the unity of the hand as opposed to the plurality of activities it can accomplish as a hand. Thus, if an animal has the capacity to $\varphi\rho\nu\epsilon\acute{\iota}\nu$, and this capacity presupposes the ability to use instruments, then the hand is there for the sake of that end. We should note that the explanation is the kind that appeals to the better or $\kappa\alpha\lambda\acute{\omega}\varsigma$, for Aristotle appeals to nature doing what is best ($\beta\acute{\epsilon}\lambda\tau\iota\omicron\nu$) here. Unlike being two-footed, which follows necessary from our nature, hands could be present or not be present. But it is better that they are present. The explanation really must begin from the fact that there two free limbs belong to human being. This follows from the fact that they stand upright. Nature will do something with these free limbs, but it is best for nature to make the best use out of them. The best use for an animal with the $\varphi\rho\nu\epsilon\acute{\iota}\nu$ capacity is to have hands, which allows the animal to use many instruments. The first demonstration below shows the conditions by which it is possible that human beings can have hands:

That which can have two hands requires free limbs.
Free limbs belongs to that which can stand upright.
 That which can have two hands must stand upright.
Standing upright belongs to human beings.
 That which can have two hands is human beings.

Now that Aristotle has shown that human beings can have hands, the next set of demonstrations will prove why it is better for human beings to have hand, it is because they conform to the end of a human being.

Human beings have the capacity to reason and $\phi\rho\nu\epsilon\acute{\iota}\nu$.

Things with the $\phi\rho\nu\epsilon\acute{\iota}\nu$ capacity are best when they can use many instruments.

Human beings are best when they can use many instruments.

That which can use many instruments is a hand.

Therefore, human beings are best having hands.

The argumentation here differs from the explanation of our two-footedness because Aristotle demonstrates having two hands from what is best. But the demonstration appeals to the same elements of our definition. We have a rational nature and blooded nature, and these two natures together we have two free limbs. Since human beings are the only animal with hands, the universal is commensurate with the subject and the middle term.

There is another question answered by this passage raised by Furth in his book *Substance, Form and Psuche*. Furth argues that Aristotle recognizes that a thing is defined by many differentiae in *Metaphysics* H.2. One of the examples Aristotle appeals to is the hand (1042b31). Aristotle explains what he means just after the argument that human beings are animals with hands *per se*. The hand is defined by the capacity to handle a variety of instruments or be the instrument of instruments. This requires the capacity to grasp and to squeeze (687b10-1). It is this capacity that requires a plurality of differentiae: an opposable thumb and distinct digits. But this is clearly the material for the capacity for the primary action of the hand. This makes sense of *Metaphysics* H.2 and its subject matter. H.2 claims that the differentia is the actuality of the thing. But there is no difference between an opposable thumb and distinct digits and the capacity to

be an instrument of instruments. One way to express the being of a thing is by expressing the many differentiae—the being as the material. But the being here is just the being of the form, as we saw above, even in respect to a hand, is ultimately expressed by one, final differentia, the ability to grasp. So, when Furth claims that the form is composed up of many differentiae, he is really expressing the form as the material for a certain capacity.

We can now see that the unity responsible for the fact that human beings stand upright, are two-footed, and are two-handed is our rational nature. Our rational nature is the essence that explains the parts that belong to a human being. The problem is that Aristotle explains other parts that belong to human beings in *Parts of Animals* IV.10 that does not appeal to our rational nature. Aristotle appeals to the fact that we are two-footed by nature. Is now two-footedness a part of our rational nature? Should we conclude that the essence of human being at least contains many differentiae? There is a deeper problem here that may help us solve this issue. The essence of a human being does not refer to a capacity that is material in any way. At best, human beings must stand upright. I will argue below that this capacity, standing upright, which entails being two-footed, will provide the unity necessary to explain the rest of the parts of a human being. But, since standing upright and being two-footed follow from our rational nature, it is assumed in the inquiry without being stated. Let us look at what other parts Aristotle explains in *PA* IV.10.

Aristotle explains that human beings have mammae in a certain position, are tailless, have haunches, fleshy thighs, shanks, and large feet. All of these parts really follow in some way from the fact that human beings are two-footed and stand upright. Aristotle explains being tailless in respect to having haunches as well as having fleshy

legs. I will use this passage as an exemplar of the other explanations. Here is the passage.

The posterior parts and the parts around the legs are distinctive in human beings when compared with the four-footed animals. For practically all of them have a tail, not only the live-bearing ones but the egg-layers as well; for even if in those which have this part it is not large, at least they have, as a token tail, a sort of stump. Mankind, however, while tailless, has haunches, though none of the four-footed animals does. And furthermore, mankind has fleshy legs, both thighs and shanks, while all the others have fleshless legs, not only the live-bearing but generally all those animals that have legs; that is to say, they have sinewy, bony, and spiny legs. And there is, so to speak, one particular cause of all these things, namely that mankind alone of the animals is upright. So in order that it may easily carry the upper parts, which are light, nature, taking that which is bodily from the upper parts, added the weight to the lower parts. This is why it made the haunches, thighs, and calves fleshy. At the same time, the nature of the haunches is rendered useful for taking rests... Mankind, then, has both haunches and fleshy legs owing to the cause just mentioned, and on account of these facts is tailless (for the nourishment which is conveyed there is used up on these parts, and on account of having haunches, the use, for which the tail-end is a necessity, is removed) (689b1-24).

We can see how demonstrations here can be constructed from this passage. The middle term is standing upright, since Aristotle labels it the cause. Standing upright requires fleshy legs to have the strength to hold the upper body above. Standing upright is also tiring on the legs, so having a haunch is for the sake of resting. The other four-footed animals require neither of these parts. Since extra material is required to make up the leg and haunch, and the haunch renders the tail useless, human beings are tailless. I will give the construction of some of these demonstrations below.

Human beings stand upright by nature.
That which stands upright by nature requires support.
 Human beings require support.
That which provides support is fleshy legs.
 Human beings require fleshy legs.

Human beings stand upright by nature.
That which stands upright by nature requires rest.
 Human beings require rest.

That which makes rest possible is a haunch.
Human beings require a haunch.

If we add one more premise to this series of demonstrations, that which has a haunch is tailless, then we demonstrate that human beings are tailless. The connection between these two is made clear above. A haunch renders useless having a tail. The tail would serve no purpose. Since nature does nothing in vain, human beings are tailless. We should also notice that Aristotle fills in the demonstrations that discuss the material necessity of lacking a tail: the material that would be used for a tail is placed on the legs. So, Aristotle explains the end for which human beings have fleshy legs and a haunch, but human beings are tailless because this material is used up for other parts.

There are other explanations of this sort in *PA* IV.10. For example, Aristotle explains that the mammae of a human being have a certain position because we stand upright and the position of the arms calls for a wide chest (688a12-25). There is also the explanation that human beings have the largest feet of all the animals. Once again, the cause is that human beings stand upright (690a28). The unity of the material parts of a human being is standing upright and their capacity of walking on two hind limbs or being two-footed. This capacity alone is for the sake of our rational nature. Hands also are explained by our rational nature, but in respect to what is better for our rational nature. But even the hands are possible because human beings are two-footed in that, being blooded, we have two free limbs.

Aristotle solves his problem that there appear to be two different sets of explanations for the material parts of a human being by appealing to the locomotive capacity of a human being. It is this capacity that requires the parts that belong and be organized as they are. This may explain a curious phenomenon in *Metaphysics* Z.12:

why does Aristotle define a human being as being two-footed? There may now be at least one plausible answer to this puzzle. *Metaphysics* Z.12 shows how the definition of the essence of a sensible *ousia* is one. Although the essence of a human being is the capacity to reason and to think, it also needs a material counterpart—an action that requires material as part of its being. The two-footedness of human being fulfills this demand, and Aristotle works it out carefully in *Parts of Animals* IV.10.

We now have a picture about how Aristotle will explain the parts that belong *per se* to other animals and other genera of animals. He needs to state the primary action of that animal or genus of animal and also locate the material part that best explains all other parts of that animal or genus. Let us turn to another set of explanations, for this set appeals to a generic unity rather than the specific unity of a form.

5.4.2 Birds

Aristotle's investigation of the causes of the attributes of birds is found in *PA* IV.12. Aristotle spends most of the chapter explaining what generic attributes will belong to birds *per se*. What we will find is that Aristotle seems to appeal to various middle terms to demonstrate that these parts belong. The problem is not just that there are various levels of explanation of what belongs to a bird but that Aristotle appeals to the particular life style or the environment of some birds to explain what parts belong. Neither of these two appears to pertain to the essence of an animal, and Aristotle makes little to no attempt to try to trace these features, lifestyle or environment, back to the nature of that bird. This poses a problem in explaining all the *per se* attributes that are particular to certain kinds of birds through one cause. Balme's and Lennox's view seems

to handle the text better here than my view. I will argue below that these features can be traced back to the essence or at least we can construct how this might be possible. But then there is the issue that Aristotle does not inquire into the nature of any specific bird. He simply explains what parts belong to the genus bird *per se*. But given these explanations, I will show that it is at least possible how the specific nature of a bird will be necessary for a complete explanation of the bird and how Aristotle is moving towards this explanation but does not do so explicitly in the text.

Let us begin in the middle of the chapter with an explanation that appeals to the essential nature of the genus bird. The two parts that Aristotle seeks to explain are the wings and its kind of two-footedness. The passage where these two explanations are proposed is as follows:

They are two-footed of necessity; for the *ousia* of the bird is that of the blooded animals, but at the same time that of the winged animals, and blooded animals do not move by more than four points. Accordingly, the attached parts are four—as in the other locomotive land-dwellers, so too in the birds. But four arms and legs are present in the one group, while in the birds, instead of forelimbs or arms, wings are a common feature; and in virtue of these they able to stretch out, and the ability to fly is in the *ousia* of the bird. So it remains for them to be, of necessity, two-footed; for in this way they will move, with their wings, by means of four points (693b5-14).

Aristotle is clearly seeking an explanation at the generic level of bird. This conforms to his claim in *PA* I.4 that birds have been properly named a genus by ordinary people. Birds differ from each other by the more and the less. Aristotle emphasizes this point at the beginning of *PA* IV.12 (692b3-9). What Aristotle does in the above passage is seek out what defines the genus bird. Bird is defined by the ability to fly. On my interpretation, this follows from the fact that Aristotle claims that this nature is in the *ousia* of a bird (693b13). I interpret this expression, “in the *ousia*”, as one way Aristotle

expresses that a feature belongs in the formula of the essence. Further, Aristotle sees an essence of an animal as defined in terms of its primary action. The flying is a kind of action, and if I can show this is the primary middle term sought in the explanations in this chapter, it is good reason to accept this as the essence of the genus bird. To find the nature of the various species, Aristotle will divide the kinds of attributes the bird has by nature and from there, on my view, seek out what particular feature of that bird is the primary explanation for these parts. I will show that there is some support in the text that Aristotle is heading in that direction, but he does not carry it out in any significant detail. We will see how this works in syllogisms below, but we have now answered how the first two aspects of scientific syllogisms are present in this discussion. This passage also confirms the view that the blooded nature is required to explain the locomotive parts. It is stated directly in the text: “They are two-footed of necessity; for the *ousia* of the bird is that of the blooded animals (693b5-6).”³²¹ Let us turn to the explanation that birds have wings and that they are two-footed to see how these demonstrations are constructed.

The above passage provides no proof that birds are winged by nature. It seems that Aristotle makes the natural connection between the ability to fly and the nature of wings. Since wings are the primary organ for flying, and flying is made possible mostly by the wings of a bird, I assume that the ability to fly is the equivalent of being winged. Granting this, we can make sense of the explanation that birds are two-footed *per se*. We will see that the explanation does not work unless it appeals to the blooded nature of birds. This passage explicitly states what was left tacitly assumed in the previous passage that human beings are two-footed *per se*: the conclusion from *Progression of Animals* that blooded animals move by no more than four points. Since birds naturally have two

³²¹ Lennox, *On the Parts of Animals*, p. 109. Once again, I substituted “*ousia*” for “substantial being”.

wings, this fact necessitates two more limbs by which they move. Feet are limbs by which blooded creatures move. Thus, birds are two-footed of necessity and we can also add *per se*. The explanation is really for the sake of which. The necessity present is hypothetical, and it is for the sake of the end, the ability to fly. The construction of this demonstration appears below:

Birds have the capacity to fly.
The capacity to fly requires two wings.
 Birds being have two wings.
Blooded animals with two wings require two more limbs by which they move.
 Birds have two more limbs by which they move.
Blooded animals move by means of feet.
 Therefore, birds are two-footed.

There seems to be at least two ways to object to this demonstration. First, once again, the terms do not appear to be commensurate. The last premise states a condition of being a blooded animal. Another objection is that the last premise seems false: clearly there are blooded animals that lack feet such as fish and snakes. My response to the first objection is similar to the same objection raised in the demonstration that human beings are two-footed. The kind of blooded animal that is being discussed in the demonstration is bird. But the last premise's scope is all blooded animals. It seems hard to interpret the claim otherwise. We could adjust the premise to state that birds, being a blooded animal, move by a certain kind of footedness. This is empirically the case, so there is no reason to deny it. This move would salvage the commensurability of the terms. But the other problem still lurks, for Aristotle seems to be insisting that blooded animals are footed. But Aristotle has a response. When Aristotle is discussing blooded animals that lack feet, he always mentions the fact that they are footless (*HA* I.5 489b23 and II.14 505b11). Aristotle even gives an explanation why fish are footless in *PA* IV.13 (*PA* IV.13 695b16-

24). This explanation also appeals twice to the fact that fish are blooded animals (695b19, b24). This suggests that blooded animals are footed unless proven to be otherwise. My suggestion is that there is some deep connection between being footed and being blooded for Aristotle. Another sign of this is that the blooded nature is also the principle of locomotion (*PA* II.1 647a24-32). Unfortunately, Aristotle does not develop this view in the biological writings that have come down to us. The question now is whether the ability to fly is sufficient to explain the other *per se* attributes.

I will approach this issue by exploring how Aristotle attempts to explain why the parts of different kinds of bird differ by the more and the less. When Aristotle turns to explain the degrees by which attributes differ, it does not always appear that he appeals to the essence of a bird—the ability to fly (or being the kind of wing they have). Beaks differ according to way of life (693a10). The length of the legs and necks of birds, which often coincide, is sometimes due to the environment in which they live (694b13). These causes do not seem to follow from the essence of this or that kind of bird. But we can make headway into this issue by considering another passage that deals with this issue.

Further, some of the birds are able to fly and have large, strong wings, e.g. those with talons, and the flesh-eaters; it is a necessity for them to be able to fly on account of their way of life, so for the sake of this they have both many feathers and large wings. It is not, however only the taloned birds, but other kinds of birds as well, that are able to fly, namely all those for whom self-preservation lies in the quickness of their flight or that are migratory. But some birds are not able to fly, but are heavy—those whose way of life is earthbound and that are fruit-eaters or are swimmers and spend their life around water (693b28-694a8).

Aristotle attempts to associate the kind of wing a bird has with its way of life. Since birds have a flying nature, their way of life will pertain to the kind of flying it engages in. It would appear as if these two things, way of life and kind of wing, are equivalent, but part of this passage would tell against this claim. Those birds with strong wings and

many feathers are good fliers, but Aristotle tells us that these attributes are for the sake of this kind of life. This suggests that the kind of wing is subordinate to and explained by the way of life—the kind of flying the bird engages in. This threatens the claim that wings are the primary feature of a bird and kind of wings are that which explain the other *per se* attributes. Lennox reads this passage in a similar way. What is being explained according to him is why certain birds have *large* wings and *many* feathers.³²² But if being winged just is the main way to express the capacity to fly, then it would appear as if Aristotle is explaining an essence, which would make it subordinate to another feature of the bird. But this problem can be solved by recognizing that Aristotle is appealing to the generic nature of birds to explain what might be the essential nature of a specific bird. In other words, the explanation moves from the generic claim that birds are capable of flying to the specific realization of this capability in a particular kind of bird. Another way to describe this kind of explanation is that it connects ability to fly with kind of wing. There is no real conflict between the fact that the wing is for the sake of flying and also just the primary part that enables a bird to fly. The difference is the perspective of the explanation. The following example may help us see this more clearly.

Taloned birds have strong wings and many feathers and this enables them to fly well. This also allows them to partake in the kind of lifestyle they live. For example, eagles have the kind of wings that allow them to fly high and far. The kind of wing also enables them to catch their prey. The kind of sustenance a bird lives off is determined, in part, by their mode of flying. So, the kind of wing a bird has is a capacity for a certain way of life. These two, the capacity of flying and way of life, are the same in a certain

³²² See Lennox, *On the Parts of Animals*, pp. 332-3. For Lennox, since he is not concerned with one feature explaining all other features, he states the problem as the way of life explaining the ability to fly. He rightly concludes that this is only an apparent conflict.

respect, much like form and material are the same in a certain respect. The kind of wing determines what kind of bird that bird can be. On this interpretation, the wing is the unity of a bird, and essence of a particular bird is the final differentia of the kind of wing it has. I will show that this interpretation of the nature of a bird is present in demonstrations that can be constructed from passages in this chapter.

For example, the kind of legs each kind of bird has is due to its way of life. But we will soon see that this is really connected to the kind of wing a bird has. There are two kinds of birds that dwell in water. One kind of bird has short legs but webbed feet. The other kind of bird has long legs and many jointed toes to move around in marshy areas. At first, Aristotle makes the explanation primarily through the way of life of each bird. Some birds are swimmers, i.e., the webbed footed ones, and others just dwell in the marshes, i.e., those with long legs and many jointed toes. But something a bit latter tells that their flight is different from other kinds of birds. The birds with long legs use up much material in their legs and have no tail, but they use their feet as a kind of tail in flight (694b17-21). Birds with webbed feet, on the contrary, tuck their legs under when they fly (694b22-5). Although Aristotle is appealing to their way of life to explain these features, the way of life of a bird is the kind of flying it engages in. This again points to the fact that the wings of each of these kinds of bird will ultimately explain these features.

This also tells us something interesting about appealing to the environment that a kind of animal dwells in as part of the explanation for why it has the attributes it does. This would appear to appeal to something external to the essence of an animal, but this does not seem to be the case. The environment an animal lives in is precisely the

environment its essence allows it to live in. The environment does not determine the nature of the animal, since this is external to the animal. This kind of cause would be by chance. Rather, it is the case that the explanation of the animal demands that it live in a certain environment. One might object that Aristotle would have to appeal to a doctrine like Leibniz's that this is the best of all possible worlds that the environment that an essence demands is exactly where the animal dwells. But this is not necessary either under Aristotle's ontology or his understanding of the cosmos. The nature of an animal must be able to sustain itself, so it will exist if it can sustain itself, for if an animal exists at all, it must be where it can exist. This is because Aristotle argues against the claim that forms can come to be (*Met. Z.8*). So, the form will entail the kind of environment the animal needs to sustain itself. This really just is an appeal to the nutritive capacity of an animal. It is not clear how else Aristotle can use such an explanation as this without violating his assumption that an animal is an *ousia*.

As I stated before, it is not clear that Aristotle arrives at the definition of a particular form of bird. But I have hopefully shown that such an inquiry is possible. It is not clear why Aristotle does not explore these kinds of explanations in more depth in the *Parts of Animals*. It is unfortunate for any interpretation of Aristotle's zoology. But we saw in section 5.4.1 that Aristotle did locate an essence of a particular kind of animal. This is sufficient proof that it is possible for Aristotle to arrive at such a definition. Further, both this definition of human being and what could serve as a definition of a particular kind of bird can simply be a final differentia.

5.5 Inconsistencies and Their Resolutions

There are three apparent inconsistencies with my interpretation of Aristotle's practice of zoology with certain other passages or claims in Aristotle. First, there are the explanations that seem to appeal to no formal nature such as the gluttony of fish explains its eating habits (III.14 675a19-22). But the gluttonous nature of a fish is not clearly part of its essence nor does Aristotle explain how this nature follows from a fish's essence. So, some explanation of animal parts will not follow from the essence. Second, Aristotle in the *Generation of Animals* does not divide the different modes of the reproductive capacity by locomotive features, which seems to be what marks off either particular species or extensive genera in *Parts of Animals*, but by internal heat and moisture (II.1 732b15-733a17). These two features are distinct, since the locomotive capacity pertains to an action and internal heat and fluidity derive from the nature of the material, so there is no unity of the essential nature of an animal. Both criticisms are raised explicitly by Charles.³²³ Finally, *De Anima* claims that the genus animal is defined by the capacity of perception (II.2 413b2-3), and *Parts of Animals* confirms this (II.8 653b22). But my view entails that most animals will be defined by their mode of locomotion. *Parts of Animals* also seems to confirm my view by defining birds in respect to the capacity of flying and fish in respect to the capacity to swim (IV.12 693b12, IV.13 695a19-20). This would imply that the essence of the species leaves out and is different from the essence of the genus. If the genus animal is defined by having the capacity to perceive, then the essence of a specific kind of animal should be a specific way of perceiving. I will address these inconsistencies of Aristotle's claims with my interpretation.

³²³ See *Aristotle on Meaning and Essence*, pp. 333-37.

Can the fish's swimming nature explain its gluttony? Charles claims no, and has textual support for his view (*PA* III.14 675a19-22, IV.13 696b30-32). But I believe that the fish's nature can explain its gluttony, and certain explanations above will help. A fish has many teeth due to the fact that it must consume its food quickly while eating under water (5.2.2.2). This would seem to follow from its swimming nature and way of life (βίος). But if a fish consumes its food quickly, it will not be able to concoct the food well, even with many teeth, leaving much of the food undigested. So, a fish must eat more to nourish itself. The swimming nature and eating under water (way of life) explains the gluttony. Aristotle does not give this connection in *PA* III.14 because he has already provided it in *PA* III.1 662a6-15). So, the text ultimately does make the connection, just not all in one place. But this reveals something else about *Parts of Animals* and its method and order that I have stressed. Aristotle begins from the widest generic nature of animals and explains the parts that belong because of this nature. In moving closer towards the extensive genera and particular species, explanations do not get repeated, nor should they. Aristotle has adopted this method to avoid repetition (*PA* I.5 645b10-14). But there is another problem with Aristotle's explanation of fish parts that Charles oddly leaves out. There is another attribute of a fish that is explained by degree of heat: number of gills and their complexity (IV.13 696a12-23). Charles seems satisfied with the explanation of the gills generically belonging to fish because they belong due to its way of life—they must cool themselves down with water.³²⁴ But he ignores the passage cited below:

Some fish have many gills, some few, and some have double gills, some simple ones; in most of them, however, the last one is simple. (For accuracy, one should

³²⁴ Ibid., p. 331.

study with the help of the dissections of these things and the enquiries about animals.) A cause of the number of gills being larger or smaller is a larger or smaller *amount of heat in the heart*; for the movement must be more rapid and stronger for those with more heat. And those with more gills and double gills have a nature of this sort more than those with simple and fewer gills (696b12-20).³²⁵

So, gills belong due to the way of life of a fish, but the number of gills and their complexity, e.g., simple or double. But these are essential differentiae of gills, for number and complexity are in respect to the work of the gills: cooling. But maybe Charles ignores this problem because the cooling of a fish will pertain to its internal heat, so differentiae of cooling or gills will pertain to amount of heat. Internal heat is part of the nature of any living being (*De Anima* II.4 416b28-29). A blooded animal has a higher degree of heat than bloodless animals. So, it seems that amount of heat is part of the blooded nature and so part of the essence.³²⁶ This will be important to address the second inconsistency: internal heat and moisture determine the kinds of reproduction that belong to various kinds of animals.

The inconsistency here is that material is part of the essence and middle term. To alleviate the inconsistency, we should remember that part of the blooded nature of an animal is its particular kind of nutritive capacity. The fundamental material of the nutritive capacity is blood, and blood is by nature of belonging to this capacity, hot and moist (see 5.2.2.1). The nutritive capacity requires heat and moisture for its work: heat is necessary to concoct food. But it will also be necessary to concoct the blood to be either semen or menstrual fluid (*GA* I.19 726b2-12, *GA* I.20 729a21-34). But the work of the

³²⁵ Italics are mine.

³²⁶ Charles accepts that the blooded nature may be part of the nature of these kinds of animals, but it does not on these grounds become part of the essence according to him. I hope that I have shown sufficient reason and textual support for the fact that being blooded is part of the essence of a blooded animal. See Charles, *ibid.*, p. 333.

capacity is the nature of that capacity. So, the degree of internal heat and moisture are really formal aspects of the nature of an animal. This is why Aristotle divides the animal in respect to the reproductive capacity by degrees of internal heat and moisture (*GA* II.1 732b15-733a17). Although this will admit of many cross-divisions, e.g., not all four-footed animals are viviparous or oviparous, it is not clear this would affect the unity of the middle term. If degree of internal heat and moisture is part of the essence of the animal, the form of a particular kind of animal will further determine the amount of internal heat required to be the kind of thing it is, and its form of reproduction will be consistent with its form and definition. This turns out to be another sign of the subsumption of the various capacities by the end and form of the animal.

This leads us towards solving the final inconsistency. The genus animal is defined by having the perceptive capacity. Animals should be differentiated by ways in which they instantiate this nature distinctly. If the various instantiations of the locomotive capacity differentiate animals, then the generic nature is distinct from the specific nature. For example, a distinct number must be a determinate way of being a plurality of units, assuming that this is the generic nature of number. But we should note that the same problem arises with the definition of human being: we are defined by our capacity to reason. Aristotle seems to imply that this rational capacity, being divine, orders our perceptive capacity in the following passage in *Parts of Animals* II.10:

Such is mankind; for of the animals known to us either mankind alone, or mankind most of all, partakes of the divine. So both because of this and because the shape of the external parts of mankind is most familiar, one ought to speak about mankind first. For straight away the natural parts are disposed according to nature in this kind alone, that is, what is above for mankind accords with what is above for the whole cosmos; for mankind alone among the animals is upright (656a7-13).

This passage implies that our capacity of sight is placed above all other perceptive capacities for the sake of our rational and divine nature (cf. *PA* II.11 657a11-14). And, as we saw in section 5.2.3.1, flesh organizes the uniform parts yet the locomotive capacity organizes the whole body, for the structure of the skeleton is formed for the sake of the kind of locomotion of that animal. As I have been stressing all along in this chapter, a higher capacity can subsume the nature of a lower capacity. So, no animal is defined apart from having perception, yet animals can be differentiated by higher capacities such as locomotive capacity or the rational capacity. So, the specific nature of any animal will include the generic nature of an animal: the capacity to perceive. On the other hand, if some one does not accept this defense, the problem seems to come from Aristotle himself. He advocates defining certain genera of animals by their locomotive capacities, that of bird and fish. So, it does not affect my reading of *Parts of Animals* or Aristotle's science of zoology understood by my interpretation, but does point to some inconsistency in his thought.

5.6 Conclusion

Although there is little evidence that Aristotle has defined any animal by one, final differentia in the *Parts of Animals*, I have tried to block the various criticisms of this view and show ways to read the text that are charitable towards this interpretation. One thing that is clear on most interpretations is that the science Aristotle presents in *Parts of Animals* is not complete. We saw this incompleteness in respect to various explanations above where sometimes Aristotle had yet to discover one of the causes relevant to zoological explanation. So, it is not a devastating criticism of my interpretation that there

are no such explanations of a species of animal by means of a final differentia. On the other hand, there is some evidence that supports the view that Aristotle has grasped the definition of the essence of human beings, and this definition can be interpreted as one, final differentia: the capacity to reason. This differentia subordinates all the parts of a human being for the sake of this end: standing upright, being two-footed, having hands, haunches, fleshy legs, and being tailless as well as the kind of teeth that belong, kind of tongue intestines, lungs, and the nature of our blood. All of this material together just is the form of the human being, for the whole body is organized as such. But subordinated in this organization is a locomotive capacity appropriate for this end (walking on two-feet), perceptive capacity appropriate for this end (sense capacities located in the most advantageous location for acquiring knowledge), and a nutritive capacity appropriate for this end (a long intestine to increase the time of digestion to allow human beings to pursue other activities than nutrition and growth). The nature of a bird is no different. A bird is defined by its capacity to fly. This seems most exemplified by the nature of its wings. Although Aristotle does not carry his explanations this far for particular species of birds, it seems possible that the particular kind of wing that belongs to a particular species of bird will define the nature of all of its features: the kind of life (flying high or staying close to the ground), the nature of its beak (whether it eats meat or grain), the kind of feet each has (most appropriate in respect to where it lives or things it dwells in), and the shape of its body (for the sake of the kind of flying it has).

The advantage of this reading is that it makes sense of both Aristotle's metaphysical and physical claims about the nature of animals. Aristotle assumes that an animal is one in formula (e.g., Z.12 1037b25-27) and one in number (e.g., Z.16 1040b16-

19) in the central books of the *Metaphysics* insofar as he assumes that an animal is an *ousia*. On the other hand, Aristotle suggests in various places that the formula of an animal is complex in respect to the study of physics (e.g., *Physics* II.3 194b26-29, *PA* I.3 644a5-8). As we saw above, both assumptions are compatible insofar as the many features within the definition of an animal can be subsumed by the final difference that ultimately is the form and *ousia* of the thing. But it is also the case that Aristotle is defining the composite *ousia* insofar as physics studies both form and material. So, another complexity of the definition is that the material is included. This material is one, in a way, as the whole body organized for the sake of a certain action, but, on the other hand, this whole body is also divisible into many parts each of which has its own nature and work. These are the many differentiae mentioned in Aristotle's critique of dichotomy. This kind of definition is also compatible with Aristotle's arguments that the composite whole is also an *ousia*. Form and material are one in a way (*Met.* H.6). But the definition that articulates out the various parts assumes that the material is one in a way. For, the nature of each part has added into its formula the definition of the essence to which it belongs. This is how the zoologist can know that all the parts belong to one material object and one formal nature. As my interpretation of the practice of zoology above intends to show, the zoologist assumes this unity insofar as he seeks out the nature of each of the material parts of an animal to find the essential nature of that kind of animal (so, it also assumes the unity of the definition of the form, as *Met.* H.6 does). The various demonstrations that can be constructed from the text slowly build up the various features of the animal, each for the sake of some end and action of the animal, into a unified whole. This kind of unity is not a mere conjunction, as Aristotle stresses both in

his metaphysical writings and his physical writings (e.g., *Met.* Z.4 1030b9, H.6 1045a13, *PA* I.3 643b18).

Constructing a consistent view of Aristotle's conception of an animal provides a pathway into judging the coherency and legitimacy of his metaphysical views. An animal is Aristotle's primary exemplar of an *ousia*. This may at first not appear to bode well for Aristotle, since the contemporary biological view that species have evolved seems incompatible with the interpretation I have presented of Aristotle's conception of an animal. On the other hand, such an inquiry into Aristotle's view of science and scientific inquiry may help show how metaphysical inquiry and natural scientific inquiry can be both separate and informative of each other. As we saw above, Aristotle's understanding of the parts does not often differ too much from our own understanding of them today. Of course, he does not always have the correct understanding of a part or an incomplete one. But all this shows is that we have better access to the facts and can also grasp more facts through the tools used to study the nature cells and their DNA, not that Aristotle's metaphysics informed his inquiry into the nature of particular parts. On the other hand, the metaphysical inquiry is distinct from the empirical observations, not in that it ignores the fact, but it attempts to grasp the nature of the being of the thing. Aristotle's metaphysical inquiry in *Metaphysics* ZH begins from assumptions about what it is to be a primary thing or *ousia* and shows that the form of an animal can be such. Aristotle's physical inquiry into the nature of an animal assumes this result, that form is the *ousia* and essence of a thing, and seeks to find the definition of that particular kind of animal through an inquiry into the parts. So, I have confirmed the initial claim that Aristotle studies the same thing in different ways through each science. This is a radical

break from contemporary metaphysics that considers this science (if it is even to be a science) to be either logically clarifying our assumptions of natural science (logical positivism) or claiming that there is no need for a separate inquiry insofar as the synthetic-analytic distinction collapses (Quine) or determining the way we can name a thing so as to grasp the essence with logical necessity (Kripke-Putnam view). Aristotle's view of metaphysics really incorporates aspects of all three claims without being reduced to any one of these views nor is it some aggregate of the best features of these approaches. The metaphysical principles must be grasped in respect to our assumptions about being. Natural science studies a particular kind of being, so it cannot determine anything about the nature of being as being. But, on the other hand, since natural science studies a kind of being, this science cannot ignore these principles, it simply assumes them for the sake of inquiry and provides a path to move from not knowing the specific nature of animal to knowing it through the empirical facts.

APPENDIX 1:**Abbreviations of Texts**

<i>APo.</i>	<i>Posterior Analytics</i>
<i>De. An.</i>	<i>De Anima</i>
<i>GA</i>	<i>Generation of Animals</i>
<i>HA</i>	<i>History of Animals</i>
<i>MA</i>	<i>De Motu Animalium</i>
<i>Met.</i>	<i>Metaphysics</i>
<i>PA</i>	<i>Parts of Animals</i>
<i>Phys.</i>	<i>Physics</i>
<i>Resp.</i>	<i>Respiration</i>
<i>Sens.</i>	<i>De Sensu</i>
<i>Top.</i>	<i>Topics</i>

REFERENCES

Texts, Translations, and Commentaries

- Apostle, Hippocrates G., *De Anima*, Grinnell, Iowa: Peripatetic Press, 1981.
- _____, *Aristotle's Metaphysics*, Grinnell, Iowa: Peripatetic Press, 1979.
- _____, *Aristotle's Physics*, Grinnell, Iowa: Peripatetic Press, 1980.
- Balme, D. M., *De Partibus Animalium I and De Generatione Animalium I (with passages from II.1-3)*, Oxford: Clarendon, 1992.
- Barnes, Jonathan, *Aristotle's Posterior Analytics*, second edition, Oxford: Clarendon, 1993.
- Bostock, David, *Aristotle's Metaphysics ZH*, Oxford: Clarendon, 1994.
- Düring, I., *Aristotle's Parts of Animals: Critical and Literary Commentaries*, 1943.
- Furth, Montgomery, *Metaphysics VII-X*, Indianapolis: Hackett Publishing, Inc., 1985.
- Jaeger, Werner, *Aristotelis Metaphysica*, Oxford: Clarendon Press, 1957.
- Lennox, James G., *On the Parts of Animals I-IV*, Oxford: Clarendon, 2001.
- Peck, A. L., *Aristotle: Parts of Animals*, Loeb Series Vol. XII, Cambridge, MA: Harvard University Press, 1961.
- Ross, W. D., *Aristotle's Metaphysics*, Vol. II, Oxford: Clarendon Press, 1924.

Books

- Burnyeat, Myles, *A Map of Metaphysics Zeta*, Pittsburgh: Mathesis Publications, Inc., 2001.
- Carnap, Rudolf, *Philosophy and Logical Syntax*, London: Paul Kegan, Trench, Trubner & Co. Ltd., 1935.
- Charles, David, *Aristotle on Meaning and Essence*, Oxford: Clarendon Press, 2000.
- Denniston, J. D., *The Greek Particles*, second edition, Oxford: Clarendon Press, 1978.

Drake, Stillman, *Discoveries and Opinions of Galileo*, New York: DoubleDay Anchor Books, 1957

_____, *Essays on Galileo and the History of Philosophy and Philosophy of Science*, Vol. I, Toronto: University of Toronto Press, 1999,

Furth, Montgomery, *Substance, Form and Psyche: An Aristotelean Metaphysics*, Cambridge: Cambridge University Press, 1988.

Galileo, *Dialogues Concerning Two New Sciences*, Buffalo, NY: Prometheus Books, 1991.

Gotthelf, Allan, ed., *Aristotle on Nature and Living Things*, Pittsburgh: Mathesis Press, 1985.

Gotthelf, Allan, and Lennox, James, ed., *Philosophical Issues in Aristotle's Biology*, Cambridge: Cambridge University Press, 1987.

Halper, Edward, *One and Many in Aristotle's Metaphysics*, Columbus, OH: Ohio State University Press, 1989.

Jaeger, Werner, *Studien zur Entstehungsgeschichte der Metaphysik der Aristoteles*, Berlin, 1912.

Lennox, James, *Aristotle's Philosophy of Biology*, Cambridge: Cambridge University Press, 2001.

Lloyd, G. E. R., *Aristotelian Explorations*, Cambridge: Cambridge University Press, 1996.

Moravcsik, J. M. E., ed., *Aristotle: A Collection of Critical Essays*, New York: Anchor Books, 1967.

Owens, Joseph, *The Doctrine of Being in the Aristotelian Metaphysics*, third edition, Toronto: Pontifical Institute of Medieval Studies, 1978.

Pellegrin, Pierre, *Aristotle's Classification of Animals*, translated by Anthony Preus, Berkeley: University of California Press, 1986.

Biologie, Logique, et Metaphysique chez Aristote, Paris: Editions du CNRS, 1990.

Sorabji, Richard, *Necessity, Cause, and Blame*, Ithaca: Cornell University Press, 1980.

Articles

Balme, D. M., "Aristotle's biology was not essentialist", in *Philosophical Issues in Aristotle's Biology*, pp.291-302.

_____, "Appendix 1: Note on the *aporia* in *Metaphysics Z*", in *Philosophical Issues in Aristotle's Biology*, pp. 302-6.

_____, "Appendix 2: The Snub", in *Philosophical Issues in Aristotle's Biology*, pp. 306-12.

_____, "The place of biology in Aristotle's philosophy", in *Philosophical Issues in Aristotle's Biology*, pp. 9-20.

_____, "Aristotle's Use of Division and Differentiae", in *Philosophical Issues in Aristotle's Biology*, pp. 69-89.

Barnes, Jonathan, "Aristotle's Theory of Demonstration", in *Articles on Aristotle: 1. Science*, edited by Jonathan Barnes, Malcolm Schofield, and Richard Sorabji, London: Gerald Duckworth & Company Limited, 1975 pp. 65-87.

Carnap, Rudolf, "Empiricism, Semantics, and Ontology", in *The Linguistic Turn*, ed. by Richard M. Rorty, Chicago: University of Chicago Press, 1967, pp.

Code, Alan, "The Aporematic Approach to Primary Being in *Metaphysics Z*", in *Canadian Journal of Philosophy*, suppl., 1984, pp. 1-20.

Cooper, John, "Hypothetical Necessity", in *Aristotle on Nature and Living Things*, pp. 151-67.

Düring, I., "Aristotle's Method in Biology", in *Aristote et les problèmes de méthode*, edited by S. Mansion, Paris: Louvain, 1961,

Gotthelf, Allan, "Notes towards a Study of Substance and Essence in Aristotle's *Parts of Animals* ii-iv", in *Aristotle on Nature and Living Things*, Pittsburgh: Mathesis Press, 1985, pp. 27-54.

_____, "First Principles in Aristotle's *Parts of Animals*", in *Philosophical Issues in Aristotle's Biology*, pp. 167-198

_____, "Division and Explanation in Aristotle's *Parts of Animals*", in *Beiträge zur antiken Philosophie*, edited by Hans-Christian Günther and Antonios Rengakos, Stuttgart: Franz Steiner Verlag, 1997

_____, "Darwin on Aristotle", *Journal of the History of Biology*, 32, 1999, p. 3.

Grene, Marjorie, "About the Division of the Sciences", in *Aristotle on Nature and Living Things*, pp. 9-13.

Halper, Edward, "Metaphysics Z 12 and H 6: The Unity of Form and Composite", *Ancient Philosophy* 4, 1984, pp. 146-159.

Lee, E. N., Mourelatos, A. D. P., and Rorty, R. M., ed., *Exegesis and Argument: Studies Presented to Gregory Vlastos*, *Phronesis* suppl. Vol. I, edited by, 1973.

Lennox, James, "Kinds, Forms of Kinds, and the More and the Less in Aristotle's Biology", in *Aristotle's Philosophy of Biology*, pp. 160-81.

_____, "Material and Formal Natures in Aristotle's *De Partibus Animalium*", in *Aristotle's Philosophy of Biology*, pp. 182-204.

Lloyd, G. E. R., "The Development of Aristotle's Theory of the Classification of Animals", *Phronesis*, VI, 1961, pp. .

_____, "Aristotle's zoology and his metaphysics. The *status quaestionis*. A critical review of some recent theories", in *Biologie, Logique, et Metaphysique chez Aristote*, Paris: Editions du CNRS, 1990

_____, "The theories and practices of demonstration", in *Aristotelian Explorations*, pp. 7-37.

Loux, Michael, "Aristotle on Matter, Form, and Ontological Strategy", *Ancient Philosophy*, 25, 2005, pp. 81-123.

Owens, Joseph, "Our Knowledge of Nature", in *Proceedings of the American Catholic Philosophical Association* (29), 1955, pp. 63-85.

Quine, W. V. O., "On What There Is", in *From a Logical Point of View*, second edition, revised, 1980, p. 1-19.

_____, "Reference and Modality", in *From a Logical Point of View*, Second edition, Cambridge: Harvard University Press, 1980, p. 139-59.

Pellegrin, Pierre, "Aristotle: A Zoology without Species", in *Aristotle on Nature and Living Things*, pp. 95-115.

_____, "Logical Difference and Biological Difference: the unity of Aristotle's thought", in *Philosophical Issues in Aristotle's Biology*, pp. 313-38.

Rorty, Richard, "Genus as matter: A Reading of *Metaphysics Z-H*" in *Exegesis and Argument: Studies Presented to Gregory Vlastos*, *Phronesis* suppl. Vol. I, edited by E. N. Lee, A. D. P. Mourelatos, and R. M. Rorty, 1973.

Sober, Elliot, "Evolution, Population Thinking, and Essentialism," in *Conceptual Issues in Evolutionary Biology*, Second Edition, Cambridge, MA: The MIT Press, 1994, pp. 161-89.

Woods, Michael, "Problems in *Metaphysics Z*, Chapter 13", in *Aristotle: A Collection of Critical Essays*, pp. 215-38.