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I. Introduction

In the last section of Book 2 of the *Generation of Animals*, Aristotle discusses hybrid animals. Two conclusions, representing opposing viewpoints, have been drawn from this material. The first is that Aristotle’s acceptance of this phenomena means that he is not committed to species fixity; that is, fertile hybrids allow for the advent of new kinds of animal. The second denies this and posits that since in an instance of hybrid generation form is lost, it is a contamination of form by matter. These two alternatives clash in their understanding of Aristotle’s theory of the roles of the sexes in generation. Those who think that hybridization can result in the creation of a new form must believe that half of the form comes from the female parent.¹ The contamination view, in contrast, has it that the female animal contributes nothing but recalcitrant materials.

This paper will argue that when the key passages on hybrids in the *GA* are analysed, although neither view is entirely correct, the second one is closer to the mark. Here, as is also evident more generally in the Aristotelian corpus, it is clear that hybrids are monstrosities without any forms. Thus, it is not the case that they show any softening on species fixity. However, this doesn’t mean that hybrids represent a situation in which ‘only the raw feminine matter remains’.² Indeed, the phenomenon displays that shaping powers come from both sides, which is detailed in Aristotle’s account of hereditary resemblance later on in the *GA*. However, it is correct to view hybridization as a loss of form. The paper will show how this ‘theory of hybrids’ illuminates two aspects of Aristotle’s broader theory in the *GA*. First of all, it makes clear the connection between his theory of generation and his metaphysical commitment to the eternity of forms. It also shows how his account of the way in which individual animals contribute to hereditary resemblance is gendered, with the female exerting more influence on external bodily appearances than the male.

The paper will begin by giving an overview of the two interpretative strategies mentioned above. It will then set out Aristotle’s use of hybrids as an example in *GA* 2.4, supplementing this with the account of hereditary resemblances and monstrosity in *GA* 4. It

¹ Galen tried to use the Aristotelians’ view on hybrids to argue that form must come from the female as well as the male (*De semine* 2.44-50; IV 603-5 K).

² P. Li Causi, Hybridization as Speciation? Greek Folk Biology (and Aristotle) on the Mutation of Species in: F. Citti, L. Pasetti, D. Pellacani (eds.) *Metamorfosi tra scienza e letteratura*, Firenze 2014, 63-79 at 75.

will then show how this fits with Aristotle's complex discussion of mule sterility in *GA* 2.8. The implications of Aristotle's view will be explored in the last two Sections.

II. Hybrids as a threat to species fixity

Some scholars have argued that hybrids show that Aristotle did not espouse any fixity of species.³ Preus thinks that they are evidence for a 'fuzziness of the edges of the species-concept in Aristotle'.⁴ Referencing *GA* 2.7.746a30, Balme proposes '[t]here is room to doubt whether Aristotle in fact believed that species do not change. He accepts the possibility of new species arising from fertile hybrids'. For Balme, this view helped him to accommodate his conviction that Aristotle requires individual forms in order to make his account of generation and heredity viable.⁵ However, there is much evidence that Aristotle's biology and philosophy requires and reinforces species fixity. As Cooper explains, in order to pit his teleology against 'materialist' opponents such as Democritus, Aristotle put forward that 'it is an inherent, non-derivative fact about the natural world that it consists in part of the natural kinds and works to maintain them permanently in existence'.⁶ For Aristotle, animals have a drive to be eternal in the way open to them; part of their form (*eidos*) is that drive (*de An.* 2.4, 415a29-b1). But what about the idea that a new species could be created through interbreeding?

Pellegrin argues that hybrids are not unnatural in any other sense than that they occur infrequently. If they were to occur frequently, as in Libya, then they could be 'normal' and so natural. He adds that 'the entire species of mule is sterile' allowing for the advent of new 'species' through mating one kind of animal with another. From this he concludes that species are 'permeable' for Aristotle.⁷ Although Groisard rejects the view that crossbreeds threaten 'the fixist framework of Aristotle's biology', he refers to mules as a 'species'.⁸ There is very little evidence, however, for such a view. Aristotle himself does not refer to the mule

³ A. Preus, *Eidos as Norm in Aristotle's Biology, Nature and System* 1, 1979 at 80-82; Balme, D., *Aristotle De Partibus Animalium I and De Generatione Animalium I* (Clarendon), Oxford 1972, 79; Pellegrin, P.: *Zoology Without Species* in: A. Gotthelf (ed.), *Aristotle on Nature and Living Things: Philosophical and Historical Studies (Mathesis)*, Pittsburgh 1985, 95-115 at 109-110.

⁴ Preus (see fn. 3), 81.

⁵ D. Balme, *Teleology and Necessity* in: Allan Gotthelf and James Lennox (eds.), *Philosophical Issues in Aristotle's Biology* (Cambridge University Press), Cambridge 1987, 275-85.

⁶ J. Cooper, *Hypothetical Necessity and Natural Teleology* in: A. Gotthelf and J. Lennox (eds.), *Philosophical Issues in Aristotle's Biology* (Cambridge University Press), Cambridge 1987, 243-74 at 271.

⁷ Pellegrin (see fn. 3) 109-110.

⁸ J. Groisard, *Hybridity and Sterility in Aristotle's Generation of Animals* in: A. Falcon and D. Lefebvre (eds.) *Aristotle's Generation of Animals: Cambridge Critical Guide* (Cambridge University Press), Cambridge 2018, 153-170 at 158, 159, 160.

or any other hybrid as a ‘species’ (*eidos*); he provides an opposing argument which does and which he believes to be highly dubious (see Section IV). For Aristotle, hybrids of one sort are very rarely said to be a ‘kind’ (*genos*) and more often referred to the product of those that are not the same in *genos* (*mê homogenê*, 2.7, 746b13). The most detailed account of hybrids in Aristotle’s writings are the texts discussed in Sections IV and V; these reinforce that hybrids cannot have forms and so the advent of new kinds via interbreeding is impossible.

III. The mule (and other hybrids) as product(s) of contamination

The second interpretation of Aristotle on hybrids is based on a broader cultural view of them as the result of some kind of (moral) corruption. This position associates Aristotle’s scientific viewpoint on hybridization with human prohibitions on forced intercourse and adultery.⁹ The first idea is that, as in human cases of inter-cultural rape, forced intercourse between animals of different kinds is to be seen as a kind of corruption of one kind by the other. It is then postulated that Aristotle thinks of hybrids as the result of the corruption of male form by crude female matter. The male in his theory is taken as form giver and female as matter provider.

For clarity, let’s consider the views of these later theorist. For various agricultural writers, hybrids represent, not a mixing of two types of animal, but a corruption of one animal type ‘by other animals perceived as agents of contamination’.¹⁰ The artificiality of mating a male donkey to a mare grounds their explanations of mule infertility. Varro (1st-2nd Century, B.C.E.) and Columella (1st Century A.D.), for example, equate mule production with rape or adultery. Let’s begin with rape, which is taken to be unnatural or ‘unlawful’ intercourse; the results of it will then be degenerate. This idea is reinforced by a description of the somewhat brutal methods employed – a metal device literally forcing the donkey to mount the female horse.¹¹ Another idea is that hybrids are the result of cheating on the legitimate male parent. On this model, a foreign male seed introduced later than an earlier

⁹ Li Causi (see fn. 2) 66-68.

¹⁰ Li Causi (see fn. 2) 67.

¹¹ Columella, *De re rustica*, VI 37, 10; see Li Causi, P.: Livestock Breeding and the Cultural Construction of the Mule in the Greco-Roman World in: L. Sannicandro and M. Schwarzenberger (eds.), Proceedings of ‘Morborem signa et causas praedicere. Thierheilkunde in Antike und Mittlealter Texte und Praxis’, Ludwig-Maximilians Universität, *Commentaria Classica: Studi di Filologia Grece e Latina* (Special Issue) 2018, 383-408, 387.

seed corrupts the conceptus; thus is adultery seen as a cause of deformity, a view also available in some of the fragments of Democritus.¹²

In interpreting Aristotle along these lines, the passage at *GA* 2.4, 738b30-36 which explains how after several generations, hybrids take after the female's side, is read as implying that the female contributes 'rude matter'. Furthermore, given that the father contributes the form, this 'regression' 'is to be read as something like the denial of reproduction itself'.¹³ It is again, the idea of the forced or adulterous nature of intercourse that leads to the idea that for Aristotle, the animals end up without any form, as contaminated, so that there is in effect 'a return to the "raw matter" of life'.¹⁴ Although there is some truth in characterising Aristotle's view in term of 'loss of form', it is necessary to put some distance between his stance and these latter views. Two key claims that do not fit with Aristotle's account are: (1) the force or cheating involved in intercourse in hybrids means that the results must be negatively evaluated, e.g. they will be defective offspring, and (2) deformity is the result of a process whereby the form from the male is corrupted by matter from the female.

On (1) we can note that Aristotle nowhere discusses the forced nature of the breeding of domesticated animals. In the *HA*, he focuses almost exclusively on natural sexual urges (*HA* 5.13-14, 6.18). When it comes to hybrid animals, they are taken to be the result of natural friendly feelings in the animals, resulting from abundant food. Even when hybrids are produced artificially, this is due more to habituation or persuasion than force. Male donkeys are reared and suckled by female horses, amongst horse foster siblings, making these their kin.¹⁵ Friendliness is thus brought about through nurture (see *HA* 6.23, 577b15-17).

In order to interpret Aristotle's theory along the lines of (1), the process of hybrid mating is likened to adultery, where a 'foreign' seed is introduced to a legitimate mixture as the cause of defect. First of all, this cannot cover most cases, where there is no original conceptus to corrupt; it is just the mating of e.g. horse and donkey without previous mating. Instead, it must be posited that the animal is pure before the mating and contaminated after it.

¹² Li Causi (see fn. 2) 66-67: 'every time an adulterer makes love to a forbidden woman, the identity of the offspring of that union becomes dubious and confused. This is because those children might be from the wrong partner (the adulterer), or because they could be the product of a process of the agglutination of two different seeds (i.e. two different blood lines) that belong to the adulterer and the legitimate partner' (67). In what follows I argue that this is not a good representation of Aristotle's view of what causes deformity of hybrids. He does, however, note at one point that if a donkey mates with a horse after it has conceived, the coldness of its seminal contribution destroys the conceptus (*GA* 2.8, 748a34-35).

¹³ Li Causi (see fn. 2) 71-72.

¹⁴ Li Causi (see fn. 2) 73.

¹⁵ Li Causi (see fn. 11) 386.

But if this is due to a foreign male (an ‘adulterer’) then how can it be that this is the result of contamination by matter of the female? This is suspect as an analogy; what is introduced in the case of adultery after legitimate conception is another male seed and not female materials. In any case, in his biology, Aristotle would disagree that the advent of another male seed after an initial conception is a source of corruption or contamination. In *GA* Book 4 he explicitly dismisses the Democritean view that the mixture of two male seeds is the cause of deformity (*GA* 4.4, 769b30-770a7). Furthermore, when Aristotle notes the effect of intercourse with several males in quick succession (e.g. *GA* 3.1, 750b32-3, 3.7, 757b3-5; 4.5, 773b13-16), he does not see this in terms of contamination. Such instances can even be beneficial, for example by providing more heat so that the female contribution is drawn down to the uterus (3.1, 750b35-751a3). In cases of super-foetation, when the same or another male impregnates an already pregnant female, there need be no deformity if the female body can complete the gestation of a second offspring (4.5, 773b16-774a17). When there is more than one male involved, and the embryos have not yet been formed, Aristotle merely remarks that the offspring will take after the male that has mated with the female last (3.7, 757b3-5) and not that there has been any sort of corruption. The term used for the influence of the last male taking precedence is the neutral ‘change over’ (*metaballei*).

Although Aristotle does not appear to have had in mind culturally prohibited intercourse when writing about hybrid mating, he did view the process as against nature. When different kinds mate this is unnatural, since it is most natural for those that are the same in kind to mate (*GA* 2.7, 746a29-30).¹⁶ This on its own cannot explain the phenomena which concerns the agricultural theorists, that is, the infertility of mules. All hybrid mating is unnatural, so this on its own cannot explain why only horse and donkey matings results in offspring that are unable to generate. As we will see, the mating being contrary to nature must be combined with facts about the kind – which show that horse and donkey are already prone to infertility ‘so that when in addition something happens contrary to nature’ (*GA* 2.8, 748b16), the resulting offspring must be sterile (all translations are mine unless otherwise indicated).

The problem with (2) is that Aristotle’s explanation of hybrid animals doesn’t make sense if what the female contributes is raw or rude matter. The male has lost the ability to contribute the form of the kind but the fact that the offspring is still a living animal with parts from both male and female parents, means that the materials are far from raw or rude. The

¹⁶ Groisard (see fn. 8), 154-5.

comparison to plants and soil is not meant to be illustrative of generative degeneration or failure – soil brings its own characteristics.¹⁷ The soil is not recalcitrant matter but nutriment which aids the plant to live its life. So also the female contribution to generation should not be viewed in the context of hybrid animals as crude contaminating matter.¹⁸ Furthermore, Aristotle’s theory of the causes of deformity is not that female matter overpowers male form, but rather than the proper requirements for successful generation, whereby both male and female play their respective part, is disrupted.¹⁹

The contamination view may not be applicable to Aristotle’s theory of hybrids in these two ways, but it does correctly identify that hybridization results in a loss of the male bloodline. The metaphysical aspect of his theory of generation is enriched by considering why and in what sense hybrid populations, as described in *GA* 2.4, represent a loss of form as will be explained in the next Section. That hybrids show a feminisation of external appearances also correctly characterises Aristotle’s view which will be detailed further in Section VI.

IV. Hybrids in *GA* Book 2

In Aristotle’s general account of generation, male and female contributions are distinguished in terms of the four causes – the male contributes the efficient cause of substantial generation, the female the material cause (*GA* 1.2, 716a5-7; 1.21, 730a24-30; 2.1, 732a3-9; 2.4, 740b24-5; 3.11, 762b2-4; 4.1, 765b10-15). Only together (‘it concerns them both’, *GA* 2.1, 732a10-11) do they achieve generation of a living being the same in form (since they are the same in form themselves; 1.23, 730b35). A good part of *GA* Book 2 consists in an attempt to face potential difficulties (*aporiai*) for Aristotle’s innovative theory of generation, in which the male contributes no material. It is in this context that hybrids are first mentioned in *GA* 2.4.

Hybrid populations are used as empirical support for the male not contributing the body to offspring. The case that is being referred to is not an individual example of a hybrid animal, which resembles the male in half its body parts and the female in the other half, but

¹⁷ S. M. Connell, *Aristotle on Female Animals: A Study of the Generation of Animals* (Cambridge University Press), Cambridge 2016, 129-131.

¹⁸ The combination of a new environment, including soil with particular powers and potentials, results in flourishing plants, even though they are changed from their original nature (Theophrastus, *CP* II 3.7). We should note here the difference between animal and plant generation. The seeds of plants are already a combination of male and female principles. The seed of male animals, in contrast, must first combine with the female generative contribution to form a conceptus (or *kuêma*) which is equivalent to the plant seed. The soil is then parallel to whatever nutriment the female animal provides during gestation (which will be in the egg or given through the umbilical cord).

¹⁹ For a fuller account of this see Connell (see fn. 17) 350-352.

the case of the absorption of bodily differences that come from the original male after many generations.

ἡ γὰρ ψυχὴ οὐσία σώματός τινός ἐστιν. καὶ διὰ τοῦτο ὅσα τῶν μὴ ὁμογενῶν μίγνυται θῆλυ καὶ ἄρρεν (μίγνυται δὲ ὧν ἴσοι οἱ ὁμογενῶν μίγνυται θῆλυ καὶ ἄρρεν [μίγνυται δὲ ὧν ἴσοι οἱ χρόνοι καὶ ἐγγὺς αἱ κυήσεις, καὶ τὰ μεγέθη τῶν σωμάτων μὴ πολὺ διέστηκεν]), τὸ μὲν πρῶτον κατὰ τὴν ὁμοιότητα γίνεταί κοινὸν ἀμφοτέρων, ... προϊόντος δὲ τοῦ χρόνου καὶ ἐξ ἐτέρων ἕτερα γινόμενα τέλος ἀποβαίνει κατὰ τὸ θῆλυ τὴν μορφήν, ὥσπερ τὰ σπέρματα τὰ ξενικὰ κατὰ τὴν χώραν

The body is from the female, the soul from the male. For the soul is the essence of a certain sort of body. Because of this when male and female that are not the same in kind mate (mating happens in those whose lifespans are equal, gestational periods close and that do not differ much in body size), the first generation resembles both parents in common...but as time progresses, different from different, the end result is the shape (*morphê*) of the female, like seeds planted in foreign soil (*GA* 2.4, 738b24-35).

This idea is at first perplexing both theoretically and empirically. If Aristotle means to show that the body comes from the female, why does this effect take many generations? And if it takes many generations, who are the hybrid animals mating with? Are they mating with other hybrids or with the original parents' kinds?

The most plausible scenario is that Aristotle is thinking about a population of hybrid animals – let's take dog and fox hybrids.²⁰ These doxes, if left to themselves and without mating with dogs or foxes in their pure breeds, end up looking like the original female animal with respect to their bodily form. If this were the case, there are many difficult questions, beginning with the puzzle, as in *de Anima*, of how an animal could be separated into body and soul.²¹ What does it mean to say that they have only bodies and not souls if they are alive? Related to this, it is difficult to understand how if an animal has the body of the female,

²⁰ Although Aristotle thought that dogs and foxes mated and produced hybrid offspring, it is highly unlikely that this actually occurs.

²¹ This is 'Ackrill's problem'. See N. Carraro, Aristotle's Embryology and Ackrill's Problem, *Phronesis* 62/3, 2017, 2744-304. Cf. *PA* 1.5, 645a35-37.

it does not also have the soul or form of that kind. How can the resultant fox-like beings not actually have the form ‘fox’?

Leaving those perplexing problems aside for the time being (they will be taken up again in Section VI), we can note that this statement provides an expanded view of the role of the sexes’ contributions. The general theory of generation ought to cover all instances, and Aristotle does not shy away from facing seeming difficulties for it, particularly in unusual instances. Later, we learn that in spontaneous generation, there are no proper equivalents to the male and female roles; the efficient cause is not from another animal the same in form and the material is not a residue of any animal (*GA* 3.11, 762b4-12). Furthermore, there is a threat of parthenogenesis; several animals do not seem to have any male specimens (*GA* 2.5, 741a32-741b5) and Aristotle is aware of the worry that males might be superfluous to generation if they contribute no material (*GA* 2.5, 741a6-9). The theory of generation he puts forward requires some refinement in light of these observations. This is also the case for hybrids and their eventual reversion to the female side. In fact, the real causes of this are not revealed until Book 4. Here the story about hybrid populations serves as a way to introduce the more complicated idea that male and female principles are not simply to be seen in terms of the efficient and material causes, as has been suggested up until this point (*GA* I.21, 729b4-19, 2.1, 732a3-10), but also as body and soul (*GA* 2.4, 738b25-26).

The case of hybrids also plainly shows that the popular shorthand for Aristotle’s theory of the male imposes the form of the kind onto raw matter is incorrect.²² If this were really so, then the male would only need similar blood and a place for gestation. Instead, the crossing of a male of one form with a female of another does not result in offspring the same in form as the male. He cannot impose form on any matter. The process of successful generation to type requires that both parents be of the same form. It is also part of Aristotle’s theory that in the process of generation in particular instances, both male and female generative residues can shape parts of the body to resemble them and their ancestors (*GA* 4.3). This is what gives the hybrid animal body parts that are halfway between those of the parents (*GA* 2.4, 738b31), which makes them monstrous. They are deformed versions of

²² Li Causi (see fn. 2), 72: ‘As we know from the beginning for the passage – and from all of Aristotle’s biological works – the contribution of the female to the process of reproduction is spoken of in terms of rude matter’. For challenges to this way of characterising Aristotle’s theory of generation, see S. Follinger, *Differenz und Gleichheit in der Sicht griechischer Philosophen des 4. Bis 1. Jahrhunderts v. Chr.* (Hermes-Einzelschriften 74), Stuttgart 1996, 142-143, 178-179; A. Kosman, *Male and Female in Aristotle’s Generation of Animals*, in: J.G. Lennox and R. Bolton (eds.), *Being, Nature, and Life in Aristotle*, Cambridge 2010, 147-167 and S. Connell, *Aristotle on Generation and Hereditary Resemblance*, in S. Connell (ed.), *The Cambridge Companion to Aristotle’s Biology*, 2021, 142-158.

either kind in comparison to their parents; their bodies do not display the integration of parts that are required to live out the *bios* (i.e. way of life) of the kind of either.

In Aristotle's view, hybrid animals are failures of generation and fit to his account of monsters in *GA* 4. Any offspring that is unlike its parents is incomplete (*GA* 1.21, 729b32-33; 2.1 733b13-16) or defective (*GA* 4.3, 767b5-7). Aristotle does not call hybrids fertile, instead merely noting that they can produce young (*GA* 2.7, 746b12-14). In fact, they must be sub-fertile, because fertility is the ability to produce another like in kind which no hybrid can accomplish.²³ The focus in Book 4 is on what happens in particular instances of generation where fathers have influence at three levels; there are 'powers' (*dunameis*) at the level of kind (e.g. human or horse), sex (male) and individual (e.g. Socrates or Coriscus). Females have complementary influences at the level of sex (female) and individual (Xanthippe or Aspasia) (*GA* 4.3, 767b24-25, 768a5-9).²⁴ In the most straightforward instances, these influences compete resulting in an offspring the same in kind which is either male or female and resembles the parents. Other normal cases include influences that emerge from ancestors, which happens when the sources of changes (*kinêseis*) in the generative residues of parents 'relapse' (4.3, 768a31-768b1).²⁵ When more relapses occur, the result is furthest away from any individual and all that is left is 'human being' (the form, 768b10-12). This process of relapse can go too far and result in a loss of form, which is what occurs in some cases of monstrous generation (4.3, 768b10-30). The birth of a hybrid is slightly different from that last case because the parents are from different types of animal. It does, however, fit into the general structure of analysis here given.

Since in hybrids the parents have no form in common, the male is not able to bring about the form because the female's materials are not prepared to become that kind of body with all the relevant functions (*GA* 2.3, 737a22-24, 2.4, 740b18-20).²⁶ For this reason the offspring cannot become a member of any kind at all. The power at the level of species is inoperative. When generation fails because the female's materials poised to become one type of animal cannot be converted into another type of animal, what remains is what is most general (*to katholou malista*; *GA* 4.3, 769b13). Aristotle notes that animals which can breed together in this way must have a nearby (*suneggus*) nature (*GA* 2.8, 746a30-32). The use of the word 'genos' in this term may suggest that these animals that differ in form nonetheless

²³ Further evidence for this will be provided in Section V.

²⁴ The female brings about resemblance to her family: *kinêseis* in the female contribution overpower those from the male. See *GA* 4.3, 768a18-20; Connell (see fn. 17) 294-296.

²⁵ For translating *kinêseis* as 'sources of change' see Connell (fn. 17) ch. 9.4.

²⁶ Connell (see fn. 17) 259.

both belong to some higher grouping (*genos*).²⁷ However, is not possible to exist properly as an individual animal at that level of generality; to do so is to be monstrous. The monster is merely ‘an animal’ (*GA* 4.3, 769b9-10, 13).

The hybrid animal is a failure of generation and has no proper integrity; however, it is put together and given a shape, combined from parts of both kinds the parents come from, because of the individual powers to produce parts like the parents in their generative residues. These powers remain even though the power to produce the type are lost.²⁸

[S]ome parts [of the body] are more like those of the father, some those of the mother, and certain others of the ancestors, for the sources of change (*kinêseis*) of the parts are in them [i.e. the generative secretions], some in actuality, some potentially (768b2-5).

The hybrid is halfway between the parents, taking some parts from the female and some from the male. So, for example, mules have long ears and wide eyes like a donkey and long faces and large muzzles like a horse. This has to be explained not by the different forms of the parents²⁹ but by their dual hereditary influences.³⁰

V. Context and Content of *GA* 2.8

The first part of *GA* Book 2 explains how the nutritive capacity in the new animal directs the gradual development of the parts of the body (and details the order of this development; *GA* 2.6). Only the male’s spermatic contribution can bring about the substantial change necessary to begin this process, acting as an external cause. In this way Book 2 sees Aristotle apply his radical new theory of generation to conception and embryo-genesis. In order to complete this picture, he must cover several side issues in live-bearing blooded animals. Chapters 7 and 8 thus explain the way in which the embryo is nourished in utero (chapter 7) and delve into the anomalous occurrence of crossbreds, which can result in significant impairment in the offspring (chapters 7-8).

²⁷ Somewhat confusingly, Aristotle also says that the parent animals are not the same in *genos* (*mê homogenê*, *GA* 2.7, 746b11).

²⁸ The powers to produce male and female will also remain effective (*GA* 4.3).

²⁹ See fn. 1.

³⁰ The *kinêseis* which bring about resemblances are neither form nor matter but as *per se* causes; they relate to the parent as an individual generator. For a fuller account, see J. Gelber, *Form and Inheritance in Aristotle’s Embryology*, *Oxford Studies in Ancient Philosophy* 39, 2010, 183-212 and also Connell (fn. 17), ch.9.

GA 2.8 is principally concerned with the sterility of mules (746a29-746b11). This account can be broken down into 4 key sections, (i) Introduction to the problem; (ii) others' attempted solutions and their shortcomings; (iii) Aristotle's own solution; (iv) attempted explanation for sub-class of fertile mules (males only).

(i) Introduction to the problem of mule sterility

Aristotle doesn't treat the issues of hybrids or of sterility in their own right, but the unusual combination of both in mules. Beginning with a brief aside on the causes of human sterility (746b12-747a22), he then notes several principles that govern the occurrence of hybrids:

Γίγνεται δὲ ὁ συνδυασμὸς τοῖς ζώοις κατὰ φύσιν μὲν τοῖς ὁμογενέσιν, οὐ μὴν ἀλλὰ καὶ τοῖς μὲν σύνεγγυς τὴν φύσιν ἔχουσιν οὐκ ἀδιαφόροις δὲ τῷ εἴδει, ἐὰν τὰ τε μεγέθη παραπλήσια ἢ καὶ οἱ χρόνοι ἴσοι ᾧσι τῆς κυήσεως. σπάνια μὲν οὖν γίγνεται τὰ τοιαῦτα ἐπὶ τῶν ἄλλων, γίγνεται δὲ καὶ ἐπὶ κυνῶν καὶ ἀλωπέκων καὶ λύκων <καὶ θώων>

Copulation occurs naturally in those animals that are the same in kind, but otherwise in those animals that have a nearby nature and are not the same in form, if they are about the same in size and if their times of gestation are equal. Copulations of this sort happen rarely in the other animals, but yet they happen in dogs and foxes and wolves <and jackals> (746a29-34)

Another prerequisite for hybridization is hinted at in the reference to a proverb.

λέγεται δὲ καὶ τὸ περὶ τῆς Λιβύης παροιμιαζόμενον ὡς αἰεὶ τι τῆς Λιβύης τρεφούσης καινόν, διὰ τὸ μίγνυσθαι καὶ τὰ μὴ ὁμόφυλα ἀλλήλοις λεχθῆναι τοῦτο· διὰ γὰρ τὴν σπάνιν τοῦ ὕδατος ἀπαντῶντα πάντα πρὸς ὀλίγους τόπους τοὺς ἔχονταςνάματα μίγνυσθαι καὶ τὰ μὴ ὁμογενῆ.

[T]he proverb about Libya says that Libya is always producing something new, because it is said that those that are not of the same tribe [*mê homophula*] mate with one another. This is because, given the scarcity of water, they all meet together at the

few places which have springs, and then even those that are not of the same kind mate with each other (746b7-11).

This same proverb is also noted in *HA* (7(8).28, 606b17-607a6) in the context of explaining how character traits are affected by differences in localities. Aristotle adds this explanation for the production of hybrids: '[the parents] become mild toward each other³¹ because of their need for drink' (*HA* 606b20-21). This suggests that Aristotle did not view hybrid generation as forced like rape. The passage proceeds to focus only on mules.

Τὰ μὲν οὖν ἄλλα τῶν ἐκ τοιαύτης μίξεως γιγνομένων συνδουαζόμενα φαίνεται πάλιν ἀλλήλοις καὶ μιγνύμενα καὶ δυνάμενα τό τε θῆλυ καὶ τὸ ἄρρεν γεννᾶν, οἱ δ' ὀρεῖς ἄγονοι μόνοι τῶν τοιούτων· οὔτε γὰρ ἐξ ἀλλήλων οὔτ' ἄλλοις μιγνύμενοι γεννῶσιν. ἔστι δὲ τὸ πρόβλημα καθόλου μὲν διὰ τίν' αἰτίαν ἄγονον ἢ ἄρρεν ἢ θῆλυ ἔστιν· εἰσὶ γὰρ καὶ γυναῖκες καὶ ἄνδρες ἄγονοι καὶ τῶν ἄλλων ζώων ἐν τοῖς γένεσιν ἐκάστοις, οἷον ἵπποις καὶ προβάτοις, ἀλλὰ τοῦτο τὸ γένος ὅλον ἄγονόν ἐστι, τὸ τῶν ἡμιόνων.

Others produced from matings of this sort appear both to mate with each other again and to be able to generate both the male and the female; the mule is the only one of these to be infertile. For they generate neither by mating with each other nor by mating with other animals. There is a general problem what the reason is why male or female are infertile. For there are infertile women and men, and in each kind of the other animals, for example in horses and sheep. But in the case of mules the whole kind is infertile (746b12-20).

Finding the cause of mule sterility was obviously of interest at the time and remained so in antiquity. Aëtius's *On the Opinions of the Philosophers*, Book V (*Plac. Phil.*, 2nd century BCE) lists it among the main issues that any theory of reproduction must cover. It similarly appears in such a list in Censorinus' *Birthday Book* (*De Dei nat.*), who, writing in the 3rd century AD, shows the continued importance of the question. There would seem to be two reasons for this – one practical and the other theoretical. Practically, mules were of enormous

³¹ The word here is *prao* – tameable (*HA* 1.1, 488b22).

economic importance in an era before mechanical means of transportation.³² It was very time consuming and expensive to keep breeding them from horse and donkey parents.

Theoretically, the mule question challenges philosophers to explain what happens in the process of generation. Materialist philosophers used theories about the mixtures of male and female seeds to explain their sterility. For Platonists, the mule has a form that has to be somehow potentially present in the parents or their seed.³³ Later Platonists and Aristotelians argued about the role of forms in generation partly through the discussion of mule sterility.³⁴

(ii) Others' attempted solutions and their shortcomings.

Aristotle begins his more concentrated analysis of mule sterility by considering the views of other theorists. These can be broken down into two types of theory, physiological and philosophical. For the physiological accounts, Aristotle mentions both Empedocles and Democritus (*GA* 2.8, 747a25-748a20). Both theorists focus on the failure of the mixture of male and female seeds in their explanations. Aristotle takes time to refute the specificities of their theories, which are principally based on disagreements about whether the empirical evidence supports their theoretical viewpoints.

Aristotle calls the other approach 'the abstract argument' (ἀπόδειξις λογική). For Aristotle, this means that the theorists are employing a dialectical or rhetorical argument³⁵ and not providing a properly scientific explanation.³⁶ Bolton compares the present passage to *GA* 729b8ff. which contrasts arguing 'according to a general account' (*kata ton logon katholou*) with arguing 'aiming at a task' (*epi ton ergon*). The former argument he takes to be dialectical, relying on reputable opinions (*endoxa*) and so lying "outside the procedures for the justification of results laid down in his Posterior Analytics".³⁷ This division can also be expressed in terms of methods which proceed 'in an abstract manner' (*logikos*; *Ph.* 3.5, 204b4; 8.8, 264a8) as opposed to those which proceed 'in a natural manner' (*phusikos*); or more properly 'in an analytical manner' (*analutikos*).³⁸ In a rhetoric context, the aim is to

³² di Causi (see fn. 2) 383-387.

³³ See Ascepius *Commentary on Aristotle's Metaphysics* 404, 3-31 as cited in Wilberding, J., *Forms, Souls and Embryos: Neoplatonists on Human Reproduction* (Routledge), London, 2016, 75-7.

³⁴ Wilberding (see fn. 33) 76-77, 162-163.

³⁵ *de An.* 403a2 substitutes *dialectikos* for *logikos*. See R. Bolton, *Definition and Scientific Method in Aristotle's Posterior Analytics and Generation of Animals* in: Allan Gotthelf and James Lennox (eds.), *Philosophical Issues in Aristotle's Biology* (Cambridge University Press), Cambridge 1987, 120-66 at 162n58.

³⁶ See also Charlton, W., *Aristotle Physics Books I and II* (Clarendon), Oxford 1970, ix-xi.

³⁷ Bolton (see fn. 22) 162.

³⁸ *A Po.* 1.22, 84a7-8; Cf. *GC* 3.7, 316a5-14

convince as many of your audience as possible and so the most generally known and accepted premises are appropriate.³⁹ At times, more general and abstract points of view are useful in natural science.⁴⁰ At other times, such as now, this perspective is superseded by principles closer to the subject matter.⁴¹ It is clearly important for the student of nature to be able to guard against a theory that is persuasive (*pithanê* 747b28) but wrong because it employs an inappropriate general principle (748a7-10).⁴² In order to explain mule sterility, Aristotle will turn to natural facts about horse and donkey parents. Before detailing his own solution, he refutes the position of the abstract argument.

Ἴσως δὲ μᾶλλον ἂν δόξειεν ἀπόδειξις εἶναι πιθανή τῶν εἰρημένων λογική—λέγω δὲ λογικήν διὰ τοῦτο ὅτι ὅσῳ καθόλου μᾶλλον πορρωτέρω τῶν οἰκείων ἐστὶν ἀρχῶν. ἔστι δὲ τοιαύτη τις· εἰ γὰρ ἐξ ὁμοειδῶν οἰκείων ἐστὶν ἀρχῶν. ἔστι δὲ τοιαύτη τις· εἰ γὰρ ἐξ ὁμοειδῶν ἄρρενος καὶ θήλεος ὁμοειδὲς γίνεσθαι πέφυκε τοῖς γεννήσασιν ἄρρεν ἢ θήλυ, οἷον ἐκ κυνὸς ἄρρενος καὶ θήλεος κύων ἄρρην ἢ θήλειαν, καὶ ἐξ ἐτέρων τῶν εἴδει ἕτερον τῶν εἴδει, οἷον εἰ κύων ἕτερον λέοντος, καὶ ἐκ κυνὸς ἄρρενος καὶ λέοντος θήλεος ἕτερον καὶ ἐκ λέοντος ἄρρενος καὶ κυνὸς θήλεος ἕτερον· ὥστ' ἐπειδὴ γίνεταί ἡμίονος ἄρρην καὶ θήλυς ἀδιαφόρων ὄντων τῶν εἴδει ἀλλήλοισι, γίνεταί δ' ἐξ ἵππου καὶ ὄνου ἡμίονος, ἕτερα δ' ἐστὶ τῶν εἴδει ταῦτα καὶ οἱ ἡμίονοι, ἀδύνατον γενέσθαι ἐξ ἡμίονων· ἕτερον γὰρ γένος οὐχ οἷόν τε διὰ τὸ ἐξ ἄρρενος καὶ θήλεος τῶν ὁμοειδῶν ταύτῃ γίνεσθαι τῶν εἴδει, ἡμίονος δ' ὅτι ἐξ ἵππου καὶ ὄνου γίνεταί ἐτέρων ὄντων τῶν εἴδει, ἐκ δὲ τῶν ἐτέρων τῶν εἴδει ἕτερον ἐτέθη γίνεσθαι ζῶον. οὗτος μὲν οὖν ὁ λόγος καθόλου λίαν καὶ κενός· οἱ γὰρ μὴ ἐκ τῶν οἰκείων ἀρχῶν λόγοι κενοί, ἀλλὰ δοκοῦσιν εἶναι τῶν πραγμάτων οὐκ ὄντες. οἱ γὰρ ἐκ τῶν ἀρχῶν τῶν γεωμετρικῶν γεωμετρικοί, ὁμοίως δὲ καὶ ἐπὶ τῶν ἄλλων· τὸ δὲ κενὸν δοκεῖ μὲν εἶναί τι, ἔστι δ' οὐθέν. οὐκ ἀληθὲς δέ, ὅτι πολλὰ τῶν μὴ <ἐξ> ὁμοειδῶν γενομένων γίνεταί γόνιμα καθάπερ ἐλέχθη πρότερον. τοῦτον μὲν οὖν τὸν τρόπον οὔτε περὶ τῶν ἄλλων δεῖ ζητεῖν

³⁹ *Soph. Ref.* 172a29; *Top.* 1, 105b30, 8, 155b7-10, *Metaph.* 4.2, 1004b22-26.

⁴⁰ *GA* 2.7, 746a23-25, 3.10, 759a24-27; *Ph.* 3.5, 204b1-11; A. Falcon and M. Leunissen: *The Scientific Role of Eulogos in Aristotle's Cael.* II 12 in: D. Ebrey (ed.) *Theory and Practice in Aristotle's Natural Science* (Cambridge University Press), Cambridge 2015, 228.

⁴¹ *GA* 4.1, 765b4-6; Lloyd 1987, 62; see also Balme (see fn. 3) 165 and Connell 2016 (see fn. 17) 72-80

⁴² This opponent has been too hasty in applying a general principle without investigating everything that falls under it. This is exactly the same criticism that Aristotle has of Democritus in *GA* 5.8 (788b10-12). I would like to thank Jim Lennox for pointing out this similarity.

οὔτε περὶ τῶν φυσικῶν· ἐκ δὲ τῶν ὑπαρχόντων τῶ γενεὶ τῶ τῶν ἵππων καὶ τῶ τῶν ὄνων θεωρῶν ἄν τις μᾶλλον λάβοι τὴν αἰτίαν,

Perhaps an abstract proof would seem to be more persuasive than those we have been talking about. I say 'abstract' for this reason: that the more general it is, the further away it is from the appropriate principles. It is something of this sort. For if from a male and female which are the same in form an offspring the same in form to the begetters is naturally generated (either a male or a female) - for example from a male and female dog, a male or female dog - and from two begetters different in form an offspring different in form <from them>, for example from a female dog and a male lion and from a male dog and a female lion something different <comes to be>. Thus since male and female mules come to be, not being different in form to each other, a mule coming to be from a horse and a donkey, both being different in form to mules, it is impossible to generate from mules. For a different kind (*genos*) is not possible because that which comes from male and female of the same form comes to be the same in form, and a mule comes to be from horse and donkey which are different in form and an animal will be generated as different from those that are different in form. However, this argument is too general and thus empty. For empty arguments are not derived from the appropriate principles, but only seem to be about these things but are not. That which is geometrical derives from geometrical principles, and likewise with other matters. The empty might appear to be something, but it is nothing. And it is not true; many animals that come to be from parents differing in form become fertile as has been said already. This manner of proceeding must not be undertaken in inquiry about natural objects or about other things. We are more likely to grasp the causes by examining what occurs in the horse kind and in the ass kind (747b27-748a7).

According to the abstract argument, (1) the definition of mule as product of horse + donkey, means that two mules can't produce a mule. But neither can (2) the offspring of two mules not be a mule, since two animals of same in form (*eidōs*) always produce an animal of that form (*eidōs*).

Aristotle's first reply is that this argument applies to all hybrids when in fact the vast majority are able to generate.⁴³ The same logic makes it that, for example, dog and fox = dox. A dox by this reasoning must be infertile, since dox + dox should = dox, but can't because a dox is something produced exclusively by dog and fox. But doxes are fertile after all. The second issue is that it disregards many facts. Any hybrid animal, although it might mate with another hybrid, is most likely (given the hybrid's rarity) to mate with one or other of the types its parents were from. So the dox will not mate with another dox but rather with a dog or a fox – and the resulting offspring would not be, strictly speaking, like a first generation dox. If doxes mate with dogs or foxes then they cannot produce doxes. But what if a dox mates with another dox; why wouldn't their offspring (given that they are able to produce young) be a dox? If this could happen, then, as Pellegrin and others thought, a type or form of animal would have been created. But Aristotle is emphatic that there can be no new species of dox; instead after some generations, the resultant animals will tend toward the form (*morphê*) of the female (2.4, 738b26-36; see also Section IV). This means that a dox that mates with another dox will produce offspring that look a little bit more like a fox than they do. For any generation of dox, then, it will be unlike its parents. This reinforces, then, the fact that dox cannot be a form or species since they are unable to produce another like themselves (*GA* 2.1, 735a17-18). This conclusion also fits with a passage in *GA* 1.1 where Aristotle explains that if a parent produces an offspring that is not like itself in form, this type of generation cannot continue in that manner. If waste animals are produced which are dissimilar to their originators, they shouldn't be able to mate because their offspring would be dissimilar and so on *ad infinitum* (715b12-16). The explanation is that 'nature flies from the indefinite (*apeiron*) because the indefinite is incomplete (*ateles*) and nature always seeks the end/completion (*telos*)'.⁴⁴ In the case of hybrids, there can be a second and third generation, but rather than an infinite number of types, in the not too distant future,⁴⁵ we get fox (the mother's type).⁴⁶

⁴³ In actual fact, this is not true. Many hybrids are sterile (see Hybrid. [U*X*L Complete Life Science Resource](https://www.encyclopedia.com/social-sciences/applied-and-social-sciences-magazines/hybrid). Retrieved March 29, 2019 from Encyclopedia.com: <https://www.encyclopedia.com/social-sciences/applied-and-social-sciences-magazines/hybrid>). Aristotle must have had in mind animals that were from the same species, such as dogs and wolves.

⁴⁴ 715b14-16; for other places where Aristotle associates limit with *telos* see: *Metaph.* 2.2, 994b9-16, 12.8, 1074a29-31, *A Po.* 85b29-30, *EN* 1094a18-21; M. Johnson, *Aristotle's Teleology* (Clarendon), Oxford 2005, 86 and Balme (see fn. 3) 129.

⁴⁵ Groisard (see fn. 8) 161.

⁴⁶ It is not clear that we do actually get to the original female's form. This issue will be more fully explored in Section VI below. In other cases, there seems to be a limit of three generations, as in bees (*GA* 3.10, 760a33-760b1).

In Aristotle’s refutation of the ‘abstract argument’ we see him explicitly dismissing his opponent’s presumption that a hybrid has a form.⁴⁷ This is part of their mistake; they attempt to define mule. Aristotle argues in his *Analytics* that definitions must specify the essence – causally necessary features that make something what it is. The abstract argument’s definition of mule as (1) ‘product of horse + donkey’ is a very inadequate with respect to that description. ‘Product of horse + donkey’ is not a definition of that kind but, rather, a contingent marker for a concept (‘mule’) which labels something temporary. It would be foolhardy, given this, to seek to use such definitions in serious philosophical and scientific contexts; there can be no demonstrations about mules.⁴⁸ Although mules (and other hybrids) have a principle, a heart, and live, they are not proper substances because they are not part of a universal and eternal kind, maintained through continuous generation (see Section VI).

(iii) Aristotle’s solution

For Aristotle mule sterility is based in particular facts (*GA* 2.8, 748a14-31 *tôn huparchontôn*) about the parent kinds: horse and donkey. These facts are ones that Aristotle sets out in terms of his own theories and observations about generation. These animals as already prone towards being infertility due to the coldness of their generative contributions.

ὄντος δ’ ὡσπερ εἴρηται ψυχροῦ τὴν φύσιν καὶ τὴν γονὴν ἀναγκαῖον εἶναι τοῦ τοιούτου ψυχράν. σημεῖον δὲ τούτου· διὰ τοῦτο γάρ, ἐὰν μὲν ἵππος ἀναβῆ ἔπι ὠχευμένην ὑπὸ ὄνου οὐ διαφθείρει τὴν τοῦ ὄνου ὀχείαν, ὁ δ’ ὄνος ἐὰν ἐπαναβῆ διαφθείρει τὴν τοῦ ἵππου διὰ ψυχρότητα τὴν τοῦ σπέρματος. ὅταν μὲν οὖν ἀλλήλοις μιχθῶσι σώζεται διὰ τὴν θατέρου θερμότητα· θερμότερον γὰρ τὸ ἀπὸ τοῦ ἵππου ἀποκρινόμενον· ἢ μὲν γὰρ τοῦ ὄνου ψυχρὰ καὶ ἡ ὕλη καὶ ἡ γονή, ἢ δὲ τοῦ ἵππου θερμότερα. ὅταν δὲ μιχθῆ ἢ θερμὸν ἐπὶ ψυχρὸν ἢ ψυχρὸν ἐπὶ θερμὸν συμβαίνει αὐτὸ μὲν τὸ ἐκ τούτων κῆμα γενόμενον σώζεσθαι καὶ ταῦτ’ ἐξ ἀλλήλων εἶναι γόνιμα, τὸ δ’ ἐκ τούτων μηκέτι γόνιμον ἀλλ’ ἄγονον εἰς τελειογονίαν.

⁴⁷ The use of the word for ‘form’ (*eidōs*) occurs throughout the abstract argument (747b27-748a7); it is not a word Aristotle himself uses of hybrids.

⁴⁸ Arguably the palpable connections between *GA* 2.8 and *GA* 4.3-4 means that this discussion has already moved away from teleological explanations and begun to focus on material necessity. This is the best way to approach mules because they do not have essences; each one must be treated as an individual anomaly and thus Aristotle here employs the methods he uses extensively in *GA* IV and V to account for differences in development in particular instances of generation. Connell (see fn. 17) 236-237; see also Lefebvre and Corcilius in this volume.

Being, as was said, in its nature cold, the semen of such an animal must also be cold. A sign of this is that, for this reason, if a horse mounts a female that has already mated with a donkey, it does not destroy the mating of the donkey. But if a donkey should mount after, it does destroy the horse's <mating> because of the coldness of the <donkey's> semen. So when they mate with one another, <the conceptus> survives due to the heat of one of them, for the horse's secretion is hotter. For the matter and the seed of the donkey are cold and those of the horse are hotter. When they join together either the hot to the cold or the cold to the hot, this happens: the embryo coming to be from them survives and they are fertile with each other, but that from these is not fertile but infertile with respect to completing generation (748a31-748b7)

Aristotle is careful to use semen (*gonê*) and seed (*spermatos*) of only the male contribution. The phrase 'the matter and the semen' (748b3) indicates both male and female residues. In order for conception to take place, at least one of these contributions must be hot enough. The relative coldness of the male donkey's contribution is proven by the fact that a male horse's semen does not destroy a fetation while a male donkey's does.

In the case of female donkey mating with male horse, it is the heat of the male semen that ensures the viability of the foetus. In the case of a male donkey mating with a female horse, it is due to the heat of the female contribution ('the cold added to the hot'). 'Both the semen and the matter are hotter in the case of the horse; with the donkey both are cold' (748b3-4). Thus, in the most common case of mule production, when a male donkey is mated to a female horse,⁴⁹ the female contribution to generation is hotter than the male one and ensures the viability of the foetus. One might worry that this contradicts Aristotle's theory of generation in indicating that the female and not the male contribution is hotter and initiates generation. There is only a dilemma here if when a mule is produced from a female horse and a male donkey, the male is the formal and efficient cause of generation. This is not, however, the case in the particular context.

The general account of generation, in which the male contribution is hotter than the female, applies when both parents are from the same species. In an anomalous failure to reproduce to type, as in hybrids, there is no formal or (proper) efficient cause. The male donkey fails when it mates with the female horse – it cannot make another like itself. There is

⁴⁹ Li Causi (see fn. 11) 2.

no formal cause of this occurrence and so there is also no proper or intrinsic efficient cause.⁵⁰ Since the efficient cause is accidental, there is no reason why it could not come from the heat of the female horse's spermatic contribution. The fact that the female's contribution in this case is hotter also fits to Aristotle's theory of temperature and blood. Each type of animal has a generative residue specific to it, having been derived from its specific blood, which will be of a certain temperature.⁵¹ Since horses are hotter animals than donkeys, it is understandable that the female horse's menstrual fluid is hotter than the donkey's semen.

The case might be compared to what occurs in spontaneous generation where there is also no formal cause. In such cases, the efficient cause of generation is not connected to the form/soul of any animal but brought about by the heat of the environment (*GA* 3.11, 743a35-36). The character of the offspring is determined by the materials, for example shellfish are like the type of mud they emerge from (*HA* 5.15, 547b18-23).⁵² That the *morphê* of spontaneously generated animals is determined by the materials may remind us of the stronger influence of females on a hybrid population's appearance (*GA* 2.4). However, hybrid cases differ from spontaneous ones insofar as there are parents involved. Perhaps one might think that the only parent that contributes is the female; it is the one with the materials which will form the body of the offspring and, in the case of a female horse mating with a donkey, it also provides the heat necessary for the initiation of generation. And, as we know from the *GA* 2.4 passage, hybrid populations will end up looking more like the original female (here, the horse).

The case may, then, be more similar to parthenogenesis. If female-only species could generate, as Aristotle speculates, then the usual material cause would be present, the materials that the female animal's body have prepared to become like the parts required for her way of life. However, this is again not quite the same as hybridization, since there is a male contribution, without which generation does not occur. Female horses cannot produce mules all on their own. What, then, is it that the male contributes if not the impetus or the materials? To understand this more fully, we must go back to Aristotle account of hereditary resemblances and the processes that lead to monsters (*GA* 4.3-4). Hybrid animal, as Aristotle made clear earlier in *GA* 2.4, have parts from both parents. The explanation for this is not that the male contributes half the form and the female the other half or that they together create a new form between the two (as the first set of interpretations suggested) but that the male

⁵⁰ S. Sauvé Meyer, Aristotle, Teleology, and Reduction, *The Philosophical Review* 101/4, 1992, 791-825.

⁵¹ *Metaph.* 1044a34-1044b2, *GA* 2.1, 733b32; Connell (see fn. 17) ch. 4.5.

⁵² Cf. *GA* 3.11, 762a24-32; *HA* 5.19, 552a29-552b10.

parent has influence as an individual. This analysis is then reinforced by the final section of Aristotle's account of mules, his discussion of the occasional fertility of the male mules.

(iv) Attempted explanation for sub-class of fertile mules (males).

Aristotle ends *GA* 2.8 with more information about the occasional fertility of male mules (introduced at 747b25) and the stunted offspring they manage to bring into being (748b31-749a6). The female mule, he adds, is always sterile because it is unable to complete generation (747b25-26, 748b19-31). The female's role, as we know, includes nourishing the foetus throughout gestation (*GA* 2.6). The male mule's success, then, could only occur with a female horse which is able to complete the offspring.

ὁ δ' ἄρρην ποτὲ γεννήσειεν ἂν διὰ τε τὸ θερμότερον εἶναι τοῦ θήλεος φύσει τὸ ἄρρην καὶ διὰ τὸ μὴ συμβάλλεσθαι πρὸς τὴν μίξιν σῶμα μηδὲν τὸ ἄρρην. τὸ δ' ἀποτελεσθὲν γίνεταί γίννος. τοῦτο δ' ἐστὶν ἡμίονος ἀνάπηρος· καὶ γὰρ ἐκ τοῦ ἵππου καὶ τοῦ ὄνου γίνονται γίννοι ὅταν νοσήσῃ τὸ κύημα ἐν τῇ ὑστέρα. ἔστι γὰρ ὁ γίννος ὡσπερ τὰ μετάχοιρα ἐν τοῖς χοίροις·

The male occasionally will generate because the male is naturally hotter than the female and because the male does not contribute anything bodily to the mixture.

What comes to be in the end is a *ginnos*: this is a stunted mule. For *ginnoi* come to be from a horse and a mule when the foetation is affected by a diseased uterus because the *ginnos* is like the 'afterpig' in pigs (748b31-749a2).

Aristotle thinks that the male mule can generate but it does not have a form; forms are self-perpetuating and mules cannot produce mules, as we have seen. So what is the male mule contributing when it mates with a female horse? As in other hybrid cases, the male does not contribute the proper efficient cause linked to form. It does, however, contribute the individual differences that result in some kind of superficial resemblance.

The offspring of a male mule and a female horse is called a 'ginnos'. Aristotle uses *ginnos* of three different animals, linked only by a certain external resemblance. In this passage, it labels the stunted mule-like animals that are the product of a male mule and a horse (*GA* 2.8). The term connotes one true species, the fertile Syrian mule-like animals (*HA* 1.6, 491a2-6). It is also used of genetically full horses whose development has been stunted,

due to constriction in the uterus (*HA* 6.24, 577b25-26). This last example suggests that the female horse's menses have contributed more to the appearance and bodily features of the hybrid ginnos than the male mule's. This makes sense since the male mule's individual features are going to include ones that are horse-like as well as one's that are donkey-like. Thus the offspring will look more like a horse than a donkey. However, it will not have a form; it cannot get this from its mother and the male mule has no ability at all to generate properly speaking; there is no possibility for it to do so, not itself having any form or belonging to any kind.

VI. Puzzles about resemblance and form

Hybrids certainly are a case of the form having been lost, as the contamination view emphasises. This, then, leaves us with a question about the bodies of hybrid animals and how they can exist and live without forms. Let's return to consider the population of hybrid animals Aristotle uses as an example in *GA* 2.4. The most plausible way to read this example is as a rare occurrence whereby a whole group of hybrid animals become separated off from the types to which their parents belong, to breed with each other. In this situation, after some generations 'the end result is the shape (*morphê*) of the female, like seeds planted in foreign soil' (738b33-35). Not only the form, which is lost in the first generation, but also the individual influences of the original male animals are eventually lost. Imagine that we have 40 doxes, each with male dog parents and female fox parents. Let's say after four generation, these animals will all resemble foxes (there will be, inevitably both male and female animals). The first puzzle here is why Aristotle should think that the individual influences that make each dox look like it's male parent would be lost. The second puzzle is how it can be that these animals are not now foxes. I will take each in turn.

The first problem is exactly the one that Aristotle thinks is solved by the fact that the male animal contributes nothing bodily to generation. However, without the fuller account of the process of generation at an individual level in *GA* 4, this point is obscure. Perhaps it is something that his more advanced students would see straightaway and that would puzzle the junior cohort and inspire them to read on. The way it must work is this: in hybrids, there is no proper efficient causation, since form is not present in the offspring, and it is a deformed animal. Since that is the case, the female contribution of the materials that are potentially like the animal kind she belongs to exert more influence in the long run. Thus, although in the first generation, the animal resembles both parents equally, based on the dual individual influences, at the next generation, there is no pure dog parent to contribute those dog-like

parts. But more importantly, there is no dog-form to directly influence development of a dog body to match that form. The form being lost at the first generation, means it is not present at the second or third generation either. In that initial population of doxes, the bodies of the animals come from the female menstrual blood, which is poised to become a fox. This then exerts more influence in the second generation. The body of the first generation dox has come from the female fox. The appearance of dogness does not come from any material contributed but by the influence of the male parent as an individual, which is much more superficial. The next generation doxes all have their bodies from female foxes, so the contingent differences in the appearance of the parts are more strongly grounded on the female side: it is not that the female animal in the second generation will have a stronger influence on individual inheritance (both male and female doxes will have resemble both dogs and fox parents), it is that the parts that are like the original female (fox) will win out in the battle for inherited resemblances, over the parts that are like the original male (dog).

Superficial differences are somehow grounded in the body. The comparison with seeds sown in foreign soil hinted at by Aristotle in *GA* 2.4 Aristotle and further elaborated by his student Theophrastus, may help us to conceptualise this.

έν δέ τοῖς ἐπετείοις σπέρμασι πανταχοῦ πρὸς τὴν χώραν ἢ μεταβολὴ γίνεται πλήν οὐκ εὐθὺς σπαρέντων, ὀλίγος γὰρ ὁ ἐν τῇ γῆ χρόνος, ἀλλὰ τρίτῳ δὴ ἔτει· τότε γὰρ ἀλλοιοῦται πρὸς τὴν ἐκτελείωσιν ὥσπερ καὶ τὰ ζῶα. καὶ γὰρ ταῦτα τριγωνήσαντα συνεξομοιοῦται· οὐ μὴν ἀλλ' ἐπίδηλόν γέ τι ποιεῖ καὶ ὁ πρῶτος ἐνιαυτός.

In grains the change is in all countries in the direction of the regional character, except that it does not occur at the first sowing, since the time spent in the ground is too short, but only in the third year, for it is then that the plant undergoes the alteration that gives it its final character, as with animals too, which also become assimilated in three generations. Still even the first year produces a noticeable difference (*CP* I.9.3, 3-11)

When seeds are planted in a new locality, the regional soil becomes the body of the plant. When the plant keeps generating in that environment, it will take after the characteristics of this nourishment. So also, the body of the first fox to mate with a male dog provides the

materials that will subsequently continue to constitute the bodies of animals in subsequent generations. Thus, these will take on the character of that material.

This leads us to the second and more pressing puzzle. Let's consider this isolated population after many generations. Is it really the case that the form has been lost? One might think that, in fact, the form fox is evident and has been rescued and indeed, that the female had contributed this form in the final analysis, if not initially. Of course, Aristotle is adamant that only the male animal can ensure generation to type (*GA* 2.1). But perhaps what we have here is empirical proof that that is not the case. Why wouldn't animals with a fox body have the form fox?⁵³ It appears to be that their fox-like bodies facilitate 'the full complement of an animal's activities organised around the single goal of its specific way of life [*bios*]'.⁵⁴ What is the form of fox except the capacity to carry out a fox-like life, sensing like a fox, using their bodies to locomote, hunt, interact with one another etc. as most foxes do?⁵⁵ These fox-like animals will have the bodies of foxes and be living the life of foxes. What prevents them from have fox forms?

To find an answer to this puzzle we have to look to Aristotle's metaphysics and the ultimate reasons for animal generation.⁵⁶ The only way that an individual animal can share in the immortal and divine is by producing another like in form to itself (*GA* 2.1, 731b31-732a2), which its generative soul strives to achieve (*de An.* 2.4, 415a25-b7). That there be this eternal continuity of generation to type is not just good for the individual but also for the universe as a whole.⁵⁷ Eternal lineages ground all the change in this world including changes brought about by individual souls. It is only through eternal generation that individual living things have any proper 'being' (*ousia*).⁵⁸ Aristotle had urged against Plato and others that

⁵³ This is a speculation made in Connell (see fn. 17) 154.

⁵⁴ Lennox, J.: Form, Essence and Explanation in Aristotle's Biology in: G. Anagnostopoulos (ed.) *A Companion to Aristotle* (Blackwell), London 2009, ch. 22, 355.

⁵⁵ Ἐπεὶ δὲ τὸ μὲν ὄργανον πᾶν ἕνεκά του, τῶν δὲ τοῦ σώματος μορίων ἕκαστον ἕνεκά του, τὸ δ' οὐ ἕνεκα πράξις τις, φανερόν ὅτι καὶ τὸ σύνολον σῶμα συνέστηκε πράξεώς τινος ἕνεκα πολυμεροῦς. Οὐ γὰρ ἡ πρῆξις τοῦ πρῖνος χάριν γέγονεν, ἀλλ' ὁ πρῖων τῆς πρῖσεως· χρήσις γάρ τις ἡ πρῖσις ἐστίν. Ὡστε καὶ τὸ σῶμά πως τῆς ψυχῆς ἕνεκεν, καὶ τὰ μόρια τῶν ἔργων πρὸς ἃ πέφυκεν ἕκαστον. 'Since every instrument is for the sake of something, each of the parts of the body is for the sake of something, and what they are for the sake of is a certain action... So the body too is in a way for the sake of the soul, and the parts are for the sake of the functions in relation to which each of them has naturally developed'. *PA* 1.5, 645b15-20, trans. J. G. Lennox, *Aristotle On the Parts of Animals I-IV* (Clarendon) Oxford 2001.

⁵⁶ I would like to thank Diana Quarantotto for pointing this out to me.

⁵⁷ Henry, D.: *Matter, Form and Moving Causes: Aristotle's Hylomorphic Theory of Substantial Generation* (Cambridge University Press), Cambridge 2019, ch. 9.

⁵⁸ Quarantotto, D.: A Dynamic Ontology: On How Aristotle Arrived at the Conclusion that Eternal Change Accomplishes Ousia, in: M. Leunissen (ed.), *Aristotle's Physics: A Critical Guide*, Cambridge 2015, 162-185 at 171-2, 182-4

forms need not be separate in order to be eternal but without separation they are eternal only if continuous and uninterrupted generation to type is guaranteed, only if ‘human generates human’ (*Metaph.* 1.6, 987a29-b18, 3.2, 997b5-12, 7.8, 1034a2-5). If he were to accept an interruption in the manifestation of form from one generation to another in living beings, he will have to give up their reality and metaphysical status as ‘beings’. To exist properly through change is to return back upon itself specifically (*GC* 2.10, 338a1ff.).⁵⁹ The problem with these fox-like animals is that there is a discontinuity between the generation of the original fox and the eventual population of fox-like animals. Thus, Aristotle has to say that the fox-like animals that remain do not have fox forms. More oddly still, he will have to think that they do not properly exist, because they are not connected to an eternal lineage. For Aristotle, reproducing another like oneself is part of an animal’s essence (2.1, 735a17-19). Thereby do these later hybrid populations have more in common with spontaneously generated living being than was at first apparent. Both sets of living things are also less capable of existing *per se* due to the way in which they are generated. The contamination views’ assessment that these fox-like living beings are ‘raw matter’ has a ring of truth to it.

VII. Conclusions

I have argued that mules and other hybrids do not have forms. A hybrid is a monster, which for Aristotle is only generically (and not specifically) an animal (*zoên* – *GA* 4.3, 769b9, 13). Aristotle needs for the matter contributed by the female in higher animals to be poised to become all the functional parts of the body – but he also needs it to be the case only the male, acting as efficient cause of substantial generation, be able to bring this about. He simply cannot allow that forms in nature ever come to exist accidentally. Without a male animal serving as the efficient cause of substantial generation, all we are left with is (very) complex unnatural material processes.

Another interesting conclusion about male and female in generation can be inferred from Aristotle’s account of hybrids. The effect of the maternal materials on hereditary resemblance noted in the case of hybrid populations is also applicable to non-hybrid populations. Let’s consider 40 couples: all the men have snub noses and red hair and all the women have straight noses and brown hair. Since the effects noted in *GA* 2.4 are explained by individual hereditary influences, the first generation of this mixture should see a number of children with a combination of these features (snub nosed brunettes and straight nosed red

⁵⁹ Peck, A. Aristotle *Generation of Animals* (Harvard), Cambridge, MA. 1942, 574

heads). But eventually, after many generations, those people will all be straight haired brunettes like the original women. This sort of thing is extremely unlikely to happen naturally or spontaneously in animal populations. It would be vanishingly rare for a whole group of male animals with one variation in appearance (e.g. dark coat colour) to encounter and mate with a whole group of female animals with a contrasting variation in appearance (light coat colour). But such a happening is part of the structure of war and conquest in the ancient world. This suggests a human narrative may actually lie behind Aristotle's empirical case in *GA* 2.4. The men who conquer a region, killing the men and 'marrying' the women, may find that after several generations, the children will look like the people of that region. This effect can be mitigated if the men do not remain that area but bring the women back with them, to integrate with their own people.⁶⁰

Aristotle's assumption that the greatest influence in resemblance is to the female parent's side of the family is striking.⁶¹ There is some truth, then, in the idea that there is a loss of the male bloodline, or at least its external appearance; this seems an inevitable consequence of Aristotle's new vision of male influence as entirely immaterial. Bodies, and particularly the ways in which bodies with the same form differ due to inessential particulars like nose shape and hair colour, are material accidents (*GA* 5). For Aristotle, these aspects of a person are not important; they are merely superficial (e.g. *Metaph.* 11.9, 1058b3-5). If a person is the sort of man who cares about the legacy of their nose shape, then he can concentrate on the fate of his daughter's children in the hopes that she will secure this resemblance for him.⁶² But being a man this person is to be encouraged, thinks Aristotle, to take pride in the fact that only male animals can ensure species eternity and the proper 'being' (*ousia*) of the individual (*GA* 2.1, 732a3-6).

⁶⁰ The saying that Libya always produces something new may also indicate a comment on human practices. In the *HA* passage, the different types are said to be 'not from the same tribe' (*mē homophula*). The saying, then, may well mean that people coming from different tribes tend to intermarry in Libya, since the climate makes them friendlier towards to each other. It is quite likely that Greek colonies in Libya, such as Cyrene, interacted a good deal with people from indigenous cultures.

⁶¹ *Rhetoric* 2.15, 1390b22-31 on the degeneration of people is compared to 'things that come from the land'. As Leunissen puts it: 'the causes of familial resemblances in the material features between parents and offspring should primarily be sought in the properties of the mixture of the blood that the offspring receives from its mother'. M. Leunissen, *From Natural Character to Moral Virtue in Aristotle*, Oxford 2017, 103.

⁶² In the example of the woman from Elis who had an Ethiopian partner, that man's daughter eventually produces a grandchild resembling him (*GA* 1.18, 722a8-11).

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