

Females in Aristotle's EmbryologyJessica Gelber¹

(Penultimate draft. Please use published version if citing.)

1. Introduction

How does Aristotle view the production of females? According to what I will call the “standard reading,” Aristotle thinks that a female birth is a failure. There are a number of variations of this reading,² but the central claim that the various versions have in common is that a female is the result of a defective teleological process. For instance, Marguerite Deslauriers reports that Aristotle considers females to be “defective in the sense that if the form from the male parent had been transmitted as it should have been, male offspring would have resulted.”³ Karen Nielsen claims that Aristotle “conceives of individual female animals as the result of an incomplete, and therefore failed, teleological process.”⁴ According to Gareth Matthews, “males are supposed to be successes, and females failures.”⁵

That Aristotle thinks that females are the results of thwarted causal processes is the prevailing view. Despite its prevalence, however, it is not a view Aristotle ever explicitly expresses in his biological account of animal generation. As we will see, that view blatantly contradicts what he does explicitly say about female births.

An alternative to the standard reading, offered by Devin Henry, paints a very different picture. On Henry's interpretation, the production of a female is not due to a failed causal process. Rather, the embryo's sex is determined solely by “non-teleological necessity,” which Henry glosses as the necessity “attached to the interactions between material forces which do not occur for the sake of their end (e.g.

¹ I would like to thank the editors for their suggestions for improvement, as well as the participants at the conference in Paris. I am also grateful to Kathleen Cook, Marguerite Deslauriers, Vanessa de Harven, Joseph Karbowski, Jim Lennox, Nathaneal Stein, Stasinos Stavrianeas, and Jennifer Whiting for their helpful written comments and discussion.

² Not all proponents of the standard reading, for example, think that females do not share the species-specific forms of their male counterparts. (Human women are, after all, still *human*.) Many scholars interpret Aristotle to be claiming that females realize that form in an impoverished or defective way. For a critique of the standard view in connection with Aristotle's ethics and politics, see Karbowski 2012.

³ Deslauriers 1998: 159.

⁴ Nielsen 2008: 374.

⁵ Matthews 1986: 23. See also Witt 2012:102-4.

when cold air acts on the surface of a pond forming ice).⁶ According to this “alternative account,” as I will call it, Aristotle’s biological explanation is neutral with respect to the sex of the embryo; successful generation requires only that the offspring be one sex or the other.

This alternative account, as I will argue, also misrepresents Aristotle’s view. Aristotle does not say that sexual determination is due merely to the interaction of material forces. The explanation Aristotle gives is more sophisticated—and less egalitarian—than “material necessity” suggests.

Here I will argue for a third option. Although I do not think the cause of sexual determination is “material necessity,” I agree with Henry that, considered at the level of species-form transmission, the process of animal generation does not aim at producing males.⁷ However, there is more than one level at which Aristotle considers generation. As I understand the details of the mechanism by which sex is determined—the motions and potentials (κινήσεις and δυνάμεις) that Aristotle discusses in *GA* IV—males are in a certain sense the “default” result.⁸ But, as I will argue, the way in which Aristotle privileges the mechanisms for producing males is consistent with females not being teleological failures. This interpretation better coheres with the texts than either the standard reading or Henry’s alternative account, and it avoids attributing conflicting views to Aristotle.

2. The Standard Reading

Because it is so common, I am going to assume that the standard reading is familiar. In broad brushstrokes, this reading ascribes to Aristotle the view that generation is “teleologically directed toward the production of male rather than female animals.”⁹ In order to assess the textual evidence for this reading, it is important to distinguish the claim that Aristotle views the production of females to be

⁶ Henry 2007: 257, n. 18.

⁷ I will assume here that the concept of form employed in Aristotle’s embryology is the same, species-level form as he employs in his *Metaphysics*, at least as traditionally understood. If one thinks, like Balme 1987, that the concept of form in biology is that of an individual (sub-specific) form, which includes not only sex but also all of the father’s inheritable traits, then not resembling the father in any respect (and not only being female) is a failure of form to be realized. For arguments against that “sub-specific” interpretation of Aristotle’s embryology, see Gelber 2010.

⁸ I want to stress that by “default” I do not mean to suggest that Aristotle thinks that male replicas of the sire *should* or *are supposed to* result. Given that replicas almost never get produced, I do not think Aristotle could think that is what is supposed to occur. By “default” I mean merely to describe what would always happen, *per impossibile*, if we abstracted from actual conditions in which the causal process takes place. Ideal Gas Laws, for instance, would be descriptions of a “default” process in the sense I have in mind.

⁹ Nielsen 2008: 374.

failures from the undeniable fact that he considers males—especially human men—to be better than their female counterparts. For, although Aristotle quite certainly thinks that females are inferior to males in many respects, it does not follow from this that the production of a female is a defective generative process. Evaluation of the causal process and evaluation of some product can, and often do, take place independently. For example, consider the process of learning a language, e.g. French. The goal of that process, we might assume, is the acquisition of French form, i.e. the ability to speak and read and understand French. This goal will be achieved so long as the student can speak French with an accent that falls within some range of acceptable ones. It might very well be the case that a particular accent, e.g. a Parisian one, is more highly prized than others, perhaps for reasons having to do with social status. Yet that superior accent need not be the goal of the teaching process, such that acquiring any other accent would constitute a failure. Similarly, male offspring can be better than female ones, though not be what the reproductive process aims to bring about. Consequently, the fact that Aristotle thinks males are better than females is not evidence that he also thinks females are the results of a failed causal process.

What about Aristotle's statements that human women are "like infertile (ἄγονον) males" (728a17), that a female is "like a disabled (πεπηρωμένον) male" (737a28), that female nature needs to be considered "like a natural mutilation (ἀναπηρία φυσική)" (775a15-16), and that the nature of human women is "nearly resembling (παραπλησία) that of children" (784a5)? Does this show that Aristotle thinks females are defective results?

Not necessarily. For, in Aristotle's biology, male and female are primarily differentiated by the ability each has to concoct residues and make their respective reproductive contributions.¹⁰ And it is that ability to concoct that is at issue in each of those passages cited above. Males have a higher degree of heat, and so can fully concoct spermatic residues into semen, whereas females have a lower degree of heat, and so can only produce menses. In that respect, females are like mutilated (i.e. castrated) males and like boys, neither of which can fully concoct spermatic residues into semen. If we do not presuppose that generation aims at producing males, it is possible to read these passages more neutrally, in a way compatible with the view that successful generation merely requires that the offspring have heat within some range such as to be able to make a reproductive contribution.¹¹ No doubt the male is superior along that dimension,

¹⁰ *GA* 4.1, 765b8-14; *GA* 4.1, 765b35-766a4; *GA* 4.1, 766a30-b4.

¹¹ This way of construing sex would make sense of Aristotle's use of the comparative "more womanish" (γυναικιώτερον, 766b32), which is otherwise a bit odd. (The text is ambiguous between attributing that adjective to the parents and the female offspring.) The "more womanish" individuals would be the ones that have less heat. The hotter the organism, the more male it is, and colder the organism, the less male and more female it is.

and he is therefore “more perfect” or “complete.”¹² Yet that superiority, and the female’s corresponding “disability” with respect to concoction, need not imply that females are failures.

Another piece of putative evidence that Aristotle thinks males are not merely superior specimens but also superior *qua* effects of generation seems to be based on a misreading of certain passages. For instance, Aristotle does say (*GA* 4.3, 768a21-2) that it is “most natural” *that* a son also resembles his father. But Aristotle is not saying in that passage that it is most natural for the offspring *to be* a son that resembles his father. For, as Devin Henry has correctly noted,¹³ Aristotle says that it is most natural for the causal factors involved in determining male sex and those involved in conveying the father’s traits *to master* and *be mastered* at the same time.

It is, then, most natural that the [motion or potential or principle]¹⁴ *qua* male and that *qua* father master and are mastered at the same time [...]. For this reason, males for the most part resemble the father and females resemble the mother (*GA* 4.3, 768a21-2, 24-5).

This passage claims that male sex and paternal resemblance usually go together, as do female sex and maternal resemblance. This is why sons often resemble their fathers and daughters resemble their mothers. This passage does not claim that it is most natural that the offspring be a male who looks like the father.

In short, there is a paucity of direct evidence in support of the idea that females are simply defective results. Moreover, proponents of the standard reading generally acknowledge that sex is not part of the form (εἶδος) of any animal kind.¹⁵ If it were, males and females would differ in εἶδος, which Aristotle denies.¹⁶ Assuming that generation aims, strictly speaking, at producing an organism the same in εἶδος as the parents, then producing a male is not the goal of generation. Now, it might not follow from this that females are not defects, since a female could have the same form or essence as her male counterparts but still be defective. However, the respect in which a female is defective needs to be made precise. For

¹² See *PA* 2.2 on the correlations between heat and “perfection” across different kinds of animals.

¹³ Henry 2007: 258.

¹⁴ A feminine noun needs to be supplied here. It is clear from context that it refers to the causal factors involved in sexual determination and inherited traits.

¹⁵ See, e.g. Deslauriers 1998 and Matthews 1986.

¹⁶ *Metaphysics* 9.9, 1058a29ff. Cf. *GA* 1.23, 730b33-731a1.

instance, females are defective with respect to the ability to concoct spermatic residues. But being defective in that respect does not amount to being defective results of the generative process.

Nowhere in the *GA* does Aristotle explicitly say that the production of females is a failure in the sense maintained by the standard reading. That standard reading, consequently, lacks clear textual support.

In addition to lacking textual support, this reading is in tension with what Aristotle says about the production of females. For, Aristotle thinks there is a purpose or goal achieved by the production of females. A sustained discussion of the purpose for which there are females is found at the beginning of *GA* 2.1. The passage opens with a statement of the phenomenon to be explained:

The female and the male, that they are principles (ἀρχαί) of generation, has been stated earlier, as well as what is each's potential (δύναμις) and definition (λόγος τῆς οὐσίας). Why one comes to be and is female and the other is male, as from necessity and the first mover and what sort of matter, the account proceeding must try to say. But as on account of the better and the cause for the sake of something, the account has a higher principle¹⁷ (*GA* 2.1, 731b18-24).

Here, as elsewhere in Aristotle's natural science, he distinguishes the efficient and the material causes—the causes “as first mover and what sort of matter”—from the final causes—“the better and cause for the sake of something.” So, it is natural to read this as introducing a teleological explanation for the same phenomenon that will be given a material and efficient causal account later. In fact, when we get to *GA* 4, where he explains how sex is determined during embryonic development, he describes what he is explaining with the same language: At the end of *GA* 4.1, Aristotle says that he has explained “on account of what cause the one comes to be female and the other male” (766b27-8).¹⁸ What exactly is the phenomenon for which he gives a teleological explanation in *GA* 2, and then a material-efficient explanation in *GA* 4?

¹⁷ I am going to bracket questions both about translation and interpretation of the last clause of this quote, in particular questions about how ἄνωθεν should be rendered. For various suggestions see Peck 1942 (who takes it as a reference to the prime mover), Balme 1992 (who takes it more literally, as a reference to what was said previously), and Coughlin (who argues that this is a reference to a principle “higher” in that it is derived from Aristotle's general account of change, rather than biology).

¹⁸ The only difference between the two phrases is the insertion of “cause” (αἰτία) in 4.1, so that it reads “on account of what cause” instead of “on account of what.”

The stated *explanandum* in both passages is why “the one comes to be female and the other male,” a fact for which in book 2 Aristotle provides a series of interrelated, teleological explanations. First, he explains why there is always a genus (γένος) of humans and animals and plants:

For, since some things are eternal and divine, while others are able both to be and not be, and the noble and divine is in accordance with its nature always a cause of the better in the things able [to be better], and the non-eternal is able also to be and not be and partake in the worse and the better, and soul is better than body, ensouled is better than soul-less on account of the soul, to be is better than not be, and to live is better than to not live, on account of these causes there is generation of animals. For, since the nature of such a kind is unable to be eternal, in accordance with the way it is able, in that way what comes to be is eternal. Well, then, in number it is not able. For, the being of these is in the particular. If it really were such [i.e. able to be eternal in number], it would be eternal. But in form (εἶδει) it is able [to be eternal]. Wherefore, there is always a kind of humans and animals and plants (*GA* 2.1, 731b24-732a1).

Although the Greek is compressed, the overall meaning is fairly clear. As a general metaphysical principle, being is better than not being. For living things, which exist in virtue of being alive and so ensouled, this entails that living is better than not living. But such living substances are perishable, and as such, they obviously cannot be eternal “in number.” Instead, they achieve their eternal existence through the persistence of their kinds: this is how perishable substances can achieve the only type of eternal existence available to them—to be eternal “in form.” This type of eternal existence is that for the sake of which the kinds persist.¹⁹

Any kind of living organism’s persistence, moreover, is dependent on the continued generation of individual members of the same kind. Generation, in Aristotle’s view, typically requires both male and female principles.²⁰ So, both of those principles must exist. That there are male and female principles, even mixed as they are in plants, is a second *explanandum*.

Since the principle of these is the female and the male, for the sake of generation the female and the male should be in those having [male and female principles] (*GA* 2.1, 732a1-3).

¹⁹For a slightly different construal of the first of these three “hierarchically related” teleological explanations, see Lennox 2001: 133ff.

²⁰ Spontaneously generated organisms, for example, might be an exception. It appears that these have causal principles corresponding to (κατά) the male and female ones. See *GA* 3.11.

Third, he explains why it is that the male principle is separate from the female one in most animal kinds: It is better that the “more divine” and superior male principle be separate from the inferior female principle.²¹

Since the primary moving cause, to which the account and form (εἶδος) belong, is better and more divine in nature than the matter, better also is the separation of the superior from the inferior. On account of this, among those able and to the extent that they are able, the male is separate from the female. For, the principle of movement, in virtue of which “male” is applied to generated things, is better and more divine; matter [is that in virtue of which] “female” [is applied] (*GA* 2.1, 732a3-9).

Taken together, these three explanations amount to an explanation for why some animals are male and some are female, which Aristotle makes explicit when summarizing the discussion later on:

And concerning male and female, on account of what cause each exists, has been said (*GA* 2.1, 732a24-5).

As I read this passage, Aristotle is giving a teleological explanation, one citing the end for the sake of which some animals are produced male and some female. So it seems as though he thinks that there being females as well as males is for the sake of something. Moreover, that thought is echoed in his remarks in *GA* 4.3:

For, not resembling the progenitors is already a monstrosity in a way.²² For, nature in these cases has departed from the type²³ in a certain way. The primary source²⁴ [of the departure from type] is the female

²¹ I am going to put aside questions about why it is better for the superior principle to be separate from the inferior one.

²² The qualification “in a way” (τρόπον τινά) here and in the next sentence is important: Aristotle does not think that all non-replicas are, strictly speaking, monstrosities. He goes on to account for monstrosities in the following chapters of Book 4, after completing the account of sexual differentiation and familial resemblance.

²³ As David Lefebvre (2013: 225-6, note 26) has noted, γένος (here translated “type”) is unlikely a reference to the γένος of human beings, and is more plausibly a reference to the child’s parental (and, more specifically, paternal) lineage or clan.

²⁴ The ἀρχὴ δὲ πρώτη at the beginning of this sentence tends to be read as implying that the birth of a female is the first in a series of successive deviations from the ideal—i.e. male resemblance—that culminates in

coming to be and not the male. But, on the one hand, this [primary source of departure from type] is necessary by nature. For, the kind of those separated into female and male must be preserved. Since it is possible for the male not to master either because of youth or old age or some other such cause, the female offspring among those animals necessarily comes to be.²⁵ A monstrosity, on the other hand, is not necessary for the sake of something and cause as end, but accidentally necessary, since one must grasp the principle from there (ἐντεῦθεν) (*GA* 4.3, 767b5-15).

Failure to resemble one's progenitors is, in a way, a monstrosity, and the "primary source" of such failure to resemble one's progenitors is the birth of a female. But despite the birth of a female being the primary source of departure from type, the birth of a female is necessary "by nature." While Aristotle does not say explicitly here that to be necessary "by nature" is to be for the sake of something, the μὲν ... δέ construction of the passage suggests that this is what he means. For, he says that monstrosities are only necessary "accidentally" and do not come to be for the sake of anything. Females, on the other hand, are naturally necessary since "the kind separated into males and females must be preserved" (*GA* 4.3, 767b9-10). Given the contrast drawn in this passage between females and monstrosities—namely, that one is and the other is not for the sake of something—it appears that Aristotle thinks that females are produced for the sake of something.²⁶

So, Aristotle thinks that females are "by nature" necessary and—unlike monstrosities—are for the sake of something. If the standard reading is correct, Aristotle also views females as failures. That reading renders females the accidental results of a causal process aiming to produce males. However, these two

monstrosities. This is not the sense, as far as I can tell, of the corresponding sentence in Michael Scot's Latin translation of the Arabic: "*Non est res nisi generatio feminae, non generatio maris, et hoc indiget natura necessario, quoniam debet salvari genus animalis in quo sunt mas et femina distincta.*" Though I will not pursue this here, I think it is possible to read this as the claim that failure to resemble the sire would not occur if not for the fact that sometimes females come to be. That is, females would be the "primary source" of departure from type in the sense that the female's involvement is the primary cause: if there were not females involved, and the male were generating by himself, exact resemblance would occur.

²⁵ Assuming Aristotle does not subscribe to a principle of plentitude, the inference here, "since X is possible, Y is necessary," is strange. I return to this below, 000-000.

²⁶ Nielsen 2008: 376-7 claims that in this passage Aristotle likens females to monsters.

views are inconsistent: one and the same thing cannot be both for the sake of something and also a failure.²⁷

One and the same thing can, of course, be both *beneficial* and also a failure. So, if all Aristotle means by saying females are for the sake of something is that females are beneficial or purpose-serving, there would be nothing incoherent about them also being accidental results or even failures. Surely there are plenty of things that get used for some purpose or turn out to be beneficial but that nevertheless are the results of a failed causal process aiming at some other end.

This deflationary sense of being for the sake of something—i.e., being merely beneficial—cannot be what Aristotle has in mind, however. First, Aristotle takes it to be a substantive and controversial thesis that natural phenomena occur for the sake of something. But the idea that natural phenomena can turn out to be beneficial or serve some purpose is completely uncontroversial. Second, results of luck such as a chance meeting between debtor and lender or finding a treasure buried in your backyard would, in this deflationary sense, count as being for the sake of something. Such accidental yet beneficial results, however, are explicitly contrasted with those natural results that are genuinely for the sake of something.²⁸ This deflationary way of being “for the sake of something” that involves merely being beneficial or useful is, in my view, too thin.

3. The Alternative Reading

The textual evidence in support of the standard reading is not, as I have argued, very compelling. At any rate, Aristotle does not say explicitly anywhere that the goal of generation is a male that looks like its father. Furthermore, on the standard reading, Aristotle holds grossly inconsistent views about the production of female offspring. If Aristotle has a consistent position, he cannot think that females are failures.

An alternative to the standard reading has recently been offered by Devin Henry. In Henry’s view, generation in no way aims to produce males. Rather, on his interpretation, the sex of the embryo is

²⁷ On this point, I completely agree with Devin Henry: “The standard reading thus saddles Aristotle with the paradoxical view that females are present in the species for the sake of something even though no particular female comes to be present for the sake of anything but is merely an accidental result of a process aimed at generating males” (Henry 2007: 261).

²⁸ For example, Aristotle’s strategy in *Phys* 2.8 for arguing against an opponent of natural teleology is to show that “purpose serving” natural phenomena cannot be due to chance and, consequently, are finally caused.

“determined entirely by non-teleological forces operating through material necessity.”²⁹ Henry’s interpretation, consequently, avoids the inconsistency that the standard reading faces. However, Henry’s alternative account does not accurately describe Aristotle’s view of the production of females for the following two reasons. First, the cause of sex determination is not merely material necessity. Second, there is an asymmetry between Aristotle’s account of male and female births that the alternative account fails to appreciate.

In order to see why the description of the causal process as “material necessity” is an oversimplification of Aristotle’s explanation of sex determination, we need to turn our attention to the details of *GA* 4.1-3. Henry is right that in Aristotle’s biological explanation the determination of females involves a “deficiency of spermatic heat.”³⁰ For, lacking enough heat renders the principle from the male incapable of conveying his sex to the offspring.³¹ This is not, however, the full explanation. What Aristotle says is that in the event that “the patient is not mastered on account of a deficiency of the concocting and moving power or on account of the bulk and coldness of the thing being concocted and determined” (*GA* 4.3, 768b25-7), there is a “change into the opposite”:

Whenever the principle should not master ($\mu\eta\ \kappa\omicron\upsilon\alpha\tau\eta\tilde{\iota}$) and neither is able to concoct on account of a lack of heat, nor able to lead to its own form but in this respect is defeated, it is necessary to change into the opposite. And the opposite of male is female, and in this respect one is male and one is female (*GA* 4.1, 766a18-22).

In *GA* 4.1, there is not much more said about what happens when the “change to the opposite” occurs. The account of sexual determination in *GA* 4.1 is given almost exclusively in terms of defeat: there is a “lack of heat,” the male principle is “unable to concoct” and “gives way.” However, at the beginning of

²⁹ Henry 2007: 268.

³⁰ Henry 2007:262.

³¹ The role heat plays in determining the embryo’s sex accounts for the purported preponderance of female offspring from parents younger or older than their prime (*GA* 4.2, 766b28-31): in the young the heat is not yet perfected, and in the old it is leaving. This is also why male offspring are more common when the parents copulate during northerly than southerly winds (*GA* 4.2, 766b34-767a1): when the wind is in the south, bodies are more fluid and so abundant in residue, and an abundance of residue is more difficult to fully concoct (*GA* 4.2, 766b35-6). And shepherds say that the direction the copulating animals are facing also affects the sex of the offspring (*GA* 4.2, 767a8-11). This is to be expected, Aristotle thinks, since such small differences cause differences in heat and coldness (*GA* 4.2, 767a11-12).

GA 4.3 Aristotle says that not only the sex of the offspring but also its inherited characteristics are due to the “same causes,” and then repeats once again at the end of the discussion (at 769a1-6) that he has discussed these phenomena together. And within the discussion of the causes of offspring resembling their parents and ancestors in *GA* 4.3, Aristotle uses the same terminology to describe the causal mechanism. There in *GA* 4.3 we again find the language of “mastery” and “failure to master,” and “change into the opposite.” For example, an offspring bearing resemblances to the mother or maternal ancestors is due to a failure to gain mastery, and a subsequent change into the opposite.

In that *GA* 4.3 account, Aristotle gives far more details about the process than he does in *GA* 4.1. In particular, in *GA* 4.3 Aristotle appeals to “motions and potentials” (*κινήσεις καὶ δυνάμεις*) in the spermatic fluids by which particular traits are passed along to the offspring.³² There are, Aristotle says, motions and potentials corresponding to the father at varying levels of generality. There are motions and potentials not only *qua* member of a certain species (such as human), but also *qua* male, *qua* individual male, and *qua* animal.

I speak of each potential in this manner. The generator is not only a male but also such a male, e.g. Coriscus or Socrates, and he is not only Coriscus but also human. And in this sense, some things that belong to the generator are closer and some further *qua* generator and not accidentally, such as being literate or someone’s neighbor [...]. For this reason, motions are present from the potentials in the spermatic fluids of all such things (*GA* 4.3, 767b23-9, and 35-6)

According to Aristotle’s account, when the offspring resembles its father in a certain respect, for example with respect to the shape of the nose, that offspring’s nose shape is the *per se* result of the male’s motion and potential for producing that particular nose shape.

Moreover, not only are there motions and potentials by which the father conveys his particular morphological features such as nose shape, but there is also a potential and motion by which the male conveys his sex. Aristotle refers to such a potential and motion for producing a male offspring in the course of the discussion of resemblances in *GA* 4.3. There he says that while “what usually happens naturally is that [the motions] *qua* male and *qua* father master and are mastered together” (*GA* 4.3, 768a21-

³² According to Balme 1987:292, these motions and potentials are not additional but rather identical to the form passed from the father. There is an argument against this interpretation and for an alternative construal of the relation between the motions and substantial form in Gelber 2010:204-9 and n. 28, n. 59.

2),³³ this is not always the case. There can be mastery with respect to the male potential and motion, producing a male offspring, but also failure to gain mastery with respect to motions and potentials corresponding to the father's particular traits:

If the motion drawn from the male gains mastery but that from Socrates does not, or the one from Socrates gains mastery but the one from the male does not, then it turns out that a male resembling his mother comes to be and a female resembling her father (*GA* 4.3, 768a28-31).

Given the terminological similarity between the discussion in *GA* 4.1 and *GA* 4.3, and given the reference within the discussion of inherited traits to the motion that produces males, it is reasonable to assume that Aristotle thinks the same causal mechanism is involved in both sex determination and morphological resemblance.³⁴ It is reasonable, consequently, to take Aristotle's discussion of the causes of resemblances in *GA* 4.3 to be elucidating the details about sex determination omitted in *GA* 4.1.

There is no explicit mention of any motion or potential for conveying female sex in that discussion. There is, however, a reference to motions and potentials for maternal resemblance. Aristotle refers to these maternal motions and potentials in the course of explaining resemblances to remote ancestors. In short, there are two forms of failure that can occur at the level of these motions and potentials. The first type of failure is "displacement" (ἔκστασις), which involves a "change into the opposite." Displacement explains why there can be resemblance to maternal rather than paternal ancestors.³⁵ The other type of

³³ Μάλιστα μὲν οὖν πέφυκεν ἢ ἄρρεν καὶ ἢ πατήρ ἄμα κρατεῖν καὶ κρατεῖσθαι. I am assuming, as does Peck (1942) and Henry (2007: 258), that the unexpressed subject of κρατεῖν and κρατεῖσθαι is "motions," κινήσεις, from the preceding sentences.

³⁴ Alternatively, Henry takes the explanation of sex determination, which is ultimately a function of the degree of heat in the organism's heart, to be given in *GA* 4.1, and he takes the mechanism described in *GA* 4.3 as explaining inheritance of sexual organs (Henry 2006: 271-2). Although Henry is right that Aristotle distinguishes sexual morphology from "functional" sex (the ability or inability to concoct semen), he gives no argument for there being separate causal mechanisms for these. In the absence of an argument, I am inclined to disagree. It seems to me more economical to assume there is only one mechanism being described, first only in rough outline in *GA* 4.1, and then in greater detail in *GA* 4.3.

³⁵ Cf. *GA* 4.3, 768a2; a4; a15; a26-7; b8; b25. There is far too little said about ἔκστασις to be certain about the details. It is not clear what, for instance, undergoes ἔκστασις or what changes into the opposite. Translators supply

failure is “relapse” (λύσις), which explains how the offspring can resemble more remote ancestors on either the maternal or paternal side. When he discusses this second type of failure, it is clear that there are maternal motions and potentials as well.

In this way [both on the side of the males and] also on the side of the females (θηλειῶν), [the motion], from the female generator (ἡ τῆς γεννώσης) [relapses] into [the motion] from her mother (εἰς τὴν τῆς μητρὸς), and if not into that [motion], then into that of her grandmother (GA 4.3, 768a18-21).³⁶

So, there are motions and potentials for resemblances to the mother and her ancestors. When the male’s motions and potentials fail to master and displacement (ἔκστασις) occurs, corresponding motions for producing likenesses to the female in the respects in which the male potential failed to gain mastery become operative. Those motions and potentials then produce the features of the offspring by which it resembles the mother (or more remote maternal ancestors, depending on the whether relapse occurs as well). Assuming that roughly the same account of the mechanism that produces familial resemblances is supposed to apply to the determination of the embryo’s sex, we get the following result: the production of a female is due to the motion and potential for producing females becoming operative when the motion and potential for producing males does not master.

Assuming this is correct, the cause of sex determination is not merely the “interactions of material forces” operating in the way that “cold air acts on the surface of a pond forming ice.”³⁷ For, while there is a role for heat and coldness in Aristotle’s biological account of sex determination, that role is too remote. Aristotle, in fact, explicitly criticizes people such as Empedocles who claim that the cause of sex is heat and coldness, on the grounds that this is insufficient to explain how sexual organs are produced:

Well then, to suppose the cause of the male and the female is heat and cold, and the secretion having come from the left or right, is somewhat reasonable...But to reason thus is to grasp the cause from too far away, and it is especially necessary to move toward it from as close to the primary causes as possible (GA 4.1, 765a34-b1, b4-6).

such different subjects as “movement,” “material,” and “male principle.” In an attempt to remain neutral, I simply speak of the result being the opposite of what it would have been.

³⁶ I am taking the unexpressed verb here to be λύονται from the preceding sentence, at line a15, the subject of which is motion (κίνησις).

³⁷ Henry 2007: 7n18.

The proximate, primary cause of the production of a female is the motion and potential which becomes operative when the male motion and potential does not master. To claim the cause is material necessity is, as Aristotle says, to “grasp the cause from too far away.” The alternative reading of Aristotle’s account is, for this reason, overly simplistic.

Further, the alternative account goes too far in its rejection of the view that generation aims to produce male offspring. For, by describing the process simply as a matter of “non-teleological necessity,” the alternative account infelicitously depicts Aristotle’s account too neutrally. Although the birth of a female is not a failed attempt at the production of a male, Aristotle’s explanation does not treat male and female births equally.

First, male motions dominate when there is *συμμετρία* between the parents, whereas female births are described as occurring in cases where there is a lack of *συμμετρία* (*GA* 4.2, 767a22-27). Assuming that *συμμετρία* here means something such as “commensurability” or “due proportion,” it would appear that females occur when there is a disproportional relationship. This is why female offspring occur when the parents are too old, too young, or sick (*GA* 4.2, 766b28ff, and 767a25-26; *GA* 4.3, 767b11-12). In such cases, there is a lack of proportion, perhaps less kinetic heat than is proportionate to the amount and temperature of the matter.

Second, whereas the motions that produce resemblances to the father are present “in actuality,” those that produce maternal resemblances—or at least that which determines female sex—are said to be present “in potential” (*GA* 4.3, 768a11-14).³⁸ Although it is unclear what exactly it means for a motion to be present “in potential,” the fact that it applies to the motions and potentials for maternal resemblance (and resemblance to ancestors) indicates that Aristotle is not thinking of the motions and potentials for paternal and maternal resemblance as being on a par.

Because the alternative account suggests something much more egalitarian, and since material necessity is not the primary cause of sex determination, the alternative account misdescribes Aristotle’s view.

4. A Third Option

³⁸ *Where* these motions and potentials are present is vexed, though it is not crucial for my purposes to adjudicate this. Cooper 1988: 70n14 claims these are present in the male semen. However, it is possible (and more plausible) that these are present either in the menses or in the *κύημα* (the first mixture of male and female principles), or even that these are potentially present in—i.e. “during”—the process of generation.

So far, I have argued that neither the standard reading nor the alternative account is completely accurate. The standard reading depicts the process of generation as though it is supposed to result in a male, and that females come to be accidentally. If that were so, females could not also be for the sake of something, as Aristotle thinks they are. A problem for Henry's alternative is that it suggests Aristotle's account is more neutral than it is. I agree with Henry that, considering animal generation at one level of generality, Aristotle thinks both males and females are successes. Strictly speaking, the aim of generation is an offspring the same in form as the parents. However, when Aristotle discusses the mechanism for conveying sex (and other resemblances), there is an asymmetry: Males are the results of a motion to produce males, which motion is present in actuality and which will master provided there is commensurability or due proportion (*συμμετρία*); females, on the other hand, result when there is not *συμμετρία* and the male motion fails to master, allowing the female motion and potential to become operative.

What is needed, therefore, is an interpretation that acknowledges that the female motions are only operative when the male motions and potentials fail without saddling Aristotle with the view that females are merely lucky accidents. As I read *GA* 4.1-3, there is a motion for producing females in Aristotle's causal account. So, at least there is some *per se* cause for the production of females. However, it is still not clear why it is not just a lucky accident, in Aristotle's view, that this motion to produce females ever does become operative, let alone that it does so with any regularity. How can Aristotle be thinking that female motions are operative in the absence of *συμμετρία*, and not therefore also think that females are failures or accidents?

An answer to this emerges by considering what the circumstances would have to be like for male motions to always be dominant. This would require, for each successful generation, perfect *συμμετρία* between the parents. Such *συμμετρία* would always obtain in conditions in which climactic factors, age, and health of the parents were fixed and stable. But Aristotle knows that those are not the conditions we are in. The sublunary realm is vagarious, and living beings are enmattered, and thus subject to changes of many kinds.³⁹ The contingencies of the sublunary world and the variations in the quality and quantity of

³⁹ Aristotle is seldom explicit about this background assumption—i.e. the assumption that there is something indeterminate about how things will go for enmattered beings—though he occasionally mentions it. For example, at *GA* 4.10, 778a4-9, when discussing the connection between “cosmic” periods and the life cycles of living beings, he says the following: “Nature's aim, then, is to measure the generations and endings of things by the measures of these bodies, but she cannot bring this about exactly on account of the indeterminateness (*ἀοριστία*) of matter and

matter are already built into Aristotle's causal explanation, and the causal process that explanation mirrors. Consequently, his explanation presupposes that male mastery will not always occur.

This is reinforced by a remark Aristotle makes in the course of explaining why females are produced:

Since it is possible for the male not to master either because of youth or old age or some other such cause, the female offspring among those animals necessarily comes to be (GA 4.3, 767b10-13).

Aristotle could be taken to be claiming here that it is possible for the male not to master, and *in those cases* a female necessarily comes to be. This is not likely, however, since according to Aristotle's account, it is not necessary that females come to be when the male principle does not master; it is possible in those cases for a monstrosity to result, or no offspring at all. Instead, I think Aristotle is saying that it is the fact that it is possible for the male principle not to master—i.e. that it is not guaranteed or necessary that it always does—that explains why, necessarily, females sometimes result. In other words, it is the possibility of the male motion not mastering that makes female births necessary.

To be sure, the male motions and potentials, unlike the female's, are "present in actuality" and not merely in potential. So the male motions are, in a sense, privileged. In my view, what explains this privileging of the paternal motions is not the assumption that the whole process is aiming to produce males that perfectly resemble their fathers. Since exact replication almost never occurs, I do not think Aristotle could suppose that generation aims at that. Rather, since the male is the active factor in generation, it is more plausible to assume that all of the motions and potentials he provides are *ipso facto* the similarly "active" ones. That is, the male motions have this status solely in virtue of the privileged causal status that the male has, in general, *qua* active factor in the substantial change.⁴⁰

This interpretation, moreover, allows us to take seriously Aristotle's claims that females are for the sake of something. There is no conflict, at any rate, between the idea that females are not produced when there is *συμμετρία* between the parents, and the idea that females are for the sake of something. For, in general, the fact that something will not occur under all conditions is surely compatible with that thing also being for the sake of something. The fact that plants do not grow leaves under any and all conditions,

the existence of a plurality of principles which impede the natural processes of generation and dissolution and so are often the causes of things occurring contrary to nature" (Peck translation, slightly modified).

⁴⁰ Why it is that the male is the active factor is a further question. The answer to that question, I suspect, is that it was simply overdetermined. See Cook 1996 for a clear discussion of the various factors that would all be pulling Aristotle to this view of male and female reproductive roles.

for instance, does not prevent leaves from being for the sake of something. And the fact that something will not occur under some specific conditions does not necessarily conflict with it also being for the sake of something, either. The fact that a plant does not grow leaves in the dead of winter does not entail that leaves are not for the sake of something. I can see no reason for thinking that the fact that females are not produced under conditions in which there is *συμμετρία* between the parents is incompatible with females also being for the sake of something. That is, the fact that males—and ones that bear perfect resemblances to the father—are produced when there is *συμμετρία* between the parents does not prohibit females from being for the sake of something. For, living organisms are not generated under conditions in which such *συμμετρία* always obtains. In the actual circumstances, Aristotle thinks, there are variations in the degree of heat and bulk of the spermatic residues.⁴¹ Thus there is not always *συμμετρία*, and so Aristotle assumes that male motion's failure to master, and female motions becoming operative, is guaranteed to occur.

The fact that male motions will master when there is *συμμετρία* does not entail that animal generation is teleologically directed toward producing males. Interpreting the discussion of sexual determination in this way acknowledges that female births are due to a causal mechanism that has a secondary position, but does not require that females be failures.

5. Conclusion

I have argued that the standard reading of Aristotle's embryology, according to which females result from a defective teleological process, cannot be correct. There is no direct evidence for that reading, and it is difficult to reconcile with Aristotle's commitment to females being for the sake of something. The alternative account, according to which the cause of sex determination is merely material necessity, is also not correct. That account is too simplistic, and it glosses over the asymmetries in Aristotle's biological theory.

I proposed instead that we read Aristotle's explanation of the mechanism by which sex is determined as running parallel to his account of inherited characteristics. This mechanism is below the level of *εἶδος* transmission, which is the goal or aim of generation. At that lower level, the paternal motions are the ones that master when there is *συμμετρία*, simply because the male is the active factor and thus his

⁴¹ That there are such variations is all for the good of any animal kind, since it ensures that there will not always be *συμμετρία*. I will not argue for this here, but I suspect that it is no accident that there are such variations, for Aristotle. If so, this would lend some support for an interpretation of Aristotle's teleology as extending more globally of the sort that David Sedley (1991, 2007, 2010) has defended.

motions and potentials are present “in actuality.” But this is compatible with the production of females—which occurs when the female’s motions become operative—also being for the sake of something, since natural generation does not take place under conditions in which there is always *συμμετρία* between the parents.

No doubt Aristotle thinks that females are inferior to males, and his society considers a man unfortunate who does not have children who resemble him. But if Aristotle thinks these views are grounded in biological facts, it is not that those non-resembling children and daughters are failures.