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Chad Wiener

Dividing Nature by the Joints

Abstract: Most scholars of Aristotle's biology have accepted the view of D. M. Balme and Pierre Pellegrin that the *History of Animals* is devoid of any systematic classification of animals. I challenge this reading. I show that Aristotle can produce a taxonomy of animal kinds that are found in the essences of atomic species, or, to borrow from Plato, divide nature by the joints. I start from Aristotle's positive views of division stated in *APo.* II.13–14 and how they imply a taxonomic order of a genus. I then develop my interpretation of how Aristotle can divide nature by the joints in respect to his criticisms of division in *APr.* I.31 paired with the methodology developed in *APr.* I.27–30. I conclude by illustrating that Aristotle employs this methodology to divide the genus animal by its joints in the *History of Animals* and how he seeks out the taxonomic order of the genus animal in that work.

Keywords: Classification, Taxonomy, Inquiry, Natural Kinds, Biology

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The method of division was employed by scientists from at least the Renaissance to Linnaeus to generate their taxonomies of biological kinds. They, of course, were inspired by Aristotle but through the lens of Neo-Platonism and the tree of Porphyry. According to this tradition, Aristotle was seen as the first taxonomist of animal kinds. But this view slowly eroded in the 20th century. A close examination of Aristotle's *History of Animals* and the other biological treatises exposed various classifications of animals, no apparent systematic use of principles of classification, and no clear taxonomic arrangement of kinds.¹ By the second half of the 20th century, D. M. Balme argued that Aristotle's primary use of division was not classification but definition and is helpful in seeking causal explanations.² Pierre Pellegrin then dealt the apparent death-blow, showing conclusively that the terms γένος and εἶδος do not denote fixed kinds

¹ For the best short presentation of many of these problems, see Balme 1987a: 69–89.

² Balme 1987a: 69–89, cf. 1992: 101–6.

on a hierarchy for Aristotle but were used relative to a kind that can be further divided and the kinds that fall under that division.³ These two views have been supported by the work of James Lennox and Allan Gotthelf. They argue, following Balme, that Aristotle does not aim to classify animals in *HA* but rather he groups differentiae to seek the widest kind to which a predicate extends.⁴ I argue in this paper that this dismissal of taxonomy in Aristotle's biology is premature. Although David Charles shares a similar position, the method I take Aristotle to use differs significantly from his view.⁵ I aim to show that Aristotle's taxonomic project has less in common with modern taxonomies and actually avoids some of their pitfalls.

It is not hard to see that the above two arguments do not lead to the desired conclusion that Aristotle was not a taxonomist of animal kinds. There is no reason to suspect that Aristotle would use certain terms to denote a fixed level on a hierarchy, for he makes no mention of such terminology in his logic. This seems to be an invention of modern taxonomies. Second, finding a taxonomic order to the genus animal is neither inconsistent with seeking the widest kind to which a predicate extends nor at odds with seeking causal explanations. It would actually be an effective tool for both tasks. Something else must support the view held by these scholars. Pellegrin, Balme, Lennox, and Gotthelf also rely on negative evidence. They claim that we just do not find Aristotle seeking out this taxonomy of zoological kinds anywhere in his biological treatises. Instead Aristotle studies differentiae and groups animals according to various kinds of differentiae in *HA*, so there is no privileged, systematic grouping of animals. And, even if scholars such as Devin Henry and Byron Stoyles hold that Aristotle does classify, such classification is not taxonomic on their reading in any way.⁶ What I show is that there is evidence in the biological treatises for a privileged systematic grouping of animals, and there is also a method by which Aristotle seeks out these kinds. To borrow a phrase from Plato, Aristotle has a method to divide nature by the joints, which picks out and arranges these kinds on a hierarchy. I develop my view in the first three sections before I consider other scholars on this issue and how I would address their criticisms.

3 Pellegrin 1986: Ch. 2.

4 Lennox 2001b: 7–71; Gotthelf 1988: 100–35.

5 Charles claims that insofar as Aristotle aims in *HA* to establish the existence of kinds and what properties they have, he is engaged in the taxonomic task of which kinds exist. Charles 2000: 315, n. 9.

6 Henry 2011; Stoyles 2012.

I

Taxonomy and Seeking Kinds in Aristotle. It is not only controversial to claim that Aristotle seeks a taxonomy of kinds in his biology, but it also unclear what this would mean for Aristotle. Just as Aristotle does not stipulate any taxonomic usage for his terms “genus” and “species,” he does not seem to have any term that corresponds to what we would call “taxonomy.” To address this lacuna, I appeal to Gotthelf’s characterization of taxonomy as he conceives it would apply to Aristotle. He writes:

By a ‘systematic classification (or taxonomy) of animals’ I mean: a grouping of animal forms (*atoma eidē*) under a hierarchical series of larger kinds (*gene*) which aims to be (whether or not it actually succeeds at being):

- (i) Mutually *exhaustive* at any upper level, and especially at the highest level, of the lower kinds and forms;
- (ii) Mutually *exclusive* at any upper level of the lower kinds and forms; and
- (iii) A grouping of animals by *essential nature*, so that
 - (a) Each is an authentic *kind*, in the sense that the kind name is always in the first category of being, identifying *what something is*; from which it follows that
 - (b) There is only one such grouping of the animals there are, which entails that the systematic classification is
- (iv) Unique.⁷

Using this conception of taxonomy, I can present an outline of my view. Aristotle seeks a taxonomy of kinds that is unique in his biological treatises, these kinds being exhaustive and exclusive of the kinds found in the essences of atomic species (ἄτομον εἶδος)⁸ of animals. This also implies that these kinds have a privileged status, not only being the sole kinds found in the essences of animals but also marking off the distinct levels of generality at which explanation of all other predicates of animal kinds occur. The view only accounts for how the kinds are established rather than how Aristotle determines the relevant differentiae that define the atomic species. An inquiry that determines the relevant differentiae would take us beyond what Aristotle calls a *historia*, which just is Aristotle’s method to organize facts along explanatory lines. I also hold that

⁷ Gotthelf 2012: 264.

⁸ It is common in the literature now to translate “εἶδος” as “form” rather than “species”. Since my view is that Aristotle is seeking a taxonomic order in his zoology, there will be atomic species and they will play some role in the presentation of the facts in *HA* and explanations in *PA* and *GA* even if they are not always mentioned directly. I see no problem with this view being consistent with the fact that Aristotle uses the term “εἶδος” more broadly, i.e., to refer to specific kinds or forms that are not atomic species yet still are differentiated kinds under a genus.

this taxonomy of kinds does not exhaust the kinds found under the genus animal that are relevant loci of explanations, it just determines the various levels of generality at which explanations can occur.⁹ On my view, this means that the essences of the kinds not found on the hierarchy are composed of features that are explained by means of the essences of kinds found on the hierarchy. Hence, there can be multiple ways to classify a single, atomic species but only one set of kinds that define it.¹⁰ I do not argue this latter view in this paper but rather show that Aristotle has the resources to generate the kinds on the taxonomic hierarchy and exclude other kinds from being members of the hierarchy. The resources I take Aristotle to employ to seek out these kinds are those he develops in his logic, namely, division and the syllogistic, as well as a guiding ontological assumption, the unity assumption.

There are two issues I need to address. There are clear differences, given what I stated above, between my view of Aristotle's taxonomy and those found in the modern era, for example, not all natural kinds are found on the hierarchy of kinds. So, there could be other ways to classify animals besides appealing to features in their essences. Second, on my view, Aristotle does not hold that all atomic species need to fall under the same number of levels, that is, divisions, on the hierarchy. If this is true, it would actually seem to violate (i) above. Be-

9 Given that Aristotle does not take the term "genus" or "kind" (γένος) to denote a fixed level on a taxonomic hierarchy, it is possible that Aristotle uses the word "kind" in both ways. Aristotle does accept that there can be many kinds in such a formula (*Physics* II.3 194b27). But Aristotle also uses "kind" to signify that which has parts or attributes that hold in respect to the nature of that thing (*APo.* I.28 87a38–39). Such usage implies that a kind has an essential nature which itself is explanatory of the features that belong *per se* of it. This usage covers both the kinds that are found in the essences of atomic species as well as those kinds that I hold are explained to belong due to those features found in such essences. There is no reason to restrict Aristotle's usage of "kind" only to the former.

10 For example, Aristotle determines the essence of any mode of generation in *GA* is in respect to the degree of heat and moisture present to that kind of animal (II.1 732b28–33). These predicates, heat and moisture, belong to all animals as animals (see *DA* II.4 416b29 for the claim that all living beings possess heat and *PA* II.1 646a15–22 for the claim that moist/dry and hot/cold are the basic constituents to all uniform parts of animals). Of course, since it is the degree of heat that matters, although explained to belong to all animals at the level of generality of being an animal, these features admit of further differentiation, so they be further divided to determine the specific mode of generation that belongs to any atomic species of animal. On this view, two consequences arise. First, atomic species are already determined to be certain kinds of things prior to determining their mode of generation, or, another way of stating this, division by mode of generation does not go all the way down to the atomic species but stops at a higher level of generality. Second, on my view, mode of generation would not be a kind found in the essence of an atomic species but rather a feature due to the essence of the atomic species.

low I develop Aristotle's conception of taxonomy from passages in the *Posterior Analytics* and then address the above concerns, showing why they do not pose a real problem for Aristotle's taxonomic project in his biology.

Let us start from his discussion on the role of division in seeking definitions in *APo.* II.13. He begins by stating that division is useful in hunting down terms expressed in the *what is* (96a23). I take these to be terms that are parts of the formula of the essence of an atomic species.¹¹ These terms could be those expressed in the essences of the atomic species of any genus as implied by Aristotle with his example of quality or quantity at 96b20. Aristotle provides three rules that division must aim in order to establish definitions of this kind: "you must take what is predicated in the what the thing is; you must order these items as first or second; and you must ensure that these are all there are" (97a24–26). The second rule stresses taking the items expressed in the correct order. He has already explained why the order of the predicates matter. Each division moves from a unity to a unity (96b30–35), so failure to express the predicates in the right order sacrifices the unity of the definition. I discuss this unity below. Now, since division marks off kinds by means of differentiae within a genus and given that these kinds must be ordered correctly, such a procedure can be read to imply that a genus has a taxonomic order for Aristotle.

Aristotle's discussion of the role of division in formulating problems at their appropriate level of generality (98a1–2) also supports this view. I should clarify what is occurring in this passage, since a proper understanding of this passage is also vital to the argument of this paper. A problem, for Aristotle, is a conclusion or an "about which" of a syllogism (*Topics* I.4 101b13–16). Raising a problem at the appropriate level of generality implies formulating the problem so it will serve as the conclusion of a demonstration.¹² A demonstrative conclusion would imply that the subject and predicate are co-extensive and the predicate belongs in virtue of the subject, what are often called "commensurate univer-

¹¹ My view is closest to Ross', but I do not defend here how these chapters relate to the discussion of definition in *APo.* II.8–10. Ross 1949: 628–36. Like Ross, I hold that division seeks those immediate definitions mentioned in *APo.* II.8, and, *pace* Barnes, there is some evidence that this is the case. For alternate readings of this passage, see Barnes 1993: 240–50 and Charles 2000: 222–30. I should add that nothing in these passages implies that division could not be used to aid an inquirer at various stages of inquiry.

¹² Lennox argues that Aristotle extends the term "problem" here beyond its usage in the *Topics* where it is only used in respect to a conclusion of a syllogism. On Lennox's view, a demonstrative problem begins by asking why a certain predicate belongs to a certain subject. In *APo.* II.14, we can see that this means division is helpful in finding the right subject to which the predicate belongs *per se*. Lennox 2001: 77–82.

sals.”¹³ Aristotle claims that division is useful in finding the appropriate level of generality of any predicate that belongs to a kind within the respective genus: it marks off the kinds of that genus which serve as demonstrative subjects. Having the kinds of the genus already arranged in their correct order enables the one inquiring to seek the middle term for a demonstrative problem, the term that explains why the predicate belongs to this kind, at the appropriate level of generality. I take these kinds to be the natural joints of the genus, arranged taxonomically, and expressed in the essences of the atomic species, i.e., kinds that are parts of the definition of atomic species.

This passage uses language that suggests a hierarchy of nested kinds under a given genus. Aristotle states, in setting out the problem, one moves in order, taking what holds of the genus first (98a3–4), and then taking what holds in common at the next level of generality (98a5) and so forth (98a6–7, a11–2) until one finds the correct form to raise the problem. One possible reading of this passage is that Aristotle implies that there is only one taxonomic order of any genus, since such an order would be sufficient to address the level of generality at which the predicate is explained, and this order grasps only those kinds found in the essences of atomic species. If Aristotle assumes that the formula of these essences are one and one in such a way that every lower kind is properly divided off from a single, higher-order kind, then there could only be one taxonomic order of any genus. Such a unity assumption is controversial, so I provide grounds for my interpretation of it below. Now, Lennox and Gotthelf, following Balme, appeal to this latter passage to support their view that Aristotle groups differentiae to find the widest kind to which a predicate extends. If the passage supports both readings, and I see no reason why it cannot, this aspect of their reading of the biological treatises need not conflict with Aristotle maintaining a taxonomic order of the genus animal.

This use of division that seeks the kinds and differentia that mark off the atomic species in the right order and includes all of the kinds found in the essences of atomic species implies that the kinds are exclusive of each other, since no atomic species falls under more than one kind at any level of generality. It is also exhaustive, since this follows from the third rule stated at 97a24–26, and unique, which is implied by the exhaustive and exclusive criteria. Finally, it only includes those kinds that are named in the *what is* of a thing.

¹³ I should note that Charles disagrees with this claim insofar as it seems as if some demonstrative problems do not seem to imply that the predicate and subject are coextensive. Charles 1990: 150. This may hold for those things or events where an efficient cause serves as the middle term, such as thunder or stars twinkling, but this practice of finding co-extensive terms seems to be the norm in the zoology.

How that is possible remains to be determined below. But when we normally think of a taxonomy of kinds, we assume that each division marks off kinds at the same level of generality. This is also implied by Aristotle's use of division. I already suggested above that this may not occur, but there may be grounds to argue that this still holds. Aristotle is seeking the kinds found in the essences of atomic species and the number of kinds expressed in each essence could differ for different atomic species, e.g., eagle has at least one more kind in its essence than human being. Eagle does fall under a wider kind, namely, bird, whereas human being does not fall under a wider kind at that level of generality. The facts of the matter should decide the issue rather than any a priori assumptions about the symmetry of number of kinds in every essence of an animal, which I take to be Aristotle's view.

On the other hand, if say bird and fish are divided off at the same level of generality as the atomic species human being or ostrich, we should still hesitate to call this division marking off kinds at the same level of generality. Bird and fish are kinds that include many atomic species, and possibly other sub-kinds between them and the atomic species, whereas human being and ostrich just are atomic species. There is a way that Aristotle can answer that these kinds are marked off at the same level of generality. Aristotle raises an aporia about how to seek the definitions of atomic species in *Parts of Animals* I.1, whether one should start from what is held in common by say a kind or from the atomic species, defining them independently (639a15–b5). Aristotle answers it in *PA* I.4 by claiming that for those atomic species that do belong to a kind with a common nature and forms not too far apart we should seek the nature of the kind first, whereas those atomic species that do not fall under such kinds, we can seek the definition of each of these independently (644b1–7). One way to read this solution is that those atomic species that do not fall under such kinds are at the same level of generality as those kinds with a common nature and atomic species not too far apart. Not only does it take the same number of divisions to reach those atomic species as it would to reach these kinds, such as bird and fish, but also the kinds marked off play the same role in explanation, i.e., the lowest level of generality that is explanatory for the peculiar kind of features that an atomic species has. Birds have features in common as birds, which can be further divided, but the kind of feature remains the same across birds. But the kind of features human beings has, which is peculiar to them, admits of no further essential differentiation. So, "level of generality" need not always imply extent but can also refer to the appropriate level of explanation, and this just is the issue in *APo.* II.14. Further, whether bird and fish admit to many more divisions or are just simply divided into atomic species need not matter for Aristotle or for the coherency of his taxonomy. The only thing that does matter is that

the atomic species only fall under one set of exclusive and exhaustive kinds regardless of the number of divisions it takes to reach those atomic species. As long as there is only one set of such kinds for each atomic species, this would satisfy what Gotthelf means by taxonomy.

But how is it possible to allow there to be natural kinds not found on the hierarchy? Although a defense of this view requires a separate paper, I can say a few remarks to show my view is not implausible. Not all of Aristotle's classifications divide down to the atomic species. Neither the classification by mode of generation nor the one by way of life (*βίος*) ends with the atomic species but rather with kinds that include various atomic species. If Aristotle's aim of division is to divide down to the atomic species, to find the differentia or differentiae by which they are this atomic species rather than another, then some classifications Aristotle uses in his biological treatises cannot satisfy those demands.¹⁴ It would also follow that atomic species that are different from each other would be the same in essence if there are no further divisions that reach down to the atomic species. The status of such divisions or the classifications implied by them I leave to another discussion, but they cannot be the kinds that divide nature at the joints.

What needs to be the case is that Aristotle has some way to establish kinds that are in the essences and rule out other kinds as not being in the essences of atomic species. But there is a debate about how Aristotle establishes any kinds in his biological treatises. The two dominant answers to this question are by Charles and Lennox. Charles argues that Aristotle establishes the existence of a natural kind, at least in the zoology, by means of division paired with robust, a priori assumptions about biological kinds. Lennox argues that Aristotle establishes the existence of a natural kind empirically by means of division and counter-predication. Both options have their strengths and weaknesses in my opinion, so I develop a third option, in part, by appealing to their strengths while trying to avoid their weaknesses. Against Lennox and agreeing with Charles, I find counter-predication by itself too weak to establish the existence of kinds. Against Charles and agreeing with Lennox, I see no evidence supporting the use of robust, a priori assumptions guiding the inquiry of natural kinds in Aristotle's zoology. I propose a third alternative below in the second section. But since I am concerned with what kinds are found in the essences of atomic species, I need to propose some way that Aristotle can distinguish these kinds from those not found in the essences. I hold that Aristotle's unity assumption is sufficient to rule out those kinds not found in the essences. I clarify how I inter-

¹⁴ That this is Aristotle's conception and use of division is implied by many of the comments in *APo.* II.13, especially between 96a20–96b25.

pret Aristotle's unity assumption below, and how it functions negatively in ruling out those kinds not found in the essence as well as one way the kinds can be conceived as a unity in the formula of the essence.

What I call the unity assumption pertains to the formulation of definitions: the definition must be one in some way. Aristotle expresses some unity requirement of definitions in almost every major text about division (e.g., *APo.* II.6 92a30–32, II.13 96b30–35, *Metaphysics* Z.12 1037b25–28, *PA* I.3 643a2–3, 643a12, 643a16, and 643b7). I understand Aristotle to ground this unity requirement on an ontological assumption. Aristotle assumes that a definition is a formula of the essence (*Metaphysics* Z.5 1031a12, cf. H.1 1042a17). The essence of a thing is one (*Topics* VI.4 141a26–b2). So, on Aristotle's view, the definition must also be one in some way if it expresses the essence (*Metaphysics* Z.12 1037b24–27). The problem is what restrictions are required of this assumption. There seem to be two distinct unities required of the definition of an atomic species of a genus, in part, because Aristotle admits that such species are defined by many lines of differentiation. One form of unity is horizontal unity, i.e., the kind of unity that the many differentiae of the definition are one in some way. Another form of unity is vertical unity, i.e., any line of differentiation is itself a unity, so all levels of division are one or implied by the final differentia of that line. Aristotle does not clearly discuss the former type of unity in any text, but there are passages can be used to reconstruct Aristotle's view.¹⁵ I do not discuss horizontal unity in the paper because it is not needed for my argument. I am solely concerned with how his method will establish the kinds on the taxonomic hierarchy and not the differentiae of these kinds expressed in the definition.¹⁶ But I do show below that my understanding of the unity assumption is not inconsistent with Aristotle's reform of division found in *PA* I.2–3.

What is pertinent to my argument is vertical unity and, in particular, the kinds that are expressed in the essence. If there are multiple levels of kinds found in the essences of atomic species, then, given how I understand the unity assumption, these kinds must be one in the definition of the atomic species. I take this view to be implied by the comments Aristotle makes about division in the *Posterior Analytics*. He makes at least two distinct claims about unity of the definition in this text. At *APo.* II.13 96b32–35, he makes the following claim:

¹⁵ The most commonly cited passage that implies horizontal unity is *Metaphysics* H.6. The origin of this view seems to be both Balme's reading of this passage and Furth's reading of H.2. Balme 1987b: 304; Furth 1987: 249–64. For an alternate reading of H.6, see Halper 1984.

¹⁶ My view of horizontal unity is distinct from various answers found in the literature, so it would need to be developed separately. For the various solutions argued in the literature that address horizontal unity, see: Balme 1987b, Furth 1987, Charles 2000, and Deslauriers 2007.

For if every item is made up from two things, and if *animal tame* constitutes a single item, and if man (or whatever the single thing in question may be) is next made up from this and the difference, then you must make a division before making your postulates.¹⁷

Aristotle states that “animal tame” constitutes one single thing. Animal is clearly the genus here, and tame functions as a differentia. But a differentia always marks off a form (εἶδος) under a genus. If that form is further divisible, it also serves as a genus for that division.¹⁸ So, if one needs multiple cuts to reach the final differentia or set of differentiae that define that atomic species, then Aristotle implies in this passage that every genus which is divided serves as one thing. The proper unity seems to be one in formula.¹⁹ I take this to be one restriction which the unity assumption places on the formulation of definitions. Now, we might say that the definition now appears to be two: the genus plus the differentia, but Aristotle is clear that these must also be one (92a28–32). The final differentia must also be one in some way with the genus for the definition to be one in formula. The view is also asserted in *Metaphysics* Z.12.

Another way that Aristotle addresses unity of multiple levels of divisions or kinds is also found in *Metaphysics* Z.12. To resolve the problem, Aristotle proposes that the divider always take the difference of a difference, e.g., one should divide footed by differences relevant to feet such as two-footed or four-footed. This view is also expressed in *PA* I.2. Since this view concerns how to divide differentia and I am concerned with how Aristotle seeks out the kinds found in the essences, it will play no role in my argument. There is also the issue whether Aristotle conceives of this kind of division starting from the first division that divides the genus animal all the way to the atomic species or does it begin at a lower level, say the great genera. So, the unity of the various kinds found in the essences are either one because each differentia of a lower kind implies the higher kind, if Aristotle always divides by the difference of a difference, or he just takes the nested kinds to have the appropriate intensional unity, e.g., all birds are also blooded animals.²⁰ I remain agnostic on this issue in this paper.

¹⁷ Translation by Barnes, Barnes 1993: 65. All translations of *Posterior Analytics* is by Barnes.

¹⁸ This view was established decisively by Pellegrin. Pellegrin 1986.

¹⁹ Aristotle characterizes one in formula as that which the thinking is indivisible (Δ.6 1016b1). This passage seems to suggest that this only applies to that which has an essence, but we should note that an essence can belong to any genus as well. Although a genus is divisible, even in thought the thinking of a genus as that genus would still be indivisible. In other words, what it is to be an animal or even a bird is indivisible in thought for Aristotle in respect to that genus being thought.

²⁰ This is only to be an example, for what would account for this unity would have to be more than just that single relation.

For what I develop in this paper, I take the unity assumption primarily to rule out kinds as being in the formula of an essence. To clarify this, it may be best to proceed by example. Say Aristotle is defining an atomic species of animal, say, a mallard duck. Aristotle would locate mallard duck in the genus bird as well as a kind of animal. Now, we already have at least one kind between the genus animal and the atomic species, namely, bird. This already implies that “animal bird” form a single unit if we must divide from this unit to seek the proper differentia or differentiae of mallard duck. But we can also imagine that there are kinds between animal and bird. Let us say the differentiae water-dweller and land-dweller divide all animals. If the formula of bird is to be one, which must be the case if the formula of mallard duck is to be one, and the kind bird falls below this division, then bird as a kind must be one or the other, since a division is by means of opposites or exclusive options and no single thing is composed of exclusive differentiae. But if birds are determined to be land-dwellers, then either no mallard duck is a bird, which is false, or mallard duck has multiple, incompatible differentiae, and so kinds, in its formula. A mallard duck would have to be a land-dweller as a bird and a water-dweller as a particular kind of bird. But these kinds are mutually exclusive of each other.²¹ So, for a definition to be one, if there are multiple kinds expressed in the definition, the kinds must form a nested hierarchy and be exclusive of each other at every level. I take the unity assumption to require this of any definition of an atomic species.

I could be accused both of begging the question, since my conception of the unity assumption already implies a taxonomic hierarchy of kinds, and of using a loaded example. In respect to the first accusation, I would say that the two views are contingent on the same set of assumptions that Aristotle makes about the proper formulation of a definition, since they are concerned with the same thing: defining atomic species. It is less a matter of begging the question and more a matter of whether there are various levels of kinds in the definition of an atomic species and how they are one.²² This can be addressed by the other

²¹ These differentiae are said in several ways, which Aristotle clarifies in *HA* VIII.2, but the way in which duck would be both would not be salvaged by the distinction Aristotle makes about these differentiae.

²² I should note that Gotthelf does believe that there are various levels of generality that are stated to be in the definition but no lowest privileged level (Gotthelf 2012: 238–9). This is why I question him ignoring the fact that *HA* I.1 and *PA* I.1 and I.4 do seem to privilege a lowest level, the atomic species, although it is not stressed in the specific passages that Gotthelf cites. I suggest it is simply implied. Gotthelf, as well as Balme and Lennox, also does not read *APo.* II.14 as implying a taxonomic order of a genus.

criticism, so it merits close attention. The criticism here would be that Aristotle revises division to handle the very problem addressed in my example above, given that he raises this very problem in his rejection of dichotomous division (*PA* I.2 642b10–20). The standard view since Balme's interpretation is that the problem is solved by treating the differentia, land-dweller or water-dweller, as one line of division that picks out a feature of the kind bird and other lines of division pick out other features of the kind bird. Each line of division marks off a way to define atomic species of birds. The issue of higher or lower kinds between the genus animal and the atomic species is no longer an issue. But it is not clear to me that such a view, even if correct, resolves the issue at hand, namely, the relation of the kinds expressed in the essences of atomic species. First, Aristotle is clear that bird functions as a genus (642b10), and it is a genus of which its atomic species can be defined by many lines of differentiae (643b10–13). I take this to imply that bird is a certain kind of animal, and, given the unity assumption, bird must have a formula that is one in some way. Second, Aristotle also suggests that there are other kinds of animal at higher levels of generality than say bird or fish, such as blooded and bloodless (642b15) and the lunged-kind (669b10–13), all of which are said to be nameless. If these kinds are found in the definition of atomic species and exist at a higher level of generality than such kinds as bird and fish, the unity assumption requires that the formula of the lower kinds be one in some way with the formula of the higher kinds. Cross-division would be one sign of a formula of a lower kind failing to be one with a higher kind. Thus, the issue as I see it turns on whether such kinds are constituents of the formula of the essence of atomic species. Once again, the facts of the matter determine the issue. I discuss this in the third section. Finally, we can see that Aristotle can maintain a pretty strict unity assumption in seeking these kinds yet hold that at the lowest level of division, the definition of any atomic species of animals includes many lines of differentiation, one of which could be its particular way of life. These differentiae just would not pick out kinds in the essence, such as blooded or lunged or bird, but rather be equivalent to features of particular species of birds such as wing, feather, beak, etc., if these features are also found in the definition. What I must turn to now is the method by which Aristotle can seek out these kinds prior to knowing the essences of these kinds. This would just be the method by which Aristotle divides nature by the joints.

II

Dividing Nature by the Joints. There is evidence that Aristotle is committed to seeking the taxonomic order of a genus at least in the *Posterior Analytics*. This order is of those kinds expressed in the *what is* of the atomic species of a given genus. Aristotle informs us that division is helpful in hunting down these terms. But we should be very troubled by this claim. In both *APr.* I.31 and *APo.* II.5, Aristotle argues that division cannot prove that the terms it marks off are in the *what is* of a thing. Both chapters point to the fact that division simply asks for what it ought to be proving (46a33–4,91b15–6). What I argue in this section is that Aristotle did not conceive of division by itself to find the kinds and differentiae expressed in the *what is*. I appeal to *Prior Analytics* I.27–31 to provide some clues how it is possible for Aristotle to avoid the problem he raises about division. I start with what Plato and Aristotle hold in common about division. I then present the method by which Aristotle can divide nature by the joints, a method that can be constructed from the two methods he discusses in *APr.* I.27–31.

Aristotle holds several views about division in common with Plato. Both thinkers accept that division is useful in finding definitions.²³ Both accept that proper division is achieved only by dividing nature by the joints.²⁴ Such a claim also implies that one can divide unsuccessfully when one does not divide nature by the joints. Finally, since the divisions are supposed to be exhaustive and exclusive, both divide by means of opposites.²⁵ Putting this altogether, if Plato

²³ Plato states this directly in the *Phaedrus* (265d) and is implied by its use seeking definitions in the *Sophist* and the *Statesman*. Aristotle says that division is useful for hunting out the terms predicated in the *what is* (*APo.* II.13 96a24). He also argues that the final differentia just is the definition of a thing in *Metaphysics* Z.12 (1038a19–20)

²⁴ Plato says this explicitly (*Phaedrus* 265d–e). We have already seen how this is implied by Aristotle's conception of solving demonstrative problems, but this is also implied by Aristotle's conception of proper differentiation, already discussed, and his rule provided in *Parts of Animals* that one should never divide by the *per se* attributes but only those features in the *ousia* of a thing (I.3 643a27–31).

²⁵ Plato makes this clear by the actual divisions made by the Stranger in both the *Sophist* and the *Statesman*, but this could also be one of the primary meanings of the Stranger's claim that one must divide down the middle (*Statesman* 262b–e). Aristotle states this explicitly at *PA* I.3 (643a31–34), and it is implied by his comments in *APo.* II.13 (97a14–23). One might object that Aristotle does not divide animals by opposites, especially to reach the level of the great kinds, since there are many of them at that level. Although I acknowledge this is a real problem for my view, it does not damage my argument here. I am only concerned with how he establishes the kinds of the taxonomy and the various levels, not how he determines which differentiae actually do divide these kinds off. Since Aristotle rejects dichotomous division, he has more

and Aristotle are seeking definitions by means of division, they are seeking those kinds that necessarily hold of the atomic species. Since both divide by opposites yet division by itself does not determine which kinds and differentiae are necessarily in these definitions, Aristotle can appeal to other views he holds about division and the syllogistic to enable him to make progress determining which set of kinds and differentiae divide nature at the joints.

We can also state one more view that is common to both thinkers. Division is useful in solving problems. A problem can be raised both for a term expressed in the *what is* of a thing, i.e., in its definition, and for a term that expresses the sort of thing it is, a *per se* attribute or property in Aristotle's language. If we return to Aristotle's criticism of Platonic division, it is this question that division by itself cannot answer. But Aristotle states that division is only a small part of this method (*APr.* I.31 46a31). On the other hand, Aristotle states in the *Topics*, already quoted, that "[p]roblems are about which there are syllogisms" (I.4 101b17). Aristotle can use division to raise a problem about what features are in an essence and then appeal to the syllogistic to rule out that certain features are not in it or provide initial support that other features are in it, since a syllogism can be used to show what necessarily belongs or does not belong to a thing. This method does have a certain limitation: it cannot distinguish between a feature in the essence and a feature that just is a property. Both features would hold necessarily of that kind. But what I argue below is that the methodology developed in *APr.* I.27–30 can overcome the limitation so that Aristotle can at least determine what kinds are features in the essences. I present the method of *APr.* I.27–30 briefly below.

Aristotle announces that the methodology presented in *APr.* I.27–30 concerns "how we ourselves will be well supplied with syllogisms on any given subject and by what method we will find the starting-points about each thing" (43a20–2).²⁶ The method determines when syllogisms can be supplied for a given subject-predicate judgment, or, in Aristotle's terms, a given problem or thesis. The subject-predicate judgment is broken down into its two terms, the subject and the predicate, and, for each term, one seeks both what follows that term and what is followed by that term. In other words, the inquirer seeks what can be predicated of each term universally and what it is predicated of univer-

resources to solve this problem than Plato. I need not present these resources. The method I do present shows how he can avoid this issue at least at this stage of the inquiry: Aristotle can look for differences between kinds of predicates that these kinds of animals have. For a good discussion on how Aristotle can accept that there is more than one opposite in a given division, see Pellegrin 1986: 60–66.

²⁶ Translation by Striker 2009. All translations of *Prior Analytics* by Striker.

sally. Using these predications and a set of rules derived from the syllogistic, the inquirer can determine whether the predicate can be shown to belong to the whole of the subject or not. In the language Aristotle uses in the *Posterior Analytics*, the method will determine whether there is a middle for these two terms or not. On this understanding, the methodology plays an integral role in Aristotle's conception of scientific inquiry. We can now understand why Aristotle concludes in *APr.* I.30 that this method is the same for all sciences (46a3–4). What, then, is the role for division in this methodology?

Lennox's view on this matter is worth noting.²⁷ What is marked off by division is a potentially exhaustive source of predicates. This source of predicates can be used to seek whether a given subject-predicate judgment has a middle or not. This is the case if there is an identical item in the list that exhausts all the subjects to which the given predicate belongs universally and the list that provides all the predicates that belong to the given subject universally. But division can also be useful in seeking out those terms that are predicated of some subject universally, both in a negative and positive manner. The terms that fall below a division will not be predicated universally of that genus, i.e., the subject, but the genus will be predicated universally of the species that fall under it. Although significant for Aristotle's method and integral to my argument, the issue that is more important now is whether and how Aristotle can divide nature by its joints. I suggest that, by reversing the question I just addressed above, what role does division play in the methodology, we can address the logic and method of how Aristotle accomplishes this. This new question can be formulated as follows: what role does the methodology play in dividing nature by its joints? Or, how can Aristotle divide nature by the joints if division is not proof yet it must find terms expressed in the *what is* of a thing?

I argue that Aristotle can divide nature by its joints by employing three steps, each of which is either grounded in the syllogistic or some aspect of the methodology given in *APr.* I.27–30. I present each step schematically first and then provide a more substantial account below. To support my view, I show that by adhering to the methodology presented below Aristotle can adhere to the three rules he posited in *APo.* II.13 to establish definitions by means of division. The first step is negative, ruling out sets of division by showing that the differentiae split up known natural kinds. This step is necessary because any genus admits of various sets of divisions, none of which can be ensured by the method of division alone to pick out the right kinds. There will also be an additional assumption beyond those stated in the methodology but already made

²⁷ Lennox 2001b: 14.

clear in my discussion of Aristotle's positive views of division. Aristotle assumes the unity of the definition of an atomic species. Differentiae that cross-divides a known essential kind do not pick out the set of kinds that are found in the essences of atomic species.

The second step of the method will apply the methodology of *APr.* I.27–30 directly to the genus itself. The inquirer will seek out those terms that are predicated of the genus universally, but she will also seek out among those predicates the ones which admit of a difference in respect to the predicate, as long as they have not been ruled out during the first step. These differences have the potential to be or lead the inquirer to essential kinds of the genus. The third step of the method will then take these kinds that have been marked off and apply the methodology to these terms, seeking whether there are predicates that belong to the kind universally, which is identical to seeking whether there is a middle for various predicates in respect to the subject. This task is also the same as seeking out counter-predicates of a kind. But since steps two and three can be repeated in respect to a lower level of generality, the inquirer can reiterate these steps until she has found all of the kinds between the original genus and the atomic species. All that is needed to seek out these essential kinds is division, the syllogistic, and the unity assumption. We should recognize that we have returned to the Lennox-Charles debate about how Aristotle establishes the existence of kinds. I supply below the elements that I take to be lacking in Lennox's position, i.e., what is needed beyond division and counter-predication. It is not robust, a priori assumptions about what content is constitutive of a definition of a kind but the syllogistic and the unity assumption. I reserve my main criticisms of Charles' position for the next section.

The inquirer always begins with a genus taken by supposition. She must also have marked off some of the atomic species of the genus. We will soon see that it is advantageous to have some kinds marked off between the atomic species and the genus taken by supposition as well. Once these three steps are accomplished, the inquirer can seek out various ways to divide the genus using these atomic species to group together various differentiae to mark off kinds under the genus. One method of grouping kinds would be to seek counter-predicates at various levels of generality. For example, the inquirer will notice that certain species of animals are water-dwellers while others are land-dwellers (cf. *HA* I.1 487a15–b6). Another inquiry might lead her to recognize that some animals are footed and others are winged, and each of these admits to differences as well. For example, winged animals can be divided into those that have feathered wings from those that have membranous or dermatous wings (cf. *HA* I.5 490a5–8). Once we have a variety of sets of these divisions, the first step is to eliminate those divisions that do not divide the genus by its natural joints. If

the inquirer assumes the unity of the definition of an atomic species, it follows that no species itself can have conflicting differentiae in its definition, i.e., differentiae found on opposing sides of a given division. For example, no number could be both odd and even or prime and compound. But it also follows that, if there is a generic nature that is a part of the essence of the atomic species, e.g., the nature of bird or fish, this nature must also be a unity and cannot end up on both sides of a division.

Given the unity assumption, we can appeal to the logic of the syllogism. It enables us to rule out certain divisions as being predicated in the *what is* of an atomic species of a genus. Since each division is made according to opposites or at least exclusive options, and the one inquiring does not yet know if the division picks out differentiae in the *what is* of atomic species, the division itself can be expressed as a problem: does this differentia belong in the *what is* of this atomic species or not? Answering a problem, or reasoning about it, is by means of a syllogism. Aristotle can also show, by means of the syllogistic, whether a problem is easy or difficult to solve. His discussion of this issue will help us understand how the syllogistic can be employed to eliminate or confirm a joint in nature:

Since we have seen what syllogisms are about, which kind of problem can be proved in each figure and in how many ways, it is also evident to us which kind is difficult and which is easy to handle, for what can be a conclusion in several figures and through several modes is easier, while what can be proved in fewer figures and fewer modes is more difficult to handle (*APr.* I.26 42b27–32).²⁸

From this passage we can see that establishing a joint in nature is the hardest kind of problem, for solving such a problem minimally entails showing that one of the differentiae belongs to every member of that kind, be it an atomic species or a genus. The conclusion would be a universal, affirmative statement, which can only be proved in the first figure and in one way, by means of Barbara. We can also see that even if one produces such a syllogism, it is not sufficient. The same kind of syllogism will show that a property or *per se* attribute holds of the same subject, and these features are not found in the *what is* of a thing.

The passage above also explains why excluding a set of differentiae as picking out a joint in the nature of the genus is easier. To show that a set of differentiae is not a joint, one simply needs to refute a universal, affirmative state-

²⁸ I have emended Striker's translation of "πρόβλημα" as "thesis" to "problem". Although a problem can also serve as a thesis, it is important to distinguish the two on epistemic grounds. When we state a problem and ask for its resolution, we do not yet know which thesis is correct, although we could assume either one and seek what syllogism will show that it is the case.

ment, which would have the logical form P does not belong to some S. Here, one needs to show that one of the differentia either does not belong to some members of the same species or does not belong to some of the species with the same generic nature, e.g., that a differentia does not belong to some of the species of birds. Such a conclusion is found in all three figures and through several modes in the second and third figure.²⁹ It should now be clear why establishing the existence of some atomic species as well as higher kinds is a necessary step before one can determine the natural joints of a genus.³⁰

If the above argument holds that there will be some counter-predicates for each of the terms of any set of divisions, then Lennox's view of Aristotle's methodology cannot hold up. There must be more to Aristotle's method of seeking the kinds expressed in the essences than division and counter-predication.³¹ My analysis thus far shows that the syllogistic is at least one missing element. The unity assumption is another missing element. Does Aristotle need anything more than the syllogistic and the method derived to divide nature by the joints?

Although this first step is a major advance over the Platonic use of division, we must ask whether the logic of the syllogism can be useful for discovering which joints actually do divide a given genus. To answer this I return to the methodology presented in *APr.* I.27–30 and ask if Aristotle, by employing it,

29 The conclusion, P does not belong to some S, can be proved in the first figure by means of *Ferio*, in the second figure by means of *Festino* and *Baroco*, and in the third figure by means of *Felapton*, *Bocardo*, and *Ferison*.

30 Just how many of each would need to establish is unclear, but, since the question is really an empirical one, there may be no way to determine that a certain amount will lead one to divide nature by the joints correctly. Also, discovery of new species and new kinds of species could upset the set of divisions believed to divide nature by its joints at that time. Aristotle seems aware of this possibility. He states that, if none of the facts are left out, demonstrations become clear by means of the methodology proposed (*APr.* I.30, 46a24–27). Aristotle does exactly these two things in the very first chapter of *HA*. He has already picked out some atomic species and bird and fish as kinds having generic natures (486a21–25).

31 Lennox could respond that Aristotle seeks more kinds than just those predicated in the essence or that there is a plurality of kinds predicated in the essences that are not nested or arranged hierarchically but rather each constitutes its own line of division. Aristotle might hold such a view in his biological works but whether he could maintain that view and the view expressed in *APo.* II.14, to which Lennox also appeals, does not seem plausible to me. First, there is no mention of multiple kinds belonging to a single species or form that exist at the same level of generality. Second, although there are ways to conceive of dividing by multiple lines of differentiation simultaneously as consistent with *APo.* II.14, e.g., if the multiple lines belong to one genus (as *PA* I.3 implies), the other kinds discussed in *HA*, such as oviparous or water-dweller, must be predicated of the kinds that admit of multiple lines of differentiation. Otherwise, how would one determine whether the kind oviparous animal is considered to be above or below or at the same level of generality as the kind bird?

can fulfill the three rules laid down by Aristotle in *APo.* II.13. I begin from a passage in *APr.* I.27 (43b1–5) cited in the previous section. The methodology can seek out premises for a conclusion by listing out both what the subject and the predicate follows and what follows each. Nothing prevents the one inquiring to list out such predications in respect to the genus term and the predicates that belong to it, as long as the genus can serve both as a subject and predicate to other kinds. By seeking out what terms follow all animals as well as seeking out the differences inherent in these terms, the one inquiring will have the ability to group together the common predicates as well as note certain differences that belong to these common predicates. We can pair this part of the method with the positive side of the unity assumption. The first division of the genus should group together all known atomic species on a side of what has been divided off, and no atomic species or generic nature should admit of cross-division (97a1–2). If the inquirer finds such a division by following this method, then the inquirer adheres to a key rule given in *APo.* II.13: the inquirer is seeking the terms predicated in the *what is* of an atomic species. But what of the other two rules stated in *APo.* II.13?

We can see that this step can be reiterated on the kinds and/or differentiae marked off at any stage. By reiterating this step on kinds divided off, Aristotle can satisfy the second rule: ensure that divisions proceed in order. Before showing how Aristotle satisfies the third rule, I must first address a problem. Division merely produces a list of terms that admit to certain relations: the terms that divide the genus or differentiae below the genus cannot be predicated of the higher terms, but the higher terms can be predicated of the species of the lower terms and the higher differentiae of the lower ones. This would apply both to the subject, the differentia, and to the properties of that subject. A third step is needed to distinguish these items.

The third and final step will return us to our starting point of the paper that division is useful in solving scientific problems. Divisions must be along the joints if they are to be helpful in showing the level of generality at which a predicate is explained. We can turn to another of Lennox's insight. Although counter-predication is not sufficient to find the joint, since we saw it could pick out other kinds as well, it could confirm that these divisions pick out kinds that serve as loci of explanations. This step also doubles as a way to discover *hoti*-predications or the about which of demonstrations. A kind has an essential nature, so terms that counter-predicate with the kind will also have a middle term. Although the problem still remains whether these divisions mark off kinds in the essences of the atomic species, application of this part of the method is sufficient to move forward. Once counter-predicates are found, the inquirer can then seek the middle term. It is not a problem for Aristotle that we lack full

assurance that the correct kinds expressed in the essences have been found until we have a complete explanation for the predicates belonging to that kind. Division is part of inquiry and is fallible. On the other hand, combined with the first two steps that both rule out divisions and expose divisions that do not break up kinds, this third part of the method puts one in the position to advance the inquiry: either we arrive at a complete explanation of the known facts or we fail and realize that we must continue searching for the correct groupings of facts. We should not expect a *historia* to accomplish any more than the grouping of predicates according to empirically discovered kinds.

This step also employs the methodology of *APr.* I.27–30. Given that the first division (and any subsequent division performed) does not cross-divide known kinds, the inquirer can use this division and the kinds marked off thereby to seek whether there is a middle for the subject in respect to various predicates. The method will determine that there is a middle if counter-predicates are found at that level of generality. A cluster of terms counter-predicating with a joint will be a sign that a kind has been properly picked out and an explanation at that level of generality exists for these terms belonging to the kind. It also presupposes that these predicates, those which are shown to counter-predicate with the kind marked off, do belong to the atomic species that fall under this kind. What is not yet known is which of the terms that counter-predicate with the subject is the term or terms expressed in the *what is* of the atomic species, i.e., the differentia or differentiae that defines that kind. But this should not bother us. The inquiry or *historia* only takes us as far as establishing that there is a middle. Once that is determined, Aristotle can move from the “that” question to the “why” and “what is it” question. All that is left is to find the middle term that is explanatory of the predicates that do belong universally. Since this is also by means of a syllogism, the syllogistic underlies the entire method from ruling out differentiae to finding those differentiae that do divide nature by its joints.

From this analysis of the method we can raise a few problems with Charles’ conception of employing a priori assumptions to find the kinds and also answer how Aristotle satisfies the third rule of *APo.* II.13. Charles is motivated by the fact that the kinds established in what he calls the second stage of inquiry always or most often match those kinds with essences discovered in the third stage.³² His view is that the two stages of inquiry would not match well if the

³² The second stage of inquiry is recognizing that the thing signified by a name or name-like expression exists, or establishing the existence of a kind, and the third stage of the inquiry is determining the essence of the thing which a name or name-like expression signifies. Charles 2000: 23–5.

inquiry were merely empirical. But we can see that Aristotle has enough resources to rule out sets of divisions, which enables him to avoid this problem. Further, Aristotle relies on more than just division and counter-predication, so it is distinct from Lennox's view. My view, then, deflates Charles' motivation for holding the position he does. But there is a deeper problem in that Aristotle announces this concerning the methodology he has just developed:

However, most of the starting-points are peculiar to each science. This is why experience (ἐμπειρία) must provide us with the starting-points about each subject – I mean, for instance, experience in astronomy must provide the starting-points for astronomical science. For when the phenomena had been sufficiently grasped, the demonstrations in astronomy were found in this way. And the situation is the same in every other craft or science; so once it has been grasped what belongs to each thing, at that point we should be prepared to point out the demonstrations. For if nothing that truly belongs to the things has been left out in the collection of observations (ιστορίαν), we will be in a position to find the demonstration and demonstrate anything that admits of demonstration, and where there cannot be a demonstration, to make this evident (*APr.* I.30 46a17–27).

The emphasis in the passage is collecting the relevant facts, the predicates that truly belong to the subject, by means of experience (ἐμπειρία). This passage speaks against Charles' view. But he can present a reasonable response: Aristotle could not accomplish finding the relevant starting-points for the science of zoology independent of employing certain a priori assumptions about natural kinds of this science. The only way to respond to this claim is to show that Aristotle accomplishes seeking out the relevant natural kinds in *History of Animals* without such assumptions. I turn to this task in the next section of the paper. For now, I finish my discussion of the method by showing how my interpretation of it can be aligned with the above passage.

The emphasis of the passage above, on my view, is that of seeking the starting-points (ἀρχαί) of a science. Experience is necessary for such a task because the starting-points of each science are peculiar to that science. For example, one of the starting-points of the science of animals is that which will prove what *per se* attributes belong to every animal. But we can also study more specific kinds of animals, such as bird or fish, each of which has its own distinct nature, so the starting-point for each of these sciences will be the nature that proves the *per se* attributes that belong to each of these kinds respectively. How do we find such starting-points? First, we need to grasp what are the kinds that belong to the genus, which would need to be hierarchically arranged to determine the level of generality of any explanation of predicates of that genus. This is accomplished by the method presented above, but the last step of the method will help clarify how all of this leads to demonstrations. The last step seeks out the counter-predicates of the kind marked off. These counter-predicates will also be

the *per se* attributes of the kind, save the possibility that one of the terms could be the explanatory middle term. But these *per se* attributes will be those empirically sought in the inquiry. The *historia* will organize them along explanatory lines.³³ The methodology I just presented shows how. The above passage informs us when it is possible for us to move from the *historia* to the explanatory phase of the inquiry. This occurs when we have grasped all the predicates that belong to this kind. This answer also informs us how the methodology could satisfy the third rule: he can ensure that these are all the kinds there are because all the facts are explained at one level of generality or another. But if Aristotle seeks both the kinds of the genus animal and the predicates that belong to these kinds empirically in his *History of Animals*, then Charles' view is neither necessary for Aristotelian inquiry that seeks explanations nor consistent with the texts.

III

Dividing the Genus Animal by its Joints: History of Animals. I have presented a method by which Aristotle can divide nature by the joints prior to grasping the essences of these kinds. This method proceeds in three steps: eliminating those sets of division not predicated in the *what is* of atomic species of the genus, taking the genus and seeking what follows it as well as the differences that belong to these predicates that follow it, and finally seeking out the counter-predicates of the subjects marked off by the differences in the second step. This method enables Aristotle to mark off a hierarchy of kinds in order to find the right level of generality to explain a predicate. The question is whether Aristotle employs this methodology in *History of Animals*. If so, we have no good reason to accept Charles' view of Aristotle's conception of inquiry. He believes that such a background theory, a priori relative to the inquiry, is necessary to ensure that the kinds established prior to finding causal explanations are precisely those kinds that have essences that are explanatory of other features. On my view, a background assumption is necessary, the unity assumption, but it is not content specific to the kind being studied. It applies to any kind of any genus. Further, the assumption in respect to the methodology is a regulative principle. But one way to determine who has the stronger view is a close look at the text

³³ This view does not differ from Balme, Lennox, or Gotthelf with the exception that I also hold that Aristotle needs to seek out a systematic classification of the genus to accomplish this task sufficiently.

to see if the background assumptions that Charles' claims to be necessary are present as Aristotle divides the genus animal into its hierarchically arranged kinds.

If my view is correct, Aristotle should begin from those differentiae that are ruled out as essential. This is precisely what he does in the first chapter, or so I argue. But before he turns to excluding sets of differentiae, Aristotle clarifies key terms that will be useful both in picking out relevant sets of differentiae and the means to exclude them or to determine them as possible joints of nature. The first set of terms includes “part”, “genus”, and “species”. Aristotle claims that there are two kinds of parts that animals have, uniform (e.g., blood, bone, flesh, etc.) and non-uniform parts (hand, foot, head, etc.), and how these parts can be useful in finding natural kinds, both species and genera. A species is that which have all their parts same in form (486a14–6).³⁴ A genus is that which has parts the same generically but differ by the more and less among its species. Aristotle also admits that parts can differ by analogy, only giving examples, such as bone and fishspine, nail and hoof, hand and claw, etc., to clarify his meaning. These analogies need not be grounded on the functional nature of the part, but there is also no reason to exclude functional analogies either. We can see here that there is no mention of soul functions to group together kinds.³⁵ The nature of any part is sufficient on its own, or at least Aristotle does not suggest that there needs to be further assumptions to group the kinds of animals. We can also add that Aristotle has already marked off atomic species and higher kinds, such as bird and fish, by means of these assumptions (486a24–5) and probably by the aid of popular usage.³⁶

³⁴ The fact that Aristotle stresses that “all the parts are the same” is a sign that he is speaking of atomic species here. Such a view does not rule out using the same term to mark off kinds that fall under a genus that are not atomic species, but the stress at the beginning of *HA* seems to be on atomic species and a particular kind of genus of these species—the kind that only has species differing by the more and less. On a different note, from the standpoint of the method, one might object that this already prioritizes the nature of the parts as the most essential aspect of an animal, and Aristotle need not consider dividing by means of mode of life or activities or habits. But this need not be the case. It could be that the parts are still defined in terms of one of these. Aristotle claims that this is the case at *PA* I.5 645b15–27: parts are grouped and defined according to activities.

³⁵ Charles also recognizes that this is the case and has a response. He does not take animals to be differentiated by having the capacity to perceive but rather how they perceive. Charles 2000: 317, n. 12.

³⁶ Lennox, Gotthelf, and Charles hold that Aristotle accepts divisions of kinds made by popular usage if they are marked off correctly, as he states at *PA* I.4 (644b1–7). Gotthelf 2012: 276–7. I do not doubt that this is Aristotle's view, but I question how heavily he depends on it in this first part of *HA*. It is not that he ignores it, and may often presuppose it, for they may

Aristotle turns to another set of distinctions, those pertaining to the kinds of differentiae relevant to the genus animal, before ruling out various differentiae. He picks out four kinds of differentiae pertinent to the inquiry of *HA*: ways of life, activities, characters, and parts (487a11–12). Each kind of differentia is explored in *HA*, but this does not imply that each kind of differentiae divides the genus animal by its joints. Aristotle also initially explores each kind of differentia in this introductory section, but he may just be as interested in showing which kinds of differentiae are ruled out as well as those that are relevant in dividing the genus animal by its joints. He presents sets of differentiae that mark off kinds in respect to ways of life or activities or characters. Given the method I developed above, Aristotle rules out two kinds of differentiae in the first chapter, those concerning ways of life and those concerning characters.³⁷ If Aristotle gives an exhaustive list of the kinds of differentiae, this would leave dividing by means of activities or by parts to find the features and kinds essential to any species of animal. If the primary action of an animal is locomotion, then it is possible that this set of differentiae define the atomic species of animals.³⁸ How the differentiae that divide locomotive capacities relate to the differentiae in respect to parts I need not determine now. All I need to show is that Aristotle can mark off kinds as essential in *HA* prior to knowing their essences and do so by means of the method I developed above.

The first set of differentiae Aristotle considers is way of life, dividing animals into water-dwellers and land-dwellers. Each of these kinds admits of further division. Water-dwelling animals divide into those that live and feed in water and take it in and emit it, e.g., fish, and those that live and feed in water but take in and emit air, e.g., certain birds and footed animals such as the otter and the crocodile. But there is also a third division: those who live and feed in water but take in and emit neither air nor water, e.g., shellfish. Land-dwellers are divided in a similar manner: those that take in and emit air, e.g., human beings and those land-animals that have a lung, and those that do not, e.g., insects. Land-dwellers could also be divided into those that feed on land and

not differ fundamentally insofar as both rely on the similarities of external features. But the real issue is how does he arrive at the correctly marked off kinds, which he cannot solely rely on popular usage.

³⁷ Balme, Gotthelf, and Lennox would object insofar as “way of life” plays a vital role both in organizing the facts and in its explanatory role. For the most thorough defense of this view, see Lennox 2010: 329–55.

³⁸ Aristotle stresses that the whole body is for the sake of some complete activity (*PA* I.5 645b15–20). His language strongly suggests that there is one, primary activity (cf. Lennox 2001a: 176), supporting the unity assumption and suggesting parts that make possible that activity are definitional.

those that feed in water. Finally, there appears to be animals that are both land and water-dwellers insofar as they spend the first part of their life in water, then change shape and live on land, e.g., bloodworms (that change into gnats). What is the problem with this division? All birds have lungs, but not all birds are land-dwellers. Some are water-dwellers. The natural kind bird falls on both sides of the division but is assumed to have one common nature, i.e., they are the same in respect to their generic nature (486a21–3). This is sufficient to show that land-dweller and water-dweller do not divide the genus animal by its joints. Aristotle also appeals to this very same problem in his critique of dichotomy at *PA* I.2 64210–19.³⁹

Aristotle can use the syllogistic to rule out this set of differentiae as long as he assumes the unity of a natural kind. If either the atomic species or a genus with one common nature falls on both sides of a division, these differentiae do not divide nature by the joints. We can see that Aristotle has shown that some birds fall on one side of the division whereas other birds fall on the other side. We can put this syllogism in following form: M belongs to all N, M does not belong to some X, therefore, N does not belong to some X. This is a second figure syllogism named Baroco. Aristotle does not construct the syllogism in the text or present the result, but with little effort we can show that it can be done. The implied syllogism is as follows: living and feeding in water belongs to all water-dwellers, living and feeding in water does not belong to some birds, therefore, water-dwelling does not belong to some birds. But bird is assumed to be a natural kind that has one, common nature.

An objection to my reading of this passage is that I stretch the aim of the text too much. Aristotle states twice that the aim of these passages and exercises is to give us in outline (τύπω) what is to come (487a13, 491a7–8). But Aristotle does exclude these differentiae as those which pick out kinds predicated in the essences of animals and the method I have presented shows why that is so.⁴⁰ It is also the case that Aristotle presents other sets of differentiae in this first chapter that are ruled out by the same method, e.g., gregarious/solitary, nocturnal/diurnal, tame/wild, and numerous differentiae for characters. We can see that the differentiae, gregarious/solitary, split up both the genus

³⁹ We might hesitate to say that this passage in *PA* I.2 supports my reading. There Aristotle is arguing that dividing by two, or, as Balme has argued, dividing by one line of differentiae at a time, cannot avoid splitting up natural kinds. All I need is the fact that this division cannot constitute the initial division of all animals.

⁴⁰ A direct challenge to this view might be found in Lennox 2010. But if I understand his argument correctly, my view in regards to this matter and his view articulated in this paper are compatible. See p. 38 of this paper.

bird and the genus fish, since no crook-taloned bird is gregarious nor are all species of fish (487b34–488a7). Nocturnal/diurnal would at least divide up the kind bird, since the owl is nocturnal but other species are not. Tame/wild would divide the nature of an atomic species, since any kind of tame animal also exists as wild (488a30). All sets of differentiae presented cross-divide either an accepted genus or an atomic species. This pattern does not seem to be mere coincidence. Finally, although it is not clear what Aristotle means by “in an outline”, it is clear that the outline is supposed to group together animals, pick out relevant differentiae, and help grasp the facts (491a9–10). Aristotle does just that on my view. Charles also holds the view that Aristotle is attempting to pick out natural kinds in this first part of *HA*.⁴¹

Another objection is that I failed to consider two major sets of differentiae: mode of locomotion and mode of generation. Of the former, he first divides animals into those that are stationary and those that move about (487b6–7). All stationary animals are water-dwellers. Those animals that move about are divided into swimmers, walkers (or footed), and flyers (or winged). Each of these kinds is further divisible. The swimmers include fish, cephalopods, and crustacean. Winged animals include birds and bees. Aristotle has yet to show what is problematic about these sets of divisions, if there is any such problem, but Aristotle does hint that there is a problem with these divisions in this passage. Birds and bees are winged in different ways (ἄλλον τρόπον ἀλλήων) (487b19–20).⁴² These two kinds may not fly in the same way, so the winged kind may not cohere as a single, common kind.⁴³ The same can be said of the swimmers. Fish swim in a different way from the crustaceans. Aristotle has yet to make the distinctions to expose the problems with this division. Aristotle develops these distinctions in *HA* I.2–5. He does so by means of appealing to what belongs to all animals (*HA* I.2 488b29) and by the differentiae in respect to these common features. Similar problems can be raised against the differentiae of modes of generation, since they group animals that are too far apart in other features, e.g., oviparous animal contains at least birds, fishes, and cephalopods.

Aristotle proceeds differently in *HA* I.2, at least on my view. We can see how this shift is part of the method I developed above. Aristotle finds those terms that counter-predicate with the genus animal and whether he can locate a relevant difference with any of these terms that could divide the genus. He first

⁴¹ Charles 2000: 317.

⁴² The usage of “ἄλλον” suggests that the two kinds of wings are not grouped under the same genus, as its usage implies at *PA* I.3 643a2–3 of the two-footedness of birds and human beings.

⁴³ We should not infer from this that Aristotle has no scientific use for such a grouping.

discusses parts that pertain to nutrition and reproduction. He notes that all animals have a mouth, or that by which they take in food, and a stomach, or that into which they take the food. All animals also have a bowel and many have a bladder. He also observes that many animals have semen, using this term here to name both male and female contributions to generation. He labels these parts as the most necessary for an animal (489a15). But it does not appear that these parts will be useful in finding the first set of differentiae that divides the genus animal by its joints. Why? These parts belong to all animals as animals, and, when these parts do admit of differences, e.g., mouth, the various differentiae are relative to several different features of an animal. Aristotle makes this claim concerning the differentiae of mouth in *PA* III.1:

For nature, in virtue of itself, as we just said, puts the parts common to all animals to many distinctive uses; for example, in the case of the mouth nourishment is common to all, while strength is distinctive to some and speech to others, and again breathing is not common to all (662a18–22).

The differentiae of mouth will not be constitutive of the division that divides all animals into kinds because there is no unifying cause of these features at the same level of generality. On the other hand, recognizing that there are various parts in common to all animals ensures that we are dealing with a unified kind.

Aristotle then claims that all animals share only one sense faculty in common: touch. Aristotle marks off animals from plants in *De Anima* insofar as all animals have the capacity for perception (II.2 413b2, cf. 413b33–414a1). He then admits that this part does not have a name, but it is the same in some animals and analogous in other animals (489a17–9). This difference suggests a division of animals and one that pertains to the nature of all animals. To clarify this division, Aristotle next points out that all animals contain fluid, grouping and dividing animals according to the kind of fluid present in the animal, blood or what is analogous, and what serves as the receptacle of this fluid (489a20–3). Now, the faculty of touch comes to be present in a uniform part, the one that is called “flesh” in animals with blood. Flesh is supplied with blood (αίματικοίς), and the analogous part is supplied with the analogous fluid (489a23–6). Up to this point, Aristotle has yet to use the terms by which he marks off blooded animals (ἔναιμα) from bloodless ones (ἄναιμα). He has simply mentioned the relevant parts. But the fact that these distinct parts mark off one set of animals from another set and do so in respect to parts that essentially belong to all animals, the organ of touch, suggests a natural division of all animals. A sign of this is that, in the very next passage, Aristotle uses the terms blooded and bloodless animals to mark off animals that are footless, two-footed, or four-footed in a determinate way from those animals that have more than four feet

(489a30–4). We should only conclude that Aristotle has found a possible joint that divides all animals.

We can now answer why the original division of animals by means of locomotion was not successful, and why Aristotle can now produce one that could. In the initial division, Aristotle grouped together swimmers and flyers and walkers. But these divisions cannot stand as marking off kinds expressed in the essence. Swimmers grouped together fish with animals that move in radically different ways than fish, namely, soft-shelled animals and cephalopods. Flyers grouped together birds with insects. The same problem occurs here. Birds fly differently than insects. Walkers posed another problem, since some walkers can also swim. None of these groupings marked off kinds with a single nature. Aristotle can now point to a more significant difference that will divide off and group animals into those kinds expressed in the essence. Blooded animals move with four points of motion whereas bloodless animals move by more than four points of motion (490a26–34). We can also accept that this is part of the meaning of terms that constitute the division. Blooded signifies “that which moves by four-points of motion” and bloodless signifies “that which moves by more than four-points of motion”. This division will enable Aristotle to mark off animals into great genera (μέγιστα γένη) by means of locomotion and the kinds of parts they have. In *HA* I.6, he marks off seven great genera by means of whether they are blooded or bloodless (490b7–15). These seven great genera also seem to be marked off in respect to their capacity of locomotion, although other features may also be relevant for the initial grouping of these kinds.⁴⁴ But the methodology specified above demands that the kinds sought have a unified definition. If Aristotle still maintains this view, as I have shown he does thus far, then the great genera must be grouped by one common feature, not many. Charles’ view fails on this account as well.⁴⁵

I have now shown that Aristotle has employed two out of three parts of the methodology that divides nature by its joints. The third part of the method can be seen in the first four books of *HA*: grouping together of differentiae in order to confirm the kinds picked out are natural kinds.⁴⁶ Aristotle begins the inquiry

⁴⁴ Aristotle questions whether four-footed, viviparous and four-footed, oviparous animals constitute great genera in this passage but accepts them as such later in *HA*, e.g., 505b25–30. For a good defense that these are great genera, see Gotthelf 2012: 293–306. For an opposing view, see Stoyles: 2012.

⁴⁵ Although Charles accepts a version of the unity assumption, he believes that Aristotle can appeal to a variety of common soul-functions to mark off natural kinds. Charles 2000: 316–26.

⁴⁶ Although I agree with Lennox and Gotthelf generically that this is what occurs throughout *HA*, we should note clear differences. Gotthelf and Lennox see *HA* merely as grouping animals along the lines of differentiae. Gotthelf is not committed to the view that *HA* establishes the

first discussing those parts that belong to human beings. Human beings serve as the measure insofar as what is most familiar to us is useful in inquiry and the parts of human beings are most familiar (I.6 491a19–23). He begins with the instrumental parts of human beings and then discusses the uniform parts, so as not to neglect the proper order. However we interpret this proper order, Aristotle proceeds in a way consistent with the method I presented above. There will be general features that belong to all animals, as well as all blooded animals, and then those features that belong only to all members of a lower genus, such as bird, or a single species, such as human being. If Aristotle establishes these facts, this would serve as good evidence that the kinds marked off are those expressed in the essences of animals.

Aristotle begins *HA* II.1 discussing various parts, both those in common to blooded animals and those that are further differentiated. We can see why this discussion is valuable as the next step in the order of the inquiry. Showing commonality of parts ensures that blooded animal as a kind was marked off properly. Showing differences within this kind and where those differences occur ensure that the kinds marked off below the level of blooded animal were marked off properly as well. From *HA* II.1 to II.7, Aristotle discusses features that belong to viviparous quadrupeds, both what is held in common and those differences that mark off kinds, primarily atomic species, within this group. We should expect such diversity within this kind due to Aristotle's hesitancy to call viviparous quadrupeds one of the great genera. Aristotle continues this pattern throughout the next seven chapters (*HA* II.8–14). He marks off those great genera of the blooded kind, oviparous quadruped, bird, and fish, and their peculiar parts (ἰδιᾶ), or genera distinct from the great genera, such as serpents, or species that have peculiar features within a great genera, such as apes, baboons, and monkeys or chameleons.

After grouping animals by means of differences and counter-predications by means of external parts, he then turns to the internal parts. Once again Aristotle shows that blooded animal is a natural joint by seeking out what internal parts counter-predicate. He also shows that there are kinds that fall below the blooded kind as well, marking differences in respect to these parts that pertain

existence of natural kinds, although Lennox is. But they both take *HA* to be doing exactly what it announces to be doing, grasping the various differentiae and incidental features so that we may seek their causes (491a7–14). This task is achieved by grasping the *hoti*-predications by means of counter-predication. But this task need not be exclusive of seeking out and establishing the existence of hierarchically-arranged natural kinds. In fact, on my view, it seems to be the same thing or part of the same task.

to the blooded nature. He explicitly makes the former point at the beginning of *HA* II.15 (505b25–7). The latter point is made by means of the order and discussion of these chapters (*HA* II.15–17). The same pattern occurs when he discusses the parts and their positions that are relevant to sexual reproduction (*HA* III.1). He concludes his inquiry of blooded animals discussing the various uniform parts that are held in common as well as differences pertinent to the various kinds (*HA* III.2–22). The inquiry has proceeded in a way that we might expect in order to confirm the natural joints found by the method. This same method is employed in discussing the various parts and their differences in the bloodless kind (*HA* IV.1–7).⁴⁷

I now consider, in turn, how various scholars would object to my view. Charles can raise at least three criticisms of it. First, my view did not account for the divisions of animals by mode of generation in *HA* I.5. Second, this fact is important because Aristotle uses kinds from this division to mark off the kinds of blooded quadrupeds in *HA* I.6 and upsets my version of the unity assumption. Third, my view seems to lead to the same view as Charles: Aristotle appeals to soul functions to divide the genus animal.

It seems to me that Aristotle discusses the way mode of generation is divided for two reasons. First, once we see this division, we should realize that the animals grouped together under viviparous or oviparous animal do not constitute a genus that differs only by the more and less. Viviparous animals include human beings and all other hairy animals, cetaceans, and selachians. Although viviparous animals are further divided, these divisions will still group together kinds too distant from each other. The same problem arises for oviparous animals, grouping birds with what we would now call amphibians and reptiles. So, just as in the other passages of *HA*, Aristotle is not explicit about ruling out sets of divisions, and we are supposed to draw the same conclusion here. It works on similar terms, although here it depends upon the assumption of a genus in biology having species that only differ by the more and less.⁴⁸

But this set of divisions seems relevant when Aristotle marks off the kinds of quadrupeds into viviparous or oviparous, of which later he will admit are

⁴⁷ The only change is that each great genera of the bloodless kind is taken up separately, discussing both external and internal parts of one kind before moving to the next. Such a procedure does not upset any aspect of the method I developed in this paper.

⁴⁸ There is no reason to see that this assumption may not also be grounded on the unity assumption as well. Any kind that has species under it differing only by the more and less may just be a kind that has a unified definition. I do not need this assumption for my argument to work, but it would be convenient if this were the case.

great genera (*HA* II.15 505b28).⁴⁹ Such a division would violate the unity assumption insofar as two sets of divisions are now relevant for dividing nature by its joints, not one. Aristotle also shows in *Generation of Animals* that there is no account for why these sets of division are one.⁵⁰ But there is an easy response to the former problem. The grouping of these two kinds of quadrupeds is done by appeal to their mode of generation because Aristotle has not yet found the essential natures of each. Aristotle is engaged in inquiry, and this is the best means at his disposal. In other words, this grouping is just one way to mark these kinds off from each other, which is all that is required at this stage.

Does my view also employ the same a priori assumptions about what it is to be a common nature? I answer no. Aristotle does discuss various parts directly connected to basic soul functions and, on my view, uses some of what is discovered about these parts to divide nature by its joints. But none of this requires Aristotle to appeal to a robust, a priori conception of what it is to be a common nature to reach these conclusions. He merely uses these parts and their similarities, grasped empirically, to see if they can help group together natural kinds. Also, Charles's assumptions cannot mark off higher kinds, such as the blooded from the bloodless kinds, but I take this division to give Aristotle the ability to mark off the great genera properly. I also agree with Lennox. Even though the groupings are contingent on soul-functions, it is uncontroversial insofar as all parts of animal will relate to a soul-function for Aristotle.⁵¹

Lennox would raise three objections. First, my view entails that Aristotle treats blooded and bloodless animals each as a genus (*γένος*), but Aristotle never employs this terminology in the biological treatises for these kinds. Further, they do not form genera in the standard sense in the biology, which is having one common nature with forms that are not too distant and differ only by the more and less (*HA* I.1 486a21–3, *PA* I.4 644b1–14). Second, the joints of nature would require determining the differentiae found in the essence of an atomic species, so I am guilty of bringing the essence/accident distinction into the *HA*. Third, Aristotle treats way of life often as fundamental and as the underlying unity in organic complexity, so it would seem to be part of the essence of any kind of animal. This would rule out my reading of *HA* I.1–6.

⁴⁹ Stoyles questions this view. Stoyles 2012:11–12. Whether or not Aristotle treats viviparous quadruped or oviparous quadruped as great genera makes little difference to my view. What matters is whether they occupy a certain place on the taxonomical hierarchy similar to those kinds called the great genera.

⁵⁰ Aristotle is explicit at *GA* II.1 732b15–20 that divisions made by mode of locomotion do not map onto divisions made by mode of generation and the cause of the latter difference does not lie in any of the organs of locomotion.

⁵¹ Lennox 1990: 174.

It is not exactly true that Aristotle never states that blooded and bloodless kinds are genera. He claims that they are genera, though nameless, that are not supposed to be torn apart, like bird, and grouped by similarities (*PA* I.2 642b10–20). I return to this point soon. This claim need not imply that blooded and bloodless are genera like bird and fish in every respect. Aristotle does have a special usage for the term “genus” in the biological writings, one not found in any of his discussions of the term “genus” (e.g., *Metaphysics* Δ.28). But there is no reason to believe that Aristotle has abandoned the other senses of genus in these works. So, one meaning of genus stated in both *Metaphysics* Δ.28 and *Topics* I.5 is that which is in the formula (λόγος) of the what is a thing (1024b4–6, 102a31–3). In the *Physics*, Aristotle states that each kind in the formula of the essence is a genus (II.3 194b26–9). It is in this way that I take blooded and bloodless to be genera. There is evidence in *Parts of Animals* that supports this. Aristotle asserts that the generic nature of bird and fish and being blooded are in the *ousia* of such kinds (*PA* IV.12 693b5–13, IV.13 695b17–27).⁵² Aristotle also asserts that blooded and bloodless are in the formula defining the *ousia* of these kinds of animals (*PA* IV.5 678a31–4).⁵³ So, we see that Aristotle admits various levels of generality in the formula of the essence of an atomic species.⁵⁴

Lennox (and Gotthelf) claim otherwise. Their view is that blooded and bloodless are groupings of attributes and not genera.⁵⁵ But this is an odd claim on two grounds. First, as we saw above, they are expressed in the *what is* of atomic species insofar as they are features in the *ousia* of bird, fish, and all

⁵² I take Aristotle to equate *ousia* and essence in *Parts of Animals* or at least in these passages.

⁵³ Gotthelf has noted all of these passages, Gotthelf 1985: 27–54. His comment on this very passage both agrees and contrasts with my own. Gotthelf suggests that these passages show evidence that Aristotle took blooded and bloodless to be genera (by saying that Balme’s claim to the contrary is not that clear to him) (35). But Gotthelf also suggests that Aristotle is naming a part to be part of the animal’s *ousia*. My view is that blooded and bloodless form kinds, and they are the kinds that constitute the first division the genus animal. It is, of course, true that all blooded animals have blood as a part, but I do not take Aristotle to be asserting this fact alone or that blood is part of the essence of a blooded animal when he calls an animal “blooded”.

⁵⁴ We need not be concerned with whether Aristotle finds the complete formula of any atomic species or even if this is his aim in *Parts of Animals*. My claim is that Aristotle does admit various levels of generality in the formula of an atomic species, and given the *aporia* raised in the first book and solved in I.4, it is clear that Aristotle admits that atomic species have a formula.

⁵⁵ Lennox 2001a: 295. Yet see Gotthelf 1985: 52, n. 15 where he admits that he is undecided on this issue. But nothing in his later papers returns to this issue directly, and his paper, “Data-Organization, Classification, and Kinds” (2012: 261–292), does not treat blooded and bloodless as genera.

animals. What else would they be other than genera? Second, in respect to the bloodless animals, it would be unclear what this grouping of attributes would consist. They share very few, if any, features in common other than the analogues of the heart and of the blood. These features would hardly count as a large grouping of animals by common features, unless of course these features are part of, or follow from, the essential nature.

Second, Lennox would say that I am disavowing a key component of the empiricist reading of Aristotle's biology. If Aristotle is dividing nature by its joints in *HA*, he would need to distinguish between essence and accident. Blooded (or blood), for example, would be an essential feature, whereas having a liver would be an accident. But Aristotle does not make these distinctions in *HA*. My view does not force Aristotle to make these distinctions in *HA* but only to locate the levels of generality that mark off essential kinds. He is finding the various subject matters for which there will be demonstrations, not the essences of these subject matters. Lennox could respond that Aristotle relies on kinds marked off in ordinary language, but clearly there are levels of generality which have no corresponding terms in ordinary language. Finally, I need not worry if some fact noted turns out to be the essence of that natural kind, since Aristotle does not hold that a *historia* by itself would discover this fact. Lennox shares this view as well.⁵⁶

Third, if way of life plays a vital explanatory role of the complex system of an organic entity, does this speak against my reading of *HA*? There are a few signs that it does not. I can actually accept Lennox's view without damaging my interpretation of *HA*. We have already seen that dividing the genus animal by ways of life would tear apart such kinds as bird. Even more telling is Lennox's own account of the explanatory role of the various ways of life of birds. It only becomes relevant differentiating one kind of bird from another, so it plays no role in marking off bird as a kind, which I take to be the issue in this first part of *HA*.⁵⁷ Similarly, Aristotle's discussion of ways of life in *HA* are grouped not according to its own differentiae, e.g., by studying all the animals that are water-dwellers due to where they get their nourishment, which would include fish, dolphins, whales, crustaceans, etc. But he proceeds by discussing the grouping of differentiae relative to each of the great genera or other kinds in turn. So, these features can differentiate animals already considered a unified kind by Aristotle, but they cannot be used to mark off these unified kinds themselves.

⁵⁶ Lennox 2001b: 44–5.

⁵⁷ Lennox 2010: 344–5.

Gotthelf would object to my view in the following way. He claims that there is no justification in the text for singling out one feature that would serve as the basis for systematic classification by essential nature. There are many groupings of the animals, each of which divides up the atomic species of animals differently, e.g., mode of locomotion and mode of generation is Aristotle's own example (*GA* II.1 732b15–29). Even more to the point, he would claim that, following Balme, *HA* is neither a descriptive zoology nor a natural history nor aims at an exhaustive taxonomy of animals. It collects and organizes data along explanatory lines. This reading can accommodate the various groupings found in *HA* and the explanatory treatises. My reading cannot. Gotthelf also rejects that the kind by kind review in Books II through IV is evidence of taxonomic concerns, which I appeal to defend my view. He claims that the external-internal distinction takes precedence. Finally, there is little discussion of kinds that fall under the great genera, which would seem to be required given the discrepancies Aristotle notes in each great genera, nor are the great genera exhaustive of all the atomic species.

I start from the issue whether Aristotle is seeking a taxonomy of animals in *HA* and finish with the issue of whether there can be any justification that Aristotle is singling out a single feature upon which to base a systematic classification. The answer is complicated. The function of the text on my view can be very similar to Gotthelf's: Aristotle is organizing predicates along explanatory lines in *HA*. But my view is that many of the relevant predicates, most of the parts, will be organized along taxonomic lines, for these kinds will mark off the proper level of generality for the explanation of any part. I address the status of the kinds of predicates other than parts below. Classification and taxonomy are mere tools of inquiry, not the end, but vital tools, since there are nested kinds under the genus animal. Animals are complex entities, both in terms of structure and function, so various groupings will be needed to organize the data properly. In other words, even if the essence is simple, the explanation of various parts need not be, nor should we expect that (although I am afraid often scholars have this belief after reading the *Posterior Analytics*).⁵⁸

58 Gotthelf's analysis of Aristotle's explanation of an elephant's nose is a good example of this, but I can also show that my view can address some of his concerns he expressed about a unified explanation of the elephant's nose. Gotthelf 2012: 188–90. He shows that Aristotle appeals to five (or maybe seven) basic features (each labeled M_i) of an elephant in this single explanation. But his analysis may have less strength in respect to my view. First, we should not confound "basic" with "essential feature" (not that Gotthelf does so, but, if he does not, his argument has less force). Certain material might be basic to an animal, or its habitat, both of which can be discovered empirically, and need not be taken as essential (so, there goes his M_1 [swamp animal] and M_4 [of great size]). My view holds that being footed, here, four-footed in a

None of this precludes the fact that Aristotle's kind-by-kind review in *HA* does not serve the function of confirming the kinds marked off as predicated in the essences of animals. But we might be surprised how Aristotle proceeds in Books II–IV, ways in which taxonomic goals are not primary, e.g., the external-internal distinction. I suggest that this organizing principle might not be a significant concern for my interpretation. Aristotle actually claims that the proper order of the inquiry is to discuss the non-uniform parts first and then the uniform parts (*HA* I.6 491a24–6). The external-internal distinction is within that context, so, at best, it is secondary. But both sets of distinctions help confirm that the great genera and blooded-bloodless division have been marked off correctly.⁵⁹ It might be better to read the external-internal distinction as an epistemic one – we are more familiar with external parts and classification already held by ordinary people begins from these distinctions. Proceeding in this manner need not suggest that there is a lack of taxonomic concerns but that we start from what is more knowable to us.⁶⁰

Aristotle also need not be concerned with kinds between the great genera and their atomic species as Gotthelf believes. He would only need to be if these kinds were expressed in the essences of atomic species. Even if there are such kinds, they would merely be sub-divisions of another genus already marked off

certain way, just is a further division of being blooded or at least intimately related (so M_2 [blooded], M_3 [walker or air-cooler], M_5 [four-footed that are many-toed], and M_6 [many-toed] express different levels of generality of the essence of an elephant). Finally, if Aristotle does appeal to the elephant being “live-bearing” (M_7), then this is a feature that follows from the essential nature, at least on my view. So, the seven basic features either are different levels of generality found in a single essence or material features that are taken as basic or features explained by the essence in some way and used in the explanation. None of this directly contradicts my view of the essential nature of an atomic species for Aristotle, but Gotthelf's analysis does make us rethink what it means for an essence to explain a feature.

59 This might apply more readily to blooded animals. But even that does not present a real problem, since Aristotle holds that the bloodless animals are less complete than the blooded ones.

60 What is strange is that Gotthelf takes Aristotle to determine at least the nine great genera in some way prior to this inquiry. Gotthelf 2012: 281–2. He takes some of the kinds to be established by what popular usage has grouped correctly. But he has no clear way to account for how Aristotle determines when a kind has been marked off correctly. I do, and it occurs in *HA*. Gotthelf shifts Aristotle's attempt to establish kinds away from the inquiry in *HA*, which does not seem to me to be plausible, given that seeking out such kinds is the work of scientific inquiry, as made clear in *APo*, and he mentions proceeding in this way in *HA* itself (487a11–14). Gotthelf's concerns about Aristotle classifying in his biological treatises might dissipate as soon as we recognize that the goal is the same, definition and explanation, and is not an end of science but a tool. For another way to argue that classification is central to Aristotle's science of biology, see Henry 2011.

plus a difference. Aristotle may not be certain whether there always are other genera under the great genera, so he holds off seeking these kinds until he can decide this issue on good grounds. Nor is Aristotle committed to the view that if there are sub-genera in one great genus, there must be sub-genera in all of them or an equal number in each. In my opinion, this is a non-issue, only forced on us by the fact that later classifiers borrowing from Aristotle believed that this must be the case.

Another problem is that my reading of *HA* is best supported by the first four books but not the others. Gotthelf even goes as far to say that Aristotle is concerned with the kinds of differentiae in *HA* and suggests it might be read as a systematic classification of differentiae.⁶¹ Although Aristotle does go on to discuss differentiae concerning modes of generation, ways of life, and characters, each inquiry proceeds primarily by discussing the kinds of differentiae in relation to the great genera. That the great genera do not get regrouped during the different inquiries is a good sign that Aristotle takes them to be marked off as kinds in the essences of animals or at least have some privileged status as kinds.

But what is the justification for singling out one feature as the basis of systematic classification? My view does show that Aristotle can prioritize a single feature, mode of locomotion, as the basis for systematic classification by essential nature, in part, because he can rule out features being predicated in the essences, at least as higher level kinds. We also saw that the aim of such classification was to determine the proper level of generality to explain a predicate. As for the plurality of groupings to which Aristotle appeals or determines, there need be no contradiction or tension between that and there being one primary feature that constitutes the essential nature. More can be said on this point. Aristotle groups animals into blooded and bloodless, both of which he states as features in the essence or the *ousia* and group animals by the number of points of locomotion. Locomotive features, such as the capacity to fly or to swim, are also stated to be in the essence or *ousia* of animals (*PA* IV.12 693b13, IV.13 695b20–1). The only feature stated by Aristotle to be in the essence or *ousia* of animals in the biological treatises at odds with my view is the capacity of perception (*PA* II.8 653b22–23). But even this feature need not be at odds with my view. Aristotle states in *PA* II.1 that the perceptive, generative, and locomotive capacities are located in one part of the body, the heart in blooded animals and its analogue in the bloodless ones. So, it could just be Aristotle's view that only the locomotive features, falling under the blooded-bloodless division, constitute

⁶¹ Gotthelf makes the former claim in his own voice but not the latter. Gotthelf 2012: 281.

the essential difference of any particular atomic species.⁶² The other features do not but belong to that animal kind by means of features in the essence.

Gotthelf as well as Lennox would respond to this view by appealing to the reform of division and the fact that Aristotle does not believe that the form of an atomic species could be defined by a single line of differentia. Hence, other lines of differentiation should be included in the formula of the essence so that generative and way life features can be included in the definition. Such a view would also upset the way I interpret Aristotle's conception of division presented in *APo.* II.14: division no longer seeks a taxonomic order, which would be inconsistent with their interpretation of the reforms of division.

The problem we all face as scholars of Aristotle's biology is that the issue becomes highly interpretative. We have clear passages where Aristotle states that certain features are in the formula of the essence or *ousia* of a particular kind of animal. Aristotle does not state that mode of generation is a feature in the formula of the essence, but such an argument from silence should not convince us one way or the other. In support of Gotthelf's and Lennox's understanding of the issue, Aristotle does state that all living beings generate their own kind, suggesting it is an essential feature. But I addressed this issue above. It by no means questions my interpretation.

But I should say more how the reform of division stated in *PA* I.2–3 can be consistent with my interpretation of systematic classification and the unity assumption. Gotthelf and Lennox both see signs of the reform of division already at work in *HA*.⁶³ But I have also shown that the method I have worked out from the *Analytics* on division and systematic classification can also be read plausibly as governing the inquiry in *HA*. So, on my view, there may be a lot less reform of division as Aristotle presented it in the *Analytics* or, with few exceptions, adapted for his biological inquiries.⁶⁴ Aristotle still accepts some version of the unity assumption along with the reform. How we should understand the unity of the definition that contains many differentiae need not be solved definitively here. All I need now is that my view is compatible with this reform, and I see no reason why it is not. The hierarchy of kinds that I have presented also plays a prominent role in both *PA* and *GA*, a bulk of the explanatory biological

⁶² One obvious exception to this is human beings, which also have the capacity to reason as part of their essential nature. More would have to be said about this discrepancy, but Aristotle explains a human being's capacity of locomotion, walking insofar as we are two-footed, by means of our capacity to reason (*PA* IV.10 686a25–b1).

⁶³ Gotthelf implies this in his "Data-Organization, Classification, and Kinds" 2012: 288–9. Lennox 2004: 96–7.

⁶⁴ The latter appears to be Lennox's view in Lennox 2001c: 133–44.

treatises. So, key elements are in place to support my reading. Finally, if I am correct in saying that Aristotle prioritizes the great genera or those that function as picking out kinds below the level of the blooded and bloodless animals, the two constant exemplars Aristotle uses, bird and fish, are defined by appealing to the locomotive capacity of each kind. This by itself is not sufficient, but Aristotle does conclude near the end of *PA* I.5 that the entire body has been constituted for the sake of one action (πράξεώς τινος) (645b14–17) and claims that some actions can be prior and the ends of others (645b30). It is possible that Aristotle includes the generative, perceptive, and locomotive actions in the essence of animals but only the locomotive features pick out the kinds on the hierarchy.

But such an interpretation can be questioned from a new take on Aristotle's use of classification in the biology. Both Devin Henry and Byron Stoyles propose that Aristotle did classify animals for explanatory purposes but he did not prioritize one classification over any other.⁶⁵ In other words, Aristotle is a pluralist about biological kinds and no one classification system can account for the various biological kinds. Each classification picks out kinds that function in explanations, so each classification contains real kinds that belong in the definition of atomic species. Although their approach to the issue differs to some degree, they provide much of the same evidence to support their view and the same reasoning. The latter point is important to defend my view against their approach. Both scholars show that each classification of biological kinds cross-divides another classification of animal kinds. Since each division and classification functions to locate the right level of explanation for necessary features of animals, each classification picks out natural kinds. If each classification picks out real kinds, there is no privileged classification of animal kinds.

There is, of course, much agreement between our two views. Classification plays an important role in seeking explanations and locating the right level of generality of the explanation. These classifications pick out natural kinds because such kinds are constituted by elements of animals that have the right causal structure. There are also several sets of natural kinds, and each cross-divides another set of such kinds. So, why do I deny pluralism? They assume that a monistic conception of classification, as I hold, cannot admit cross-division of real kinds. Henry says it best: Aristotle does not treat the great genera as having “inviolable boundaries such that any division that cuts across those boundaries must fail to pick out ‘true’ kinds.”⁶⁶ I take this to follow from a Linnaean conception of taxonomy which I deny Aristotle holds. Such a conclusion,

⁶⁵ Henry 2011, Stoyles 2012.

⁶⁶ Henry 2011: 206.

then, does not follow if kinds from another classificatory schema cross-divides any of the great genera. What does matter is whether Aristotle can determine one set of kinds as privileged and expressed in the essences of atomic species as I argue he does. Further, since the great genera never get regrouped, even in respect to mode of generation, Aristotle would appear to treat them as inviolable, and my interpretation shows how.

But each scholar can raise a further problem about my view. Stoyles supplies a persuasive argument that Aristotle's use of "μέγιστα γένη" ("great genera" as I have translated) does not privilege these kinds in any classificatory way. I can agree with Stoyles's analysis here without any damage to my view. Instead of privileging these kinds that is signaled by this expression, my claim is that the method employed picks out these particular kinds as essential kinds. This brings us back to Stoyles's and Henry's basic criticism of my view: does Aristotle privilege any set of natural kinds over any other?

Two pieces of textual evidence suggest that he does. I have already appealed to the passage in *PA* I.4 that determines which kinds are relevant in seeking definitions of atomic species. Aristotle provides here his standard examples of bird and fish as being such kinds. It seems safe to assume that the other great genera picked in *HA* I.6 fulfill these requirements as well, being used to group features for explanation in *PA*. But Stoyles and Henry might object and say that kinds in other classificatory systems fulfill the same requirements. This is not clear. I hold that Aristotle's usage of "genus" and "species" sometimes denotes certain kinds of classes, especially at the beginning of *HA* (486a15–25). It is not clear that *this* usage of genus and atomic species is applicable to the kinds of other classifications such as mode of generation. The genus viviparous animal does not admit of kinds that only differ by excess and defect, since they also differ in kind in respect to parts. The same applies to the genus land-dweller or water-dweller, if they also function as kinds.

Henry would object to the fact that I have left out one kind that is predicated in the essence according to Aristotle: the lung-possessor kind (*PA* III.6 669b8–13).⁶⁷ On my view, I would have to accept that those animals that have a lung form a genus that is predicated in the essence of those atomic species. Why did I not include it above? The answer is simple. I focused on how Aristotle employs division in *History of Animals*, but Aristotle does not pick out this genus via the method I presented above in that text. Since Aristotle is engaged in inquiry, he is allowed to revise his view. Further, this division does not upset the taxonomy, since it divides all blooded animals without cross-division.

⁶⁷ Personal correspondence from Henry.

IV

Conclusion. To borrow a slightly altered phrase from Pierre Pellegrin, Aristotle does divide nature by its joints and he does it well, at least better than many of the biologists that come after him.⁶⁸ The method I have developed in this paper enables Aristotle to find various levels of generality within the genus animal using a certain ontological assumption, division, and the syllogistic. He does not divide and then explain, but rather Aristotle groups, divides, rules out divisions, finds predicates in common to all members of the genus, seeks a set of divisions among these terms, and finally confirms that the divisions at least pick out natural kinds by means of counter-predication before explanation enters into the picture. Nor does Aristotle employ robust, a priori assumptions about what it is to be a common nature for an animal kind. He does not need them. The unity assumption ensures that each kind marked off has one common nature. Finally, we saw that Aristotle need not be a pluralist about the kinds of animals even though he admits there are various ways to classify zoological kinds. Aristotle's unity assumption, as I understand it, rules out such an interpretation, and it is possible that the essences of some of the kinds of animals are explained by the essences of atomic species or those kinds expressed in the essences.

There may be much hesitancy to accept this reading of Aristotle. The view implies that Aristotle seeks a hierarchy of nested kinds of the genus animal, so classification becomes an important issue in the biology, as is stressed by Henry and Stoyles as well. The nature of this classification needs further clarification and defense, for it is distinct from any modern conception of classifying animals. But we can see the view is supported by an Aristotelian text: *Posterior Analytics* II.14. We also saw that Aristotle seeks out this classification at the beginning of *HA*, appeals to it consistently in the first four books, and uses it as an organizing tool for the inquiries of the other kinds of differentiae. Now, I take it that the first step in restoring any notion of classifying animals in Aristotle's biology, most importantly, one that is taxonomic, is to show on his own terms that it is plausible, if not necessary. I hope to have shown that it is a necessary consequence of dividing nature by its joints and a plausible read of *HA*. We also saw why: he can use systematic classification to put scientific problems in the correct form. This method determines both the subject matter and the facts of which there are demonstrations by seeking out commensurate universals. My

⁶⁸ Pellegrin concludes his book on Aristotle's classification of animals with this line: "Thus, Aristotle classifies animals and he classifies them well—much better, at any rate, than most of his successors" (Pellegrin 1986: 159).

view of Aristotle's conception of classifying animals systematically, then, is not independent from his conception of definition and explanation. The two go hand-in-hand.⁶⁹

Abbreviations

<i>APo.</i>	<i>Posterior Analytics</i>
<i>APr.</i>	<i>Prior Analytics</i>
<i>GA</i>	<i>Generation of Animals</i>
<i>HA</i>	<i>History of Animals</i>
<i>PA</i>	<i>Parts of Animals</i>

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